

Paul M. Grant's Harvard PhD Thesis Lab Notebook Gordon McKay Notebook, 9 May 1963 - 9 May 1965

All pages (including blanks and covers) scanned in "true color" in mid-December 2009.

Pages 39-46 and 2 tables re-scanned for clarity and appended at end of document.

Photograph of Notebook, "Red ONR Report (Dick Zallen's copy)" and Bill Paul's copy of thesis taken in PMG "W2AGZ Shack" early December 2009.

HARVARD UNIVERSITY LABORATORY NOTEBOOK Physics 1

NAME _____

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SECTION

INSTRUCTOR

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9 MAY 1963

Today & began the checkant of the high speed optical system. The different components, all drawings and descriptions, and modes of operation are contained in my files. This journal will be concerned only with the operation of the equipment and its use in performing experiments. All spectra shall contain references to this journal by date and possibly page. I installed an RCA type 1P21 (54) photomultiplier temporarily for use in checkout. Upon operation, found wiring error in amplifier. Once corrected, & made several scans of the output of the small GE tungsten lamp at slit widths from 100 µ to 10 u. The reproducibility at 100 u to 25 u seemed excellent, but was poor at 104. This is quite probably due to scattered light because the source optics are as yet uncovered. The noise seems to be limited by the photonultiples and the scattered light which is (at this time) a good sign. while looking for the initial trouble in the amplifier, IT was noticed that the tola regulating transformer was causing a great deal of serious 60 cycle noise pick-up. This transformer has been disconnected and the source is now men straight from the line with the ballost tubes providing regulation. Playing with the notch filter in the amplifier showed it to be quite effective in limiting noise. However, the mistake in wiring in the amplifier has caused some limiting in the low frequency response (it was 8+ tied to the grid in the frequency control stage and must have caused drift of some component) but it is not serious and nothing has been done to correct it.

L 10 may 1963

Today I attempted to calibrate the system using the altra - violet products low pressure H3 vapour lamp. Used a slit width of 10 st and observed all the lines. I am baving some difficulty obtaining the proper line shapes in their proper place. I am still using The RCA IP21. Tonight & redid all the Hg lines. I suspect that the lineshape trouble is due to speed variations of some sort in the Jaco wavelangth drive.

13 may 1963

Today & did some calculations on the spectra of Friday night in order to place some of the lines. However, these are in error as I assumed a chart speed of 180 in /hr instead of the correct 150 in/hr and I assumed that the scan speeds on the Jaco were exact, which they are not. I timed the chart speed of the LN recorder for 5 minutes and found it to be 'on the nose' giving a total feed of 12.5 in. meaning a speed of 2.5 in/min. I then used the recorder as a " clock" to check the scan speeds of the Jaco. Whe results follow.

Jaco year setting	average True Scan
2 Å /min	2.4 Å/min
5 A/min	6 A/min
10 A / min	11.9 A/min
20 Å / min	24.1 R/min
50 Å/min	59.5 A/min
125 A/min	156 Å/min
250 R/min	313 Å/min
500 Å / min	626 Å/min

14 May 1963

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Installed Mc Elroy's photomultiplier assembly today and attempted to perform a new calibration run. Operation of the monochromater is still erratic as before. I noticed that one has trouble finding the line (4046 Hg) at the right place even under manual control. Called I A this afternoon and talked with Stanley smith, est 14 or 15. Found that speed problem was due to the mis - installation of a 50 cycle motor instead of a 60 cycle one. However, the problem of bad lineshape is still unsolved. Amith suggested that deirt on the glass could cause this but it books clean. Today PTM and I also designed a rubber stamp with which to stamp a data entry table onto our spectra.

3

15 may 1963

a man from JA came this morning and took back the monochromater to the plant for a complete checkant. I built an adapter that will enable me to use RZ's 7102 (SI) phototube assembly. also the appropriate modifications to the Tektronix 514 D to convert it to a 514AD were made.

16 may 1963

This morning I went to Saura Roth's talk at Gerry-Rand on the Faraday Effect. Spent the afternoon " aligning the vertical section of the 514 AD scope. also brought the small cabinet over to the painters to be painted.

4 17 may 1963

This morning & calibrated the sweep on the 514 AD and she is now an operable scope. Used a 180 Time mark generator borrowed from mac Donald. bot back the monochromater from JA This afternoon and trouble with lineshape was apparently the spring loaded ball joint that holds the sine bar drive screw in place. normally, one should feel some "give" when pressing button "c" which helps engage the gears. Tonight I ran some calibration curves with The Hy lang, but have not analyzed the data. Initially, I noticed the tops of the peaks were distorted, suggesting a saturation effect was taking place. Careful investigation showed that neither the electronics nor the photomultiplier were saturating. The effect desappeared upon widening the slite from 10 y to 20 u suggesting That dust on the small diagonal mirror or its "bad spot" were causing trouble. This distortion could be improved by changing the leveling screws of the monochromater, thus supporting The above hypothesis. I noted that the Waterman scope loaded the pre-amp output. also the lines seemed to be broader than before the instrument was repaired although this may now be due to the slower scanning speed and a hot Hy lang. The 3131 doublet should be booked at again when the lamp is cool. also, the entire system should be optically realizned and the morochromater leveled.

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18 may 1963

I have completed computing the position of the lines measured yesterday. The lamp is a mineralight That many of the lines do not agree with the JA results. This may be due to beating of the lomp. The other cenco spectrum lamp should perhaps be tried, and the oplics realizned.

		Resulta	
		resure	
	CRC	JA	17 May 3
			and and the second s
	4046.6	4046.6	4045.7 (9)
	4358.3	4358.5 (+.2)	4357.0 (-1.3)
	5460.7	5461.2 (+.5)	5461.1 (+.4)
	5769.6	5770.2 (+.6)	5770.2 (+.6)
	5790.7	5791.5 (+.8)	5792.2 (+1.5)
	8093.2	8094.0 (+.8)	8094.1 (+.9)
	measurements were	also Taken on	the 3131 doublet
	in both first	and second order	2. In the second
	man sienala	were weak, and	drives in the norac
	The line was	readely split, 1	but not so nicely a
	The JA chart	showed. In the firs	but not so nicely a it order, the signal
	was strong, but	no splitting was a	een. However, the line
	was quite broad	. note how far y	een. However, the line from 3131 the line is
2	Se	cond Order	
3			
	CRC	17 may 3	
ting	6263.10	6264.0	(+.?)
	6263.66	6264.6	
	Fr	int Order	
		A SHALL A REAL AND A REAL AND A	
miny	CRC	17 may 3	
	3131.55 7	3128.0	(- 3.7)
	3131.83 5		
	3125.66	3121.6	(-4.1)
	At RPM & Linia	had a remension	ment of the 3131 lin
	of The minerali	it land in no	ton To see it mus
	hat a clost	and taking place.	der to see if any I let the equipment
	many up but	ally Trigged M.	The land when ready
	to any the	sulta mago esperit	The lamp when ready tially the same as
	Marta day When	O marraned The	slite down To 5 11,
1.1	The list adea	and This want di	in the in the aris
ht	the prise vion	The H galilast	scerneble in the nois
de	I just worked an	the org calibration	run of 10 may and
	the first order 5	131 line seems n	to be slightly split
	original drive scr	a sure that this	e is not due no the
	Read > 11 11 - 1 O DOD	aux the second	and the second of the second sec

6 20 may 1963

Develled monochromater and adjusted optics. I am now using the Canco line spectra sources. Late This afternoon, I began another Hy calibration run using the Cenco Siesaler tube. I placed the photomultiplier so that the exit slit image was just about focused on the cathode. I am still getting funny looking line shapes and will next try experimenting with slit widths and hights and different time constants. The lines seem to be broader than they should. The following is the result of the calibration run: CRC 20 May O 3131.7 (aug) 3128.2 (-3.5)4046.6 4045.1 (-1.5)4357.3 (-1.0)4358.3 5461.6 (+.9)5460.7 5769.6 5771.0 (+1.4)5790.7 5792.8 (+2.1) (+.4)8093.2 8093.6 T Y I also should try running on 5 A/min. 0 made number @ run at night to see effect of slit hight and scanning speed and time constant on lineshape. Found very marked improvement in resolution where slit height was lowered to 5 mm. a Obtained very good line shape and narrow width. Should test this effect for slit width of 100 4. A a d change could mean very bad misalignments. A time constant of "3" seemed to provide good filtering 20 on of noise while not being too slow to extend tail of line, 1 and 2 are not suitable in This respect. u number 3 run is another calibration un made 6 at TC=3 and SH= 5mm and 5W= 10m. The scanning ou speed was set at 5 A/min to see what the effect e would be on the calibration. i w

10 B gr on A on

7 21 may 1963 I have just completed examing the data of 20 may 3 which is the calibration curve taken with a amaller slit hight and hence improved resolution. The scan speed was 5 Å/min. The following data can be considered as most representative of the calibration data to date. 20 may 3 CRC (- 4.3) 3125.7 3121.4 3128.0 (-3.6)3131.6 (-3.6)3128.2 3131.8 4046.6 4046.1 (-.5) (-.7) 4357.6 4358.3 (+.6)5461.3 5460.7 5770.4 (+.8)5769.6 (+1.3) 5790.7 5792.0 (+1.0) 6263.1 6264.1 (+1.0) 6263.7 6264.7 8093.2 8094.2 (+1.0) The above data was taken with the Cenco Hy vapour source. The second order 4358.3 (8716.6) and some of the UV. lines should now be looked at. The result is that: CRC 21 may O 8716.3 (-.3) 8716.6 also, at this time, I made a rough reproducibility adjeriment in re-running the 8093 line after being sheet down overnight. It only came back to about 1/3 its original value, but was reproducible after that after the PM had been on for 5 minutes or so. after this I tried getting calibration in the UV by using the Philips Hg-Cd - In lamp. The lamp was so bright and the scattered light so high that the system overloaded. When I tried to shield the lamp by enclosing it, it apparently overheated and exanguished itself. Will have to wait until a suitable enclosure with a dequate cooling can be built. with a dequate cooling can be built. Late this afternoon, I began to set up for the radiative recombination experiment in GeAs. I borrowed the B \$ 1 High Intensity monochromater from Jim mery of Bloembergens. group. Had mached prepare a sample which was cemented on a steel block, on which another side held a small Al mirror. The object was to place unformed light on the Ga As sample at 2500 R and observe the

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radiative recombinations at about 8900 R. The idea is 3.5ev 1.39ev Sev This : pr By sumping with monochromatic UV radiation, one should abtain hu at The direct gap. The Ser peak a er (from Chrenniech) is at about 2 500 A, so that if the incident to light were at these wovelength elections and hales would be created at the × conduction and valence bands. These electrons and boles 2: would then be scattered to the r minima where they would recombine radiatively. a similar process should take place when pumping at the 1 point (3.5 ev ~ 4500 Å). In fact by scanning the monochromatic pump light, and by ra fe computing the function : il H IRE V2 E Io(E) . × 7 one should obtain a corrobocation of the gross features 2 of the well - known reflectivity data. IRR is the recombination radiation intensity, and to (E) in the incident intensity modified by the reflectivity of Ga As. Also, one can study the effect of a monochromatic pump -7 9 0 source on the sinewidth of the recombination radiation. 7 all direct gap materialo, plus maybe Ge, should be 1 subjects of the same experiment. The experimental arrangement is: E PM JA GaAs ~ BL 2 The exit slit of the BL was set at 1.5 mm, and both the 6256B and 7102 photomultipliers were used. In general, no radiative recombination was observed, possibly for several reasons: (1) Diefficiency of the unfocused pump option. (2) Low intensity of source (3) Poor surface of GaAs 6 (4) Ga As not cooled

Tracings I and I reveal some of the spectral properties of the BL monochromater. One sees that at high & (1400 mu) the quity is very poor while at 2500 Å the lineshape is very good, centered around 2500 Å with a 1/2 width of 50 Å for an Tic in ras exit slit width of 1.5 mm. 2 Tracing @ demonstrates the response of the septem it to higher orders of 2500 Å. dent th, luction 22 may 1963 Today I attempted to set up for a recombination radiation experiment again. The idea was to gain some by feeling for the factors involved. Therefore I decided to illuminate a piece of calcite with the Philips y • He Cd: In lamp and then analyse the resulting flouresence. Because it is difficult to set up the mirrors for a diffuse source, it was decided to try an aptical fiber light pipe to bring the flouresence to the entrance slit of the Tures monochromoter. Visually, this seemed to work quite well however, no radiation could be detected with a cooled 7102 at a red frequency 3 Veste with a bright flashlight gave some output 1. but not nearly as much as expected. e When I substituted the 62568, an almost saturated output was obtained at 4046 which is an Hy line reflected off the calcite. However, still no red autput was abserved athough the end of the fiber seemed quite bright red to the ege. I was going to switch back to the 7102 when I noticed that the window was severely covered with frost, so that will have to wait.

23 may 1963

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Today BK and I tried to observe any radiative recombination from GaAs illuminated by the Phillips mercury source on Zallen's Perkin - Elmer system. The samples were a polished one and one etched with white etch so that the surface was diffuse. all attempts to observe radiation at the expected

24 may 1963

Today & designed and built the sample holder slide for the thin films and their substrates in preparation for some preliminary film transmission experimenta. I have temporarily descontinued the recombination radiation experiments pending further information on nathan's arrangement from WP.

In

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27 may 1963

Today I made some cursory measurements to discovers the limits to the operation of the amplifier. The first test was to discover the limits of linearity as determined by input signal amplitude. The signal used was the 1000 cpa signal 5 of the calibrator of the Tehtronix 543A scope. The reproduction of the square wave was not perfect due to the inability to get absolute fixed resistors for the "flat" setting of the "bass" and "treble" controls. also, the scope vertical cabibration was not quite true between different caltage ranges. This and parallax, account for the 3-5 75 eeror in gain readings up to the onset of nonlinearity. 5 For reference, The input voltage is referred to Ian equivalent current three a 100 K registor to give an idea of the magnitude of photomultiplier anode current involved to give a certain output. all values of voltage and current are peak - to - peak 10 square arave values. Output Input Gain setting Gain

(mv)	(Ma)	Coarse (db)	Fine	(7)		
.2	.002	0	max	.75	3750	
			min	.50	2500	20
		- 20	mar	.075	375	
12 17 1	and the second second	and and the second second	min	.050	250	
12381 43		- 40	max	.008	40 2 noisy	
and the second			nin	.006	30 5 0	

	Input		Cairo de	Thing	Output	Gain
	(mv)	(ma)	Gain Se Coarse (db)	Fine	(1)	
	. 5	.005	0	max	1.9	3800
				nim	1.3	2600
			-20	max	.19	380
24				min	.13	260
			-40	max	,022	44 } nois
				min	.015	30
	1	.01	0	max	3.8	3800
5				nin	2.6	2600
	2		-20	max	.38	380
				min	.26	260
2			- 40	max	.044	44
			10	max	. 030	30
				min	. 030	59
	2	,02	0	mar	7.5	3750
2	6	,02		min	5.0	2500
			-20	max	.75	
1			20	min		375
-			-40		.50	250
za_			70	max	. 075	37.5
				min	.050	25
is .						
hus.	5	.05	. 0.	mark	. 19	3800
in				min	13	2600
_			-20	max	. 1.9	380
				min	1.3	260
			-40	mark	.19	38
				rin	.13	26
h						
lo	10	./	0	may	nonlinear	
				min	nonlinear	
			-20	mar	3.8	380
				ruin	2.6	260
			-40 .	max	.38	38
2				min	.26	26
	20	.2	0	max	nonlinean	
				nim	nonlinear	
	227		-20	mark	7.5	375
Noisy				min	5.0	250
9			-40	mar	.75	37.5
			10	min	.5	25
				man		

-	10												5			
	12	1.12			Sustant					3			1×	1		th
	8	nput	5		Gain	te	thing		0	utput	. 1	G	ain	(wind)		at
	674	(v)	(ua	.)	Coarse	(db)	F	ine		(V)					-	an
	0				Ben Re Kingt		2		17.0		-	2002	2	15	-	
	5	0	.5	• ~	0		n	rax	7	contine	n				•	of
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		1			-40			max	1	7.5		-	37.5			¢
								min		5.0			25			
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			2					min	104	"		22.	20-			
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		12						nin		13			26		4	
	1000	2		0	0			mar		noul	inean					-
		10R						min	1							
		Sec. 1			-20	3		max		"	8					
		1	6		34.			min	0.0		2					
					-4	a		max		21			21			I
				3				min		16			16	5		
										10		8		in s	1	
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T		at	The	0	and -	20	di-	settis		77	'e on	sof.	1	The.		-
-		000		-	Marro Man			acran	c ya	1 min	no ch	and we wanted	Bue	and a start	 	

at the 0 and -20 db sellings, the onset of the nortinear region was plainly visible on the scope as distortion (clipping), wheras the decrease at -40 db for a 1000 mo input showed no visible distortion. This means that the first cutoff is due to suturation of the finial stage while at - 40 db The cutoff is finally coursed by the distortion veriding

the regative feedback in the first two stages. also, 13 at -40 db some peaking is in evidence on The leading and trailing edges is noticed. This is as yet unexplained We performed a single measurement of the effect of the twin T filter in the first stage feedback loop. The presence of this filter did not seem to effect the onset of nonlinearity, maximum low cut was suplayed Ima) (ya) Sain Setting Coarse (db) Fine Output Sain (V) 1.01 0 4.8 4800 may min 3.2 3200 -20 max . 48 480 nin .32 320 52] hoisy 38] -40 .052 max nin .038 The following noise measurements were made with maximum gain. The figures are approximate peak to -peak values. Input Output Equivalent duput that Circuit .041 Flat 10 MV n 11 1 11 Twin T .004 V Open Circuit Flat .2V 50 MV .06 4 Twin T 15 MV 100 K .11 Flat 25 MV .02 V 5 ur Twin T The next point of investigation will be to find the source of the 1080 ope pick-up appearing in the later stages of the amplifier. The amplitude is unaffected by gain so that it cannot be in the first stage. 28 May 1963

We took The day off.

the as

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14 29 may 1963

Today we gave some consideration to the setting up of a Faraday Effect experiments. We talked to chen to get some idea of what is involved. f (cps) 10 20 30 30 may 1963 50 70 now working nights. Began investigation for source of 100 extraneous 1080 cps signal coming from output of The amplifier when the input is shorted. Before 200 400 starting, made measurements of pertinent voltages: 700 DC Filamento: 5.9 V (Simpson 260) 1080 + 300 : + 295 (RCA VTVM) 2000 + 300 DC current: 70 ma (fingson 260) 4000 7000 The peak to - peak value of the 1080 cro noise is 10000 about 20 mr. By pulling tables in the PSD, we found that the 12BHT CF stage was introducing the signal. 1500 2000 The P-P value of the square wave out of the CF is 4000 63 volte while the cathoda resistor is 11 K, giving about 5.7 pp plate current variation. The internal 7000 100 00 impedance of the Tambda + 300 supply is 10 r so That about 57 mr of ripple is introduced into-the B+ line. This is about what is seen off. The 10 scope and is the cause of the 1080 cps extransous 20 30 signal, This signal may make the balance setting of the recorder 50 change with the sain setting of the amplifies. The observed change is about 1% of full scale going from -40 db to -20 db and about 4% of full scale going from -20 db 70 100 200 to 0 db. 400 The solution to this problem lies in either separate 200 power supplies for the amplifier and the PSD or a redesign of the PSD CF stage with the latter the 108 200 more reasonable. At this time, however, we will defer 400 action on this matter. 700 100 150 200 31 may 1963 400 200 beginning the measurement of the frequency response of the amplifies with load connected. Using HP 100 200 co oscillator an signal source with HP 400 H Y

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VTVM for measurement.

		The	input volto	age will be m	caintained at ,	1 my. 1
	-	F 0.	utput (V)	Gain	Gain referred	l to 1080 cps
	. 10	ps)			(d6)	
		0	.06	60	- 35	
_	2	0	. 21	210	- 24	
	3	0	, 52	520	-16	
_	3	50	1.95	1950	- 4.8	This data
-	-	70	4.4	4400	+ 2.2	taken with
f	1	00	5.1	5100	+ 3.5	controle set
f	2	:00	4.1	4100	+ 1.6	for "flat"
e	4	400	3.8	3800	+1.0	response.
؛ د	7	00	3.5	3500	+.24	
	1	080	3.4	3400	0	
	2	000	3.3	3300	24	
	. 4	000	3.2	3200	5	
_	7	000	3.2	3200	5	
	10	0000	3. 2	3200	5	
d	1	5000	3.2	3200	5	
l.	2	0000	3./	3100	8	
-	4	10000	2.9	2900	-1.4	
veirg	7	0000	2.4	2400	-3.0	
al	10	0000	1.9	1900	-5.0	
to-						
e		10	. 01	10	-50	
us	1	20	.04	40	-38	
		30	.10	100	-30	10
rder		50	. 37	370	-19	
red	-	70	.95	950	-11	
6		100	1.2	1200	-9	This data
o d b		200	1.0	1000	- 10.6	taken with
_		400	1.1	1100	- 9.6	1080 cps
te		700	1.7	1700	- 6	Twin T
		1080	3.3	3300	0	switched in
he		2000	.74	740	- 13	1st stage for
the ler	1	4000	.27	270	-22	loop.
		7000	,15	150	-27	4
	-	10000	.10	100	-30	
		15000	.07	70	- 33	
		20000	.056	56	- 35	
		40000	,036	36	- 39	
		70000	1026	26	- 42	
mse		100 000	,022	22	-44	

The gain settings for all the above data are 0 25 for the coarse and "max" for the fine.

10 The response curve in plotted separately on semi-log paper. Obviously, there is some error in the "bass" circuitry that is causing the hump at 100 ges. What se I will do for the present is run with full low cut and the Twin T in. This trouble in the base circuit is also the cause of the deterioration of the square wave response. 3 June 1963 Today we placed a decoupling network in the B+ lead of the PSD CF. This reduced the fluctuation of the B+ line and now there is no variation of the zero setting with amplifier gain except when going to the ods setting when a small variation of about half a division is noticed. It is to be emphasized that this is a temporary solution, the remanent solution being the construction of a separate power supply for the amplifier. 4 June 1963 The following is an investigation of the response G properties of the PSD. The idea was to establish a relation between the AC input and the DC output 1 as displayed by the recorder and test some of the features of the device. The fine gain control was used to set the amplifier output so that the recorder read 100 for a slit width of 100 M. TC: "3" Gain: -40 ds and -20 db gine was varied PM: 6256 @ 800 v with C-DI voltage optomized.

Source: W lowp (small GE) @ 6V, 7.52. Amplifier Reponse "Flat", PSD adjusted for optimum place. Slit Hieght: 6 mm

Recorder Battery: 1.60 ma.

	slit width (u)	Gain (db)	amplifier Out (P-P SW)	Recorder (div)
t	100	-40	. 95 V	100
	90	"	. 78	81
2	80		. 60	64
	70	4	47 243 49	48.5
200	60		.35	35.5
50	50		.23	24.5
X	40	11	.15	15.5
100	30	1 2 11	.08	8.5
	30	- 20	.8 (noisy)	
4		-40		80
	20	-20	.04	4.0
	20	- 40	• 36	34
	10			2.5
20 3	10	-20	~. Z	17
	2 * 2	- A-		-78
	hole: ter	a selling dr	ifted I div during te the near guadra	the run of
5 S	about 20	ninutar. no	te the near quadra	lic behaviour
105	of the Re	corder to A	lit function as extrained for small	pected. Howeve
ig	poor res	ulto are a	stained for small	en slits and
a	lower li	ght levels.	There seemed to be	quite a la
420	of noise	present.	This motivated the	jug the
-	response	when given	a sine wave input	t. Therefore, The
a	slit was	, set at 100 m	the sain aline to	In 100 line and
			me an unnand	dor 100 and an
	The upper	sideband se	the gain adjusted	t 3, and the
	The upper	sideband se	t at 3, the lower a	t 3, and the
	The upper twin T	put in this	t at 3, the lower a resulted in a no	2 3, and the et decrease of
	The upper Iwin T DC output	put in this	t at 3, the lower a resulted in a n liv (down to 99)	t 3, and the et decrease of after re-
	The upper Iwin T DC output	put in this	t at 3, the lower a resulted in a no	t 3, and the et decrease of after re-
	The upper Iwin T DC output optimizing	put in this of only 10 The place.	t at 3, the lower a resulted in a n liv (down to 99) The following data a	t 3, and the et decrease of after re- as taken.
	The upper Iwin T DC output optimizing	put in this	t at 3, the lower a resulted in a n liv (down to 99)	t 3, and the et decrease of after re- as taken.
	twin T Iwin T DC autant optimizing Slit Width ,	put in This of only 10 The phase. (m) Gain (db)	t at 3, the lower a resulted in a n liv (down to 99) The following data a Amplifier Out (p-)	A 3, and the et decrease of after re- as taken.) Recorder (div
	Alit Width 1 100	put in this of only 10 The place.	t at 3, the lower a resulted in a n live (down to 99) The following data a Amplifier Out (P-) 1.2 v	A 3, and the et decrease o after re- as taken.) Recorder (din 100
	the upper twin T DC autant optimizing Alit Width , 100 90	put in this of only 10 The chase. (m) Gain (db) -40	t at 3, the lower a resulted in a n liv (down to 99) The following data a Amplifier Out (P-J 1.2 v 1.0	A 3, and the et decrease o after re- as taken.) Recorder (din 100 80
	The upper Iterin T DC autant optimizing Alit Width 1 100 90 80	put in this of only 10 The phase. (1) Gain (db) -40 "	t at 3, the lower a resulted in a n liv (down to 99) The following data a Amplifier Out (P-) 1.2 v 1.0 .78	2 3, and the et decrease o after re- as taten.) Recorder (din 100 80 63
	The upper Itain T DC autput optimizing Alit Width 1 100 90 80 70	put in this of only 10 The please. (m) Gain (db) -40 "	t at 3, the lower a resulted in a re- live (down to 99) The following data a Amplifier Out (p-) 1.2 v 1.0 .78 .60	2 3, and the et decrease o after re- as taten.) Recorder (din 100 80 63 48
	The upper twin T DC autout optimizing Alit Width 1 100 90 80 70 60	put in this of only 10 The phase. (11) Gain (db) -40 " "	t at 3, the lower a resulted in a n liv (down to 99) The following data a Amplifier Out (P-) 1.2 v 1.0 .78	2 3, and the et decrease of after re- as taten.) Recorder (din 100 80 63 48 34.5
	The upper Itain T DC autput optimizing Alit Width 1 100 90 80 70	put in this of only 10 The please. (m) Gain (db) -40 " " "	t at 3, the lower a resulted in a re- live (down to 99) The following data a Amplifier Out (p-) 1.2 v 1.0 .78 .60	2 3, and the et decrease of after re- as taten.) Recorder (div 100 80 63 48
	The upper twin T DC autout optimizing Alit Width 1 100 90 80 70 60	put in this of only 10 The phase. (11) Gain (db) -40 " "	t at 3, the lower a resulted in a n liv (down to 99) The following data a Amplifier Out (P-) 1.2 v 1.0 .78 .60 .42	2 3, and the et decrease of after re- as taten.) Recorder (din 100 80 63 48 34.5
	The supper Iterin T DC autant optimizing Alit Width 1 100 90 80 70 60 50	put in this of only 10 The please. (m) Gain (db) -40 " " "	t at 3, the lower a resulted in a n live (down to 99) The following data a amplifier Out (p-) (.2 v (.0 .78 .60 .42 .30	2 3, and the et decrease of after re- as talen.) Recorder (div 100 80 63 48 34.5 28.5
	The upper twin T DC autout optimizing Alit Width 100 90 80 70 60 50 40	put in this of only 10 The plase. (m) Gain (db) -40 " " " " "	t at 3, the lower a resulted in a n liv (down to 99) The following data a Amplifier Out (p-) 1.2 v 1.0 .78 .60 .42 .30 .19	2 3, and the et decrease a after re- as taten.) Recorder (din 100 80 63 48 34.5 23.5 15.0
	The supper Itevin T DC autrat optimizing Alit Width 1 100 90 80 70 60 50 40 30	put in this of only 10 The please. (m) Gam (db) -40 " " " " " " " " "	t at 3, the lower a resulted in a n liv (down to 99) The following data a Amplifier Out (p-) 1.2 v 1.0 .78 .60 .42 .30 .19 .11	2 3, and the et decrease of after re- as talen.) Recorder (div 100 80 63 48 34.5 23.5 15.0 8.0
	The supper Itarin T Dc autput optimizing Alit Width 1 90 90 80 70 60 50 40 50 40 30	sideband se put in This of only 10 The plase. (m) Gain (db) "" " " " " " " " " " " " " " " " " "	t at 3, the lower a resulted in a w live (down to 99) The following data a amplifier Out (p-) (.2 v (.0 .78 .60 .42 .30 .19 .11 .1	2 3, and the et decrease of after re- as talen.) Recorder (div 100 80 63 48 34.5 23.5 15.0 8.0 78
	The supper Itain T DC output optimizing Alit Width 1 90 90 80 70 80 70 60 50 40 50 40 30 30 20	sideband se put in This of only 10 The plase. (m) Gain (db) "" " " " " " " " " " " " " " " " " "	t at 3, the lower a resulted in a w live (down to 99) The following data a amplifier Out (p-) 1.2 v 1.0 .78 .60 .42 .30 .19 .11 .11 .05	2 3, and the et decrease a after re- as talen.) Recorder (din 100 80 63 48 34.5 23.5 15.0 8.0 78 3.5 3.5 3.2
	The upper Itain T DC autput optimizing Alit Width 1 100 90 80 70 80 70 60 50 40 50 40 30 30 20 20	sideband se put in This of only 10 The plase. (m) Gain (db) -40 " " " " " " " " " " " " " " " " " " "	t at 3, the lower a resulted in a w live (down to 99) The following data a amplifier Out (p-) 1.2 v 1.0 .78 .60 .42 .30 .19 .11 .11 .05 .45	2 3, and the et decrease of after re- as taten.) Recorder (div 100 80 63 48 34.5 23.5 15.0 8.0 78 3.5 32 45
	The supper Itarin T DC autput optimizing Alit Width 1 90 90 80 70 80 70 60 50 40 50 40 50 40 50 20 20 10 10	sideband se put in This of only 10 The plase. (m) Gain (db) -40 " " " " " " " " " " " " " " " " " " "	t at 3, the lower a resulted in a w live (down to 99) The following data a amplifier Out (p-) (2 v (10 .78 .60 .42 .30 .42 .30 .19 .11 .11 .11 .05 .45 	2 3, and 84e et decrease of after re- as talen.) Recorder (div 100 80 63 48 34.5 23.5 15.0 8.0 78 3.5 3.5 3.5 3.5 16
	The supper Itarin T DC autput optimizing Alit Width 1 90 90 80 70 80 70 60 50 40 50 40 50 40 50 20 20 10 10	sideband se put in This of only 10 The plase. (m) Gain (db) -40 " " " " " " " " " " " " " " " " " " "	t at 3, the lower a resulted in a w live (down to 99) The following data a amplifier Out (p-) (2 v (10 .78 .60 .42 .30 .42 .30 .19 .11 .11 .11 .05 .45 	2 3, and the et decrease of after re- as talen.) Recorder (div 100 80 63 48 34.5 23.5 15.0 8.0 78 3.5 3.5 3.5 3.5 16
er plase.	The supper Itarin T DC autput optimizing Alit Width 1 90 90 80 70 80 70 60 50 40 50 40 50 40 50 20 20 10 10	sideband se put in This of only 10 The plase. (m) Gain (db) -40 " " " " " " " " " " " " " " " " " " "	t at 3, the lower a resulted in a w live (down to 99) The following data a amplifier Out (p-) 1.2 v 1.0 .78 .60 .42 .30 .19 .11 .11 .05 .45	2 3, and the et decrease of after re- as talen.) Recorder (div 100 80 63 48 34.5 23.5 15.0 8.0 78 3.5 3.5 3.5 3.5 16

18Plat of above data 100for LC=3, HC= 3 and Tavin T on. 90 Alope is about: 83 dir/v 80 70 60 The input signal was 50 . 60 aycle modulated so that it was difficult to obtain 40 very accurate readings of the voltage from the scope face 30. which was divided into 1/2 con intervalo anguay. 20 10 . .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2 1.3 1.4 1.5 amplifier Out (p-p volto of sine wave) The effect of the time constant response was hardly noticible at 4, 3, and 2 and I did not really want long enough at 1 to really observe it. The drift of the entire system was measured at Gain settings - 40 and -20 with the slite adjusted to put the recorder at about mid-scale. The mayimum variation at - 40 was less than . 5% over a 1/2 hour period, and less than . 5% at -20 for 10 minutes however, There was more noise on the latter. The overall transfer function of the system na: A = APA APSD (APM) Apr = (PM anode resistor) = 10 ° a/v = 10 ma/v where amplifeer Gain = 4800 for maximum APA = 38 for menunum = Apso = 83 dw /1 Hence: A = 40,000 div / 4a (maximum APA) 316 die Jua (minimum APA) =

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made check of balance drift: no noticable drift over period of 20 minutes. Took data on 60 Film #6. This is quite a thin film as its deposition period was only two minutes. The film was held in the holder and placed over the face of Mc Elroy's PM table with a griece of masking tage. This seemed to work quite well. The scan was made at 500 Å/min to get the 'beg picture". First Io was talen, then I then Io again, each run taking about 10 minutes. It was noticed that some parts of Io hod changed by about 276 between runs. He film log gaze 50.

Io

Rec. (div)

Wavelength (Å)

Gain (db) Rec. (div) Gain (db)

19

I/Ia

			0			
	S RS LE LAR					1.11
	7000	10.2	- 20	2.4	- 20	,235
	6900	11.0	11	3.0	18	. 272
	6800	12,2	JK	4.0	d	. 328
	6700	15.0	62	5. Z		. 347
	6600	19.0	4	6.6	4	. 347
	6500	24.8	10	8.8	H	. 355
	6400	34.5	ч	12.0		.348
	6300	58.0	4	19.5	H	. 336
	6200	12.2	- 40	41.9	4	. 343
	6250	17.2	11	56.0	4	. 326
	6100	20.5		64.2	"	.313
	6080	21.5	"	66.0	"	.307
	6060	22.1	"	66.5	"	. 30 1
	6050	21.9	u	66.2	"	. 30 2
	6040	20.5	н	62.8	11	. 306
	6030	20.5		61.2	"	. 299
	6010	21.0	4	62.0	н	. 295
1	6000	21.5		63.0		, 293
•	5950	24.4	0	69.1	st	. 283
	5900	27.5	u	74.5	28	. 271
	5880	28.9	a	76.0	a d	. 263
-	5860	29.9	4	77.5	18	. 259
	58 40	30.8	u	78.2	u	.254
1	5820	31.4		78.5	11	.250
	5800	32.0		78.2	,1	.244
	5780	32.2	u	78.1	11	.242
	5760	32.6		77.9	11	. 239
	5740	32.9	ti.	77.6	11	.236
	5720	33.0		77.0	il	.233
	5700	33.2	11	76.8	ıl	.23/

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0				C A REP 1		1 1
Wavelength (Å)	Io		I		I/I.	55-
0	Rec. (div)	Gain (db)	Rec. (div)	Gain (db)		4
						7
5680	33.6	-40	77.0	-20	. 229	
5660	34.7	"	77.6	"	. 22 4	8.0
5640	35.5	"	78.9		. 222	
5620	36.7	#	81.4	1	. 222	90
5600	38.5		84.8	4	. 220	
5580	41.0	H	89.4	"	. 218	
5560	43.5	en e	95.0	3	. 2/8	26
5540	47.5		The state of the			
5520	51.9	"	10.9	-40	. 210	1
5500	57.1		12.9	11	. 208	
5480	62.4	1 1 2 1	12.8	11	. 205	
5460	68.2	м	14.0	"	. 205	
5440	74.2	a	15.0		. 202	
5420	79.0	"	15.6		. 197	
5400	83.8	10	16.4	"	.196	
5380	86.8	61	17.0	11	. 196	
5360	87.2		17.5	11	.196	
5340	91.1	81	17.7		.194	1
5320	92.2	4	17.7	"	. 192	
5300	92.5	11	17.5		.189	
5280	92.2	80	17.3	"	.188	
5260	87. 92	40	16.9	48	. 185	1
5240	87.0	11	16.2		.186	
5220	79.8	44	14.8		.185	1
5200	77.1		14.1	el	. 183	
5150	72.4		13.1	.1	.181	
5100	68.9		12.5	11	.181	6
5000	63.6		11.2	d	,176	
4900	58.4	.1	10.2		.175	4 S
4800	53.2	11 100	94.8	-20	.178	
4700	48.0		84.0	.,	.175	
4600	42.8	18	73.0		.170	
4500	37.4	.1	63.8		.171	
4400	32.2		53.6		. 166	
4300	27.2		43.6		.160	
4200	22.3		34.8		.156	16
4100	17.0		25.4		.149	
4000	12.2	01	16.5		.135	1 2
3900	84.8	-20	10.5		,124	
3800	71.2	4	8.0	14	.112	
3700	57.8	4	6.0	91	,104	1. 1.74
3600	41.0		4.0	11	.0975	
3500	23.5	11	2.2	11	.0936	*
6650	16.4	4	6.0	al	.367	E.
9939	10.1					

						21
		6 June 196.	3			first R
=/Io	4		1 ++ 0			1 along general
		Today	we platted	up the do	ata on the previous	two pages.
		The plat of	I/IO NO. 1	1 indicate	tes an absorption.	edge in the
229		neighborhood	L of 5500.	A to 6100 1	A which is proba	ably the
224		A transite	ion. The da	to is scal	thered along the b	battom of
222		the edge,	Thus maki	ng it diff	licult to determine	whether
222	A	the charac	teristic spi	in - orbit "	splitting is abserved	, although
220		The curve	do-ca sus	gest that is	splitting is abserved t is. also, it is	, hard to
218		delermine .	whether or	not this	a is an interfere	nee effect.
218	25	This of	ternoon, we	e ran a -	recheck of film #6	· between
-		6250 A and	4750 A, at	t a scan	of 125 A/min. als	so, a run
210		was taken	n at 500 Å	min on	film # 4, a rathe	a Hich
208		film, in	order to s	see the " !	big picture " here.	0.22
205		08306 M	64 2 60 5 60			04 878 9 0
205		88 83 28	24010			100 100 100 L
202			1.1.1.8.6.3		5.11	03 82 0
197		7 June 196	.3			cn 122
196					A CALLER A	10 00 00
196	3	The falk	Jowing data	is that	Taken yesterday o	n Film #6.
196		Slita:	100 M @ 6 mm		Tahen yesterday or TC: 3 Amplifier: NB	08 82 0
194			100 11/ mm		amplifier : NB	- 05 kg
192			W lamp (sm	rall)		0.6 22
89		PM: 6	62568 @ 800	v (apt)		1.2 1.00
88		12303 20 0	24.25			014 133
185		Wavelength (Å)	Io		T	I/I0
86	2	23.2 10	Roc. (div)	Gain (db)	I Rec. (dur) Gain (db)
85	1		05 0. EE			
83		6250		- 20	27.1 _ 20	. 340
81		6240	86.2		29.5	. 342
81	9	6230	93.6		3/.5	. 337
76		6220	Jan Jan Star	-40	34.1	01 10 1
75		62 10	11.5		36.8	. 320
78		6200	11.8		39.7	. 336
75		6190	12.6	-	42.5	,337
70		6180	19.6		44.9	. 330
71		6170	14.4		47.4	, 329
66	+	6160	15.3		49.8	. 32.5
60		6150	16.3		52.3	, 321
56	52	6140	17.0		54.3	. 3/9
49		6130	17.7	1 1 1	56.3	.318
35		6120	18.2		57.9	.318
24		6110	18.8		59.4	.316
12		6100	19.2		60.6	.316
04		6090	19.7		61.7	.313
975		6080	19.9		62.2	.3/3
936	the start	6070	20.1		67.8	.312
67		6060	20.2		62.9	,3//
		6050	20.2		62.5	,309
	4					

0	0
4	2
	U
-	10
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Wave length (A)	Io	I	I/Io	2 1/2 6 1
	Rec. (dir) Gain (db)	Rec. (dir) Gain (db)	*	
	19.3 -40	590 -20	201	5:
6040			, 306	
6030	(9.1	57.7 58.1		53
6020	19.2	58.8	. 303	5
6010	19.6		. 299	5.
6000	20.0	59.7		
5990	20.8	60.5	. 291	5.
5980	21.2	61.5	(A)	5
5970	21.6	62.5	.289 .284	
5960	22.4	63.7		5
5950	22.9	64.8	.283	5
5940	23.5	65.9	.280	5
59 30	24.1	67.0	,278	5
59 20	24.7	67.9	. 275	5
59 10	25.2	68.9	.273	5
59 00	25.8	69.8	.27/	5
58 90	26.2	70.5	.269	5
58 80	26.8	71.5	.267	5
5870	27.2	71.9	.264	5
5860	27.8	72.1	.259	5
58 50	28.2	72.5	.257	5
58 40	28.5	72.9	.256	5
5830	28.9	73.1	.253	5
5820	29.1	73.2	.252	5
5810	29.4	73.1	.249	5
58 00	29.6	73. 2	.247	5
57 90	29.8	73.2	.246	5
57 80	28.9	73.2	.245 .	5
57 70	30.0	73.1	.244	5
57 60	30.1	73.1	.243	5
5750	30.3	72.4	.239	5 5 5
57 40	30.5	72.1	.236	5
57 30	30.5	72.0	.236	5
5720	30.5	71.8	. 235	5 5 5 5
57 10	30.7	71.9	. 234	5
5700	30.8	71.9	,z33	5
56 90	31.0	7/.8	, 232	5
56 80	31.2	71.5	. 229	
5670	31.4	72.0	. 229	5
56 60	31.8	72.5	.228	
56 50	32.2	72.9	. 226	5
56 40	3 2.7	73.6	. 225	5
56 30	33.0	74.3	225	ک ح ح ح ک ک ک ک
56 20	33.8	75.2	. 222	5
56 10	34.2	76.5	.224	5
5600	35.1	78.0	.222	

Z/Io Rec. (dir) Gain (db) Rec. (dir) Gain (db) . .55 90 .36.5 - 40 80.0 - 20 . .306 .55 80 .37.5 . </th <th>z/9 .219 .219 .217 .217 .214 .214 .213</th>	z/9 .219 .219 .217 .217 .214 .214 .213
Z/I_0 Rec. (dir) Gain (db) Rec. (dir) Gain (db) . .55 90 .36.5 - 40 80.0 - 20 . .306 .55 80 .37.5 . .82.0 . . .303 .55 70 .39.0 .84.5 . . .303 .5560 .40.2 .87.1 . .300 .35 50 .42.2 .0.5	2/9 .2/9 .2/7 .2/7 .2/7 .2/4 .2/3
Z/I_0 Rec. (dir) Gain (db) Rec. (dir) Gain (db) . .55 90 .36.5 - 40 80.0 - 20 . .306 .55 80 .37.5 . .82.0 . . .303 .55 70 .39.0 .84.5 . . .303 .5560 .40.2 .87.1 . .300 .35 50 .42.2 .0.5	2/9 .2/9 .2/7 .2/7 .2/7 .2/4 .2/3
306 55 80 37.5 82.0 303 55 70 39.0 84.5 .303 5560 40.2 87.1 .300 .35 50 42.2 90.5	. 219 . 217 . 217 . 214 . 213
306 55 80 37.5 82.0 303 55 70 39.0 84.5 .303 5560 40.2 87.1 .300 .35 50 42.2 90.5	. 219 . 217 . 217 . 214 . 213
303 55 70 39.0 84.5 . .303 5560 40.2 87.1 . .300 .55 50 42.2 70.5 .	.217 .217 .214 .214
.303 5560 40.2 87.1 .300 5550 42.2 90.5	.217 .214 .213
. 300 53 50 42.2 70.5	. 214
	, 213
· CIT 33 40 44.0 93.7 V	
	. 2/2
	.2/9
	. 2/3
	.211
	. 210
22	. 2//
	,210
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	.206
4.8	,207
	.206
	. 206
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	.204
	.201
	.201
.252 53 60 82.5 16.5	,200
	. 197
.247 5340 84.3 16.6	. 197
. 246 5330 84.1 16.5	. 196
	.194
.244 5310 85.0 16.4	.193
243 53 00 85.1 16.4	.193
.239 . 52.90 85.1 /6.3	. 192
	.191
236 5270 84.4 16.1	.191
	.191
	. 193
	.190
232 52 30 75.3 14.4	. 191
	190
	188
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	191
	.191
	191
	187
.222	

N

Ware	elength (A)	Io					
	0	Rec. (div)	Gain (db)	I Rec. (dir)	Gain (db)	I/Io	
						a 2.	
	40	65.8	- 40	12.4	-40	. 188	
51		65.0		12.2		. 188	-
51		64.5	(12.1		. 188	
51		63.8	↓ ↓ - - '	12.0		. 188	de la companya de la
51		63.3	<i>← ⊢ ⊢ ⊢ ⊢ ⊢ ′</i>	11.9		. 188	
50		62.6	↓ + - ·	11.7		. 187	
50		62.2		11.6		.186	05
50	70	61.9		11.5		. 186	
	60	61.2		11.4	1. Not 19	.186	
50	50	60.8		11.3		. 186	
50		60.2	*	11.1		. 184	
50		59.8		11.0		. 184	
50		59.2		10.9		. 184	
50		58.7		10.8		. 134	
50		58.2		10.8		. 186	
49				10.8		.186	
49		58.1 57.8		10.8		. 185	
			(+++++++++++++++++++++++++++++++++++++	10.1		. 185	
49		57.4				. 185	
49		56.4		10.5			-
49		55.9		10.5	+	.188	
49		55.3		10.3	<u> </u>	. 186	
49		55.1		10.2	+	. 185	
49		54.5		10.1		. 185	
49		54.1		10.0		.185	3
.49	00	53.8		10.0		,186	
48	90	53.3		10.0		. 198	
48		52.7		9.9		. 188	*
48		52.5		9.8		. 187	
48 (51.5	X		- 20		
48 :		51.0	•	91.5	1	.179	
48		50.4		90.3		.179	
48		50.0		90.0	Y	.180	
48		49.5		89.2		.180	
48		49.3		88.5		,180	
48		48.7		87.3		.179	
47		48.2		86.3		.179	5
				85.5		.179	
47		47.8					
47		47.2		85.0		. 180	
47		46.7		84.1		.180	
47 :	50	46.1		82.8		.180	
100							
11/1						05 1 2	
1.2							-

		1 +			25
I/Io	The following a	data is the	at taken -	yesterday on film	the A. And C.
120	AP: t. In .: @		P.M	: 6256B @ 800V Co	+
	Alit: 100 µ @ Acan: 525 Å/			: 6(568 @ 8000(0 : 3	Jac 1
88	Source: W lan			nglifier : NB	
88	Hource . in sum	ip (amakes	cm	plycer: NO	
88	Warda att (P)	τo		I	I/Io
88	Wavelength (Å)	Rec. (div.)	Gain (db)	Rec. (div) Gain (db	
88		Rec. (am)	Gain (as)	Rec. (dir) com (ac	,
87	7000	9.9	- 20	3.8 0	02.94
86	69 00	10.0	I	5.1	.0384
86	68 00	11.0		6.5	.0591
86	68 00			6.3	.0614
36		13.2			.0542
84	6600	16.6		9.0	.05 42
84	6500	21.5		10, 2	.0474
34	6300	29.0 46.3		12.3	,0346
34	63 00	46.3		16.0 26.3	.0271
86	62 00	91.0	-40		
36	67 00	21.2		34.7 26.6	.0164
35	59 00	27.9	· ·	20.5	8.23 - 103
25	58 00	29.5		16.4	5.56 . 10 3
36	57 00		Y		11 52 . 10-3
18	57 00	31.2 34.1		14.1 14.8	4.52 · 10 ⁻³ 4.34 · 10 ⁻³
36	36 00 55 00	34.1 47.0		20.4	4.34.10-3
35	54 00	71.0			4.34.10
15	53 00	71.0 85.0		31.1	4.38.10 4.36.10-3
15	53 00	77.2		37.1	4.42.10-3
	5100	67.2		34.1	4.42 · 10 4.66 · 10 ⁻²
36 38				31.3	
?g	50 00	61.6		30.0	4.87.10
7	49 00	56.7		29.0	5.11.103
-	48 00	51.7		27.4	5.30.103
79	47 00	46.9		25.0	5.33.10-3
79	4600	42,5		22.2	5. 22 . 10 3 5. 13 . 10 3
	45 00	37,4		19.2	
30	44 00	32.5	1 2 1 1 2 1	15.9	4.89.10
80	43 00	27.7	As 100 81	12.3	4.44.10-3
30	42 00	23.0		9.4	4.09.10
79	41 00	18.2	and a lar	6.2	3.41.10
79	40 00	13.4	- 1883	4.0	2.99.10
79	39 00	9.4		2.2	2.34.10
30	38 00		-20		
30	37 00	58.0		1.1	1.87.10
80	36 00	45.0		1.0	2.22.10
	3500	27.4		.4	1.46.10

x

26 10 June 1963 to 1 July 1963

This period was spent in the design and redesign of The sample optics and in the wiring of the photometipher assombly. The original design for the sample optics was discarded because of the difficulty in performing reflection measurements. However, this assembly is still intact and can be used for other transmission measurements. The new design in as follows: mirror Mirror PM The angle of incidence of the principle ray of the beam is ~ 7°. One can see how transmission and reflection may be measured by blocking off first one mirror and then the other. The avhole assembly was built by nupelf. The two mirrors were smultaneously evaporated in the Vesco evaporator of Bloembergens ogramp. The photomultiplier divider chain was made up of 50K (14) 12 Daven wire - wound resistors. also, a minibox unit was constructed to allow the switching of the PM anode resistor from values of 100 to 10 to 1 K. Using the formula on pase 18 we find that for an anode resistor of 1 K and APA = 38 : A = 3.16 div /ua

so that a 100 div deflection requires \$1.6 up this appears to be much then the saturation current. The dark current of the 6256 B is about 1 m up For maximum Apa, A = 40,000 div/up, so that the dark current could give a deflection of 40 div. Also during This Time, Cardona's data was comerted to conform with mine.

	2	uly	1963
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lier .	character	ristico	from the	data	s of	Cardona	, that	t is, a	conve	naion
tion tout	of his	grap	from the	y s	mu.	See J	AP 34,	813 (19	763);1	Eig. 5.
act	Waveleng	th	Energy		lo	g Io/I			II.	20
nto.		0.00	0 0	-	500 Å	1500 Å	3000 Å	500 Å	1500 Å	
	3 500 Å	100 0 2 10 0 10 0 10 0 10 0 10 0 10 0 1	3.54 ev	200 12 10 10 10 10 10 10 10 10 10 10 10 10 10	. 58	2.71		2.63.10	1.95.10	3
6	3600		3.44		.57	2.71		2.70.10'	1.95	
12 - 1 N T N T	3700	ale they	3.35	and me	.56	2.68		2.76	2.09	
	3800	and the	3.26	Sec	.54	2.59		2.89	2.57	
	3900	Lie and	3.18	a second	.50	2.55		3.16	2.82	
	4000	2.3	3.10		.47	2.50		3.40	3.16	
	4100	105	3.02	and be t	.45	2.46	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	3.55	3.47	
	4200	P. Santa	2.95	Sugar	.45	2.42	X 1	3.55	3.81	S Lan
	4300	la St.	2.88	1 2	.44	2.39	1. 3	3.64	4.08	- 1. A.
	4400	Sugar C	2.82	1 23	. +3	2.36	31	3.72	4.37	
mbly	4.500		2.76		.43	2.34	S. Anno 19 10	3.72	4.58	
mbly	4600	See See 2	2.70	1	.43	2.33	11 22	3.72	4.68	
1	4700	and and	2.04		.42	2.3/		3.81	4.91	2
of	4800	12- 1- 1- S	2.58	1 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	.41	2.29	A. marke	3.90	5.14	
0	4900	1-5	2.53		.40	2.25		3.98	5.63	
p	5000	England -	2.48	1.35	.39	2.18	4.25	4.08	6.46	5.63.10
	5100	9	2.43	2 2	.38	2.10	4.25	4.17	7.95	5.63.10
	5200	N.S.	2.38	1312	.37	2.01	4.24	4.27	9.80	5.76.10
3	5300	- Ala	2.34		.35	1.94	4.22	4.48	1.15.102	6.04.10
3	5400	100	2.30		.34	1.81	4.17	4.58	1.55	6.77.10
	5500	2 march	2.26		.32	1.72	4.18	4.80	1.91	6.62.10
4	5600	151-1	2.22		.30	1.61	4.20	5.02	2.46	6.32.10
	5700		z.18		,28	1.50	4.18	5.25	3.16	6.62.10
	5800		2.14		. 25	1.39	4.05	5.63	4.08	8.93.10
	5900		2.10	-	.23	1.31	3.50	5.90	4.90	3.16.10
it.	6000	100 30-	2.07	Store Star	,21	1.25	3.10	6.18	5.63	7.95.10
For	6100	1 Sugar	2.07		,19	1.20	2.73	6.46	6.31	1.86.10
	6200		2.00	- inter	.16	1.10	2.45	6.93	7.95	3.55.10
7	6300		1.97		,14	1.05	2.25	7.25	8.93	5.63.10
4	6400	111	1.94	and and	113	. 98	2.04	7.43	1.05.10	9.14.10
0	6500		1.91	til a	.12	.93	1.90	7.60	1.18	1.26.10
	6600	1.0.10	1.88	1.2.	,11	.90	1.77	7.77	1.26	1.52.10
	6700		1.85	1	.10	.88	1.65	7.95	1.32	2.24.10
	6800	- Starle	1.82	1 dente	,10	.86	-	7.95	1.38	
	6900	tail	1.80	3.300	,10	.85	Santa 4	7.95	1.41	
	7000	and a	1.77	155	.09	.83	Pale a	815	1.48	
	2100	- 33	1.75		.08	.81	America	8.33	1.55	
X	7200	14.5 2° 1	1.73	26+	.08	.80	1 32	8.33	1.59	
1.3.	7300		1.70	0 82-1	. 08	.80	- under	8.33	1.59	
	1. 5.0									100 mar 100 mar

· 28 3 July 1963

This morning I re-adjusted the sample optics so that The beam would be focused on each of the two 4 mirrors (page 26) instead of the sample. In this 1 way, I can contain all the light and grevent its n W area illuminated on the sample not too large. an In fact, by having it larger, one averages out variations over the area of the film. This afternoon of checked for light - tightness and found generally that operation in a fully lighted noon may be feasible for low PM voltages, but not high adjusted things to the goint where my deal lamp and PM's deal lamp being on did not seem to make any difference at voltages of 2000 v. At 2500 V, dack current was high enough 06 / i A b 0/2 h to give about previously calculated value (page 26). It seem that by using a long time constant, a fairly N good dark current signal may be expected at 2500 v? A check of the feasibility of using anode resistor variation to control the gain of the system sloved to be successful to about .5% overall and loss Ha wo lo Than this when switching between adjacent ranges. Also today & finished plotting up Cardona's data. His data, Laking his stated thicknesses, seems to Go fo indicate that the transmissivities of the films are consistently higher than one would expect from the curves computed from Taucia data. also the edges of his thinner films seem to be gute broad.

8 July 1963

This morning I checked stability of the whole system, For 10 no imput, there seems to be great a mull amount of pulsing noise" due probably to small amounte of ac-over in the divider chain. when the signal is 2 present, there seems to be source instability present. 4 when the SR regulator is put back in and a long warmup allowed, the signal on stability is 9 n apparently improved. The no-signal max. 3 din result seems to be pretty clean too. This is unnauch when Do we regard that formerly the SR canaed a great deal of interference. Poolably now the Twin T is taking care of things. Overall stability of to is probably about 1%. Will continue to check this. also, this afternoon took fo 11_ Transmission curves of filters CS3-23 and CS3-70 and a full set for film # 6 in range 7000 A - 4000 A . Will do calculations later.

29 9 July 1963 t Last night I finished the mount for the Pr lamp (Manan). This morning I tried it out for stability. Found that rapping the table caused the lamp to shift in its mount thereby causing the light autput to change. -When left alone, it appeared to be very stable in output. The test was made near & 3188. also, a run was made to determine the transmissionity of coming filter cso-53. In the afternoon I ran R and T on film # 6 in the range 4000 Å - 2000 Å. The geak and edge of the × trainition ifited is very evident even in the IR and IT tracinga. but It is now also apparent that The range 3500 - 4500 should lere be covered by the tungsten lamp. Thermal contraction of the Dr lamp holder brake the lamp and we now have to wait for a new one. The new one should be rurapped with some "soft" substance like cloth. did h 26). Torright I ran a Transmission run on filter CS 3-75. airly Had about a 4% drift in Io, probably due to insufficient vo ton warmup of the W lamp. also a " gap filler" run was made with the W lamp to fill in the range around 4000 Å for film #6. ed 2 Good stability of Io was noted. It now appears that the D. following selection of sources will prove adequate: L . to Filter Source Range (A) -W lamp 7000 - 5000 CS3 - 73w W lamp 6000 - 3000 ad. none 4000 - 2000 Dr lamp none 10 July 1963 For t of This morning I wired up a Raytheon I KW line stabilizer to use between all the equipments and the mains in the hope of further stabilizing Io. is esent. There may be also some drift due to the twin T in the preamplifier and someday perhaps wire wound Daven resistors should be used in that cercuit. long sult on the afternoon I began conting the program library hen af for the future computations to be done. are 70 , oh 11 July 1963 Il set

Pienie.

12 July 1963

The day was spent preparing programs.

15 July 1963

This day was spent preparing programe.

16 July 1963

This day was spent preparing programs. A run was made on the 1401 pre-processor to detect obvious errors. The current 1401 rate is #35 per hour, or .35 per hundreth, or .59 per minute. The going rate on the 7090 is # 285 per hour, or 2.85 per hundreth, or # 4.75 per minute.

17 July 1963

The returns of last nights Fortran un were malyged. The program GRAPHI was the only program that did not compile because of errors. The running time was 9 hundrethe with a cost of 23.05. The runs will be denoted in the same way as the spectra, viz., by the data plus a sequence number. The re-compiling of GRAPH I took 2 hundrether with a cost of " 5.70. This afternoon I recorded the data from the run & July 1963 @ on Corning filter C3-73 for The surpose of testing the programs already written and compiled. The data input consisted of:

Data Card Bits 7: Jo for CS3-73 Sto, IT, Jo for CS3-73 Straph I and Straph 2 Title Card: Scale Card: Join 2 Jo, Ir, Jo for CS3-73 Straph 1 Title Card Acule Card

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1 is

31 18 July 1963 to 23 July 1963 Time spent in program debugging. 24 July 1963 Time spent in program debugging. 25 July 1963 Today the first useful results were received from the computer. The following programs now seem to be operating properly: DIVI, DIVI, GRAPHI, GRAPH 2, and GRAPH 3. The calculations for 8 July 3, 9 July 3 and 9 July 5 were completed to day. On 8 July 3 there is a Juny atructure at 6300 and 6400 & which appears in both R and T. This anamoly is unexplained and further measurements are necessary. The correlation between these three runs is not good and purther study in definitely called for. The expected structure at the L and X edges is definitely observed as is the spin-orbit splitting at the 1 edge in both Transmission and reflection. The following further steps seem to be in order: (a) study system stability for both W and Dr sources (b) Check on attenuator values. (c) make sume on film 6 using polarized (d) Find out effect of changing film position in the beam. note: all measurements on Film #6 were taken with the sample holder set at : Horizontal = 50 Vertical = 11 I have just lesigned a sample holder so that each specimen can be mounted in its own holder. It is hoped that this procedure will enable me to repeat measurements on the same spot on the film. also, I have aligned a Polaroid HN32 polarizer, The Transmitted E field is in the direction of the two staple holes.

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for

32 26 July 1963 This day was spent preparing Option I. 29 July 1963 Turned on system today at 5:25, to begins check on system stability. n The Io reamed to be highly unstable at all values of PM voltage and wavelang the and levels of light. Experimenting H

by knoching the table, laws, and mirrors showed that this instability was due to minute motions of the source lamp. After adjusting position of lamp, several To runs were made between 6000 Å and 5000 Å. The result was that about 1/2 To drift was noticed over a geried of about an hour also, removing the cover from the lamp seemed to lend greater stability to the system. All 29 July 2.

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30 July 1963

This morning I began some stability and resatability tests on film #6. Experienced the same initial Yh 2 high degree of to instability as last night. Suntly topping the lamp with a piece of cardboard y seemed to steady the output, that is, some sort of equilibrium was found. N. 0 6 also, I tested the usetability of the sample C holder under both uflection and transmission. Sample holder coordinates (50, 11) were used and the an resetability was excellent within the limits 1 imposed by the drift of to which at times was 0 as great as 470. also, there reemed to be some drift in the balance control setting. At this time, the Io 7 -0 is not halding as good as might be hoped and as good as it was last night. The following secure on #6 0 were taken : 30 July 2: 6000 - 5000 A 30 July (3): 30 July (3): 30 July (3): 30 July (5): 30 July (5): 6000 - 5000 A 5500 - 4500 A 5000 - 4000 A d 4500 - 3500 A 2 4000 - 3000 A >

6500 - 5500 Å 33 6000 - 5000 Å (polarization 1 plune of incidence) (" " " " " 30 July (8): 30 July (9); 31 July 1963 at 2:00 AM, I stopped taking data. The last run was made with polarized light from a Polaroid Type HN 32 linear polarizing sheet. This is to determine: (1) The amount of polarization introduced by the monochromater on ues of rementing monochromater, wed (2) the effect of polarized light on the transmittance reflectance of film 6. w and reflectance of film 6. all during the run, the to stability was excellent, in most cases the variation was unoticable. 0, • The suns were made over intervale of 1000 A, each The overlapping, as can be seen from above. 1 august 1963 Today & ran the data of 30 July three the computer. The results generally indicate reproducibility to within 270 as a conservative estimate. The error is probably introduced by the mechanical stage in that the film is probably not brought back to exactly the same space as before. A good set of data was attained for 6500 & to 3500 °, the I spin-orbit splitting being consistently evident in all scans between 6000 ° f The runs under polarized light indicated that The direction of polaringation made a difference of aa about 5%. However, the run on unpolarized light fell about 1/2 way between these so it is probably safe to assume normal incidence to hift To an accuracy of about 1 percent. az t6

2 august 1963

Yoday I fixed the De laws holder by wrapping asbestos around the longs and living the lamp holder with neoprene. also plotted up R and & for film 6. noticed that the transmission seemed nearer the "theoretical" curve than did Cardonas.

34 5 August 1963

This morning I began the UV run on film 6. The Dr lamp holder seemed to work satisfactorily. After a sufficient warmup period, the Dr To seemed quite stable and reproducible to within 170. The following runs were made: 5 august O Prelimany measurements 4000 A - 3000 A 0 2 3500 A - 2500 A 3 3000 A - 2000 A (F) :

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3500 Å - 2000 Å (different PM voltage) 3500 Å - 2000 Å (different settings on sample kolder) 0 : 0 1

When different setting (48, 11) was used on the samples holder, about 8% difference in reflectivity aver position (50,11) was measured. This points befinitely to the reproducibility of the sample holder setting and probably the largest error in the measurement. sometime & should investigate the possiblit of experiments using lasers and this films, notably, the effect of strong pumping on absorption.

6 August 1963

spent the day preparing the data for computation. 2:

7 august 1963

The results of 5 August seem to fit smoothly into the data of 30 July. This completes the data for film & for right now. Yonight & tried measuring the reflectivity of 6e 26 sample repaired by lave max toed. It seems as if the reflectivity half of my Transmission - Reflection stage uses not optimally alliqued. This fact invalidates the reflectivity data of film 6. Also there is quite a lot of "slop" in the mechanical store movement. Will have to try re-adjusting to obtain optimum reflectivit constant after the equipment had been given several hours warm-up. of 6 a n J 80 de hours warm-up. ci

8-9 August 1963

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veral

It is clear that the present system of mounting the sample will be unsatisfactory. Therefore a new mount will be built using micrometer adjustments following roughly a design by Kulicke and Soffa also testing of OPCONI began.

35

12-13 august 1963

most of OPCONI seems to work, but I suspect trouble in subronline TRANCE involving one of The derivatives.

14-16 August 1963

Vacation

19-21 August 1963

Vacation

22-23 August 1963

Trip to IBM. While there I began arrangements to obtain a Saertner ellipsometer with its attachments.

26-30 August 1963

This week was speat in beginning the construction of the sample holder, checking out OPCONJ, and THIFIL, building a jig to silver films and making arrangements to obtain the ellipsometer. There are many things the ellipsometer may be used for. I intend to make use of it possibly in the followine ways: (1) measure the transmission of the films at three different angles of incidence and from this calculate the optical constants and the thickness.

36 (2) measure carefully the optical constants of semicondu - uctors by ellipsonetric measurements in order to observe the fine structure which was not seen by archer. 18 a (3) make ellipsometric measurements on the films es Themselves. re a of 3-6 September 1963 to This week was spent working on the sample holder and cleaning up OPCONT. The trouble with this on no program was finally located. The writing of OPCONZ was begin. This is the program to solve for n, k, t given R, T, R'. Also, several subsidiary programs were started. A run was made for testing the silvering jig and it seems to word all right at a current of 100 a and an evaporation time of I num. Sometime ame thought will have to be given to evaporating silicon films. 2 a I Y n n silicon films. 2 an an 9-13 September 1963 ~ This week was spent doing work on The sample Th bolder and a shutter system to facilitate the measurement of Io, IK, and IT. Also, OPCOUL was ca written and the conversion to the MIT FMS started. attempts were made to catch up on the literalure. 19 usi 16-17 fextember 1963 ano abt These two days were spent principally in preparing programs, literature searches and reading, and heeping up with developments on the sample holder. ani in arch it

37 18 September 1963 reander n lo today began allignment of reflection - transmission suptain with new sample holder in place. Benerally, the findings are an follows: () The polished be mirror was used as the reflecting sample and allignments were made with a PM valtage of 500 V and an wavelength setting of 5300 R or 5900 R. (2) First, the Io and IT mileror was alliqued to give maximum output. The region of maximum lder output seemed to reak rather sharply so ghat rotation of this mirror is quite critical. UZ. (3) The IR mirror was alliqued with the Ge minor in place. The maximum of this mirror allignment seemed to be much flater thanthe To-Ir. Also, the image was slightly rained. The reflectivity at 5300 R varied from .495 to .570 which is in the right ballpack. rent 141 The reflectivity was very independent over a reasonably wide tange of micrometer settings, a very good sign. In fact, the angle of incidence eline ting on the PM seems to be the only critical value (5) The 3 point mount enabled reproduciblity and the prosted glass has been removed to increase sensitivity. (6) a Ge mirror will be prepared according to The prescription of PDE(62) in order to see if why can match Fig. 2 of that grager. 19 September 1963 Today & built the sample in - sample out manipulator using an automotive choke cable. It takes some poling around to get it to work right, but I finally obtained a good working fit. In raises the sample aut of the way for Is and out pata it reproducibly in place for IR and Ir. When in place there is actually positive tension acting that tends to heap it in place. Also, today & continued testing of OPCONS. ning r.

38 20 September 1963 PUF This morning I installed the Is and IT shutter and it seems to work or, blocking out the light and yet giving room for the sample holder to more. SAM move. We now attempt to find the center of the available somple area in terms of micrometer settings. Consider the somple area as seen from the incident side: STRE MON The light is scrept $Z_{0} = 5.00$ 5.46 5.04 $Y_{0} = 6.08$ 7.12 $X_{0} = 4.18$ DETE across the open area unter it is blocked POLA out thus giving the settings for the extremes. xo = 4.18 This afternoon and tonight I fooled around trying to allign the system of the two mirrors. I used as a reflectance standard one of the al nurrow I made some time ago. The measured reflectivity of this mirror was around 92% in the right ballpack. also, the two mirrors were realligned so that the real REMA output versus there rotation was flatter. This fact tends to reduce the critical factors of the allignment and instill confidence in the result. It was also found that the shutter leeks light and a better one will have to be found. OPER. SAMI 21 September 1963 This afternoon I began measuring the reflectivity of a sample of be prepared according to PDE (62). DETEC POLAR 21 sept 2: Fo teating run ELECT From now on we shall record a duplicate of the spectrum stamp in the log for convenience. The sample 60: PDE/62/ was prepared on a variation of The prescription given in PDE/62) as follows: (1) lap to smooth finish with # 800 SiC and 5 & Alcos (2) Etch for 3 min in 3:1 HNO3: HF The surface was quite heavily stoked but still gave quite opecular reflection. REMA OPER,

RECORDER:_____A____B_____C__

SPEED.

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of

uite

SETTINGS_____

REMARKS (X, 9, 2) = 4.18, 6.08, 5.00

OPERATOR PWG PURPOSE Reflectivity of Ge & PDE (62) DATE 9/21/63 PAGE LOG BOOK 3? SPECTRUM # 3 SAMPLE: MATERIAL Ge CODE PDE (62) ORIENTATION CIII> TEMP & T THICKNESS PREPARATION STRESS: TYPE — MAGNITUDE DIRECTION SOURCE: TYPE D2 lawp STRENGH low (ccw) MONOCHROMATOR: GRATING 30000 RANGE 3500-2000 R SCAN RATE 250 SLII WIDTH 100 - 5 DETECTOR: TYPE 62568 ILM ET

TIME CONSTANT 3

RECORDER:_____A____B_____B

SETTINGS_____

 $\frac{\text{SPEED}}{\text{REMARKS}} (x, y, z) = 4.18, 6.08, 5.00$

OPERATOR OMO

39

21 Sept 2

21 fept 3

Born today: one child low a with an	204909
Born today: one child, female, ~ 4 hg, ~ 50 cm. labelled Reborah Jean.	S BTAG
tabellist heborah pean. Today & am trying too make a reflectance on sample Ge: macdoed which was polished as high degree of care as Dry could muster.	run
on sample Ge: mardoed which was polished	with
as high degree of care as DM could muster.	
	1923972
PURPOSE Reflectivity of Ge: mailand	- Dellast
DATE 3/23/63 PAGE LOG BOOK 40 SPECTRUM # 2 23 Sept 2	- 1
SAMPLE: MATERIAL Polished Ge CODE	2 miles
ORIENTATION CITTO TEMP RT	
THICKNESSPREPARATION_Polish	SIGA ING
STRESS: TYPEMAGNITUDEDIRECTION	
SOURCE: TYPE Oz lamp STRENGTH low	
MONOCHROMATOR: GRATING 30000 RANGE 3500- 2000 A A ZI JO HAI	
SCAN RATE 250 SLIT WIDTH 100 - 5 1 10 10 10 10 10 10 10 10 10 10 10 10 1	ICROODS
DETECTOR: TYPE C256B TEMP RT	
SETTING 1610 - CUTED	
POLARIZATIONFILTER	
ELECTRONICS: PRE-AMP	NGAMER .
TIME CONSTANT 3	
SETTINGS.	PURPOR
	_3770
SPEED	LI SAMPLI
REMARKS. (X, J, E) = 4.18, 6.08, 5.00	
OPERATOR SMO	
	chowhere a late
The line is a second with the second se	
The finishing procedure followed by DM is as follo (1) Rough lap with Buchler # 1200	nur:
(2) Fine lap with 3 uchler # 1200	
(3) Poleshed with Sinde "A" on beerwax	POLARI
(4) Final polish with finds "B" on begavax	1701/3
It is haved that this produced a highly reflection	
It is haved that this produced a highly reflection	

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	PURPOSE Reflectivity of Ge: mac Loel			41
	DATE 9/23/63 PAGE LOG BOOK 41 SPECTRUM # 2	- 0	1. + -	TT
	SAMPLE: MATERIAL Poliched Ge CODE	63	Sept 2	
	ORIENTATION < TEMP P.T			
enn	THICKNESS PREPARATION			
th				
	STRESS: TYPEMAGNITUDEDIRECTION		· · · · · · · · · · · · · · · · · · ·	
20172	SOURCE: TYPE N Lang STRENGTH 61			-
21 021	MONOCHSOMATOR: GRATING 3000 RANGE 6500 - 3500 R			
	SCAN RATE 250 SLIT WIDTH, 100 - 5			
	DETEURINE G256B TEMP PET			
	SETTING 1070 P			
	POLARIZATIONFILTER			
1000	ELECTRONICS: PRE-AMP Reguler			
	PSD v			
	TIME CONSTANT			
	RECORDER:ABC			
anadi -	SETTINGS			
t t	SPEED			
	REMARKS (X, y, Z) = 4.18 6.08, 5.00		1 1 1 1 1 1 1 1 1	
	OPERATOR & MC			
	UPERATOR			
1919				
ILAO	24 April 1, 1217			
S.M.M.	24 September 1963			
	1 + + 1			
	spent today processing the date	of	2 I te	pt.
		-		
	25 1. 7. 1. 12.7			
	25 feptember 1963			
n:	Toland A TO 1 T			
	2 . Tell Thousand the data of 23	dept.	also,	tonight
	I today & processed the data of 23. I installed the shutler in the syste	in .	That in	to
	and the walk of the			
AS	of the ratio of scattered light to inci	dent	light	for
	mile shutter in its two positions, us	ing	an alu	ninged
2	the shutter in its two positions, us mirror as a sample. The results are:	0	3546 1743	
	Shutter bloching Io; Is/J. = 1.8.10-4	-	1-1-1-0	18 24
			and the	
	thatter blocking IR; Is/IR = 1.15.10-4		and harden it	James 1
	the . + to .			and the second
	the situation is more serious in position than in the To blocking pos	The	IR blo	ching
	formon than in the To blocking pos	ition	as in	~ the
10 11				

42 latter the will be incident on the PM and DATE Is a Is should be true at all times. However, in the former case, IT is incident on the SAMP PM and there may be situations where Is ~ IT. We shall have to watch for these situations. STRESS SOURC MONO 26 september 1963 DETECT Let us consider The consequences of the difference in linear thermal expansion coefficients of be and POLAR Ca F2. If we assume that the bulk of the CaFe inbatrate ELECTI is so great that the Ge film does not stress it at all and that the expansion and continuin of the Ge film is governed by the Cat's substrate, and that the film - substrate system is unstressed when the film is being formed, we arrive at the Jollowing Iquations: RECOR following equations: AlcaF2 = Albe REMAR AlcaFe = & KeaFe AT Olge = lage AT - LF Sir $F = (\chi_{Ge} - \chi_{Ca}F_{e}) \Delta T$ 27 Here we use S. without regard to crystal orientation. ita (300°K , TDC) dge = 5.75.10-6 Taking: of CaF2 = 19.5.10-6 (CRC) app AT = - 550°C cm²/dyne (TDC) 511 = .98.10-12 see gu edo Then: F = 77. 108 dyne / cm² = 7700 atru. shi det now, according to POE (62), a uniaxial stress of about 4100 atm causes a shift (in compression) in the principal L reflectivity peak from about 5840 Å to about 5854 Å. du fu bu sho This is about sost ... This is aboundly a topic for investigation on the films and we shall begin to bok for this by examing film 4 which appears to be a rather thick film. you 200 see an

	PURPOSE Overall R and T of Film 4	4.5
	DATE 9/26/63 PAGE LOG BOOK 43 SPECTRUM # 2	I.C.
	SAMPLE: MATERIAL Film 4 CODE Film log 45	
I.r.	ORIENTATIONTEMP26 sept	1
	THICKNESSPREPARATION	
	STRESS: TYPE - MAGNITUDE DIRECTION	
121	SOURCE: TYPE W LOWP STRENGTH GV	P1520386
14	MONOCHROMATOR: GRATING 3000 RANGE 6500-3500 Å	21/3
	SCAN RATE 250 SLIT WIDTH 00-5	114M 32900 3
	DETECTU. TYPE G256B TEMP R7	a 1120
e	SETTING 1080 V	13 87
-	POLARIZATIONFILTER	1.11 02307.1
trate	ELECTRONICS: PRE-AMPResular	
-		
	PSD	O SHALL YOU OUT SHAR
	TIME CONSTANT	
d :	RECORDER:ABC	A THE REPORT OF
1	SETTINGS	
		AT AT A SA STAR
	SPEED	N - WINDER
	REMARKS. (X, Y, Z) = 3.81, 6.08, 5.00	
	REMARKS. COLUMN STREET	
		anaga at
	OPERATOR_ PMG	
	27 September 1963 The uffectivity of Film 4 seemed to be too its apparent thickness so I checked the ad	THE AREA CHE
-		6 741 201
ir.	The uffectivity of Film & seemed to be too	low for
	its agazent. This and a la la la la	
	A di anticantar so & contestid the ad	Guatment
	its apparent thickness so I checked the ad	Gustment be OK so
	of the diagonal mirrors and found them to a apparently this is not an artifact.	Guestment be OK so
	apparently this is not an artifact. also, the transmission in the vicinity of 50	be OK to
	apparently this is not an artifact. also, the transmission in the vicinity of 50 seems to be oddly shaped and not at	be OK 10-
	apparently this is not an artifact. also, the transmission in the vicinity of 50 seems to be oddly shaped and not at all given by calculation using bully and the	be OK to 100 nº - 6000 nº like result
	apparently this is not an artifact. apparently this is not an artifact. also, the transmission in the vicinity of 50 seems to be oddly shaped and not at all given by calculation using bulk optical cons edge due to the 5900 i transition seems. To	be OK so 100 Å - 6000 Å like result
	apparently this is not an artifact. apparently this is not an artifact. also, the transmission in the vicinity of 50 seems to be oddly shaped and not at all given by calculation using bulk optical cons edge due to the 5900 A transition seems to sharp and goes much deered. The	be OK to 100 Å - 6000 Å like result tanto. The be very
	apparently this is not an artifact. apparently this is not an artifact. also, the transmission in the vicinity of 50 seems to be oddly shaped and not at all given by calculation using bulk optical cons edge due to the 5900 i transition seems to sharp and goes much deeper than one would at is interesting to mean to	be OK to 100 Å - 6000 Å like result tanta. The be very ld expect.
	apparently this is not an artifact. apparently this is not an artifact. also, the transmission in the vicinity of 50 seems to be oddly shaped and not at all given by calculation using bulk optical cons edge due to the 5900 a transition seems to sharp and goes much deeper than one would due to an excitor of the whether or no	be OK to 100 Å - 6000 Å like result tanta. The be very ld expect. t This is
	apparently this is not an artifact. apparently this is not an artifact. also, the transmission in the vicinity of 50 seems to be oddly shaped and not at all given by calculation using bulk optical cons edge due to the 5900 i transition seems to sharp and goes much deeper than one would due to an excitor at the first I trans	be OK to 100 Å - 6000 Å like result tants. The be very ld expect. It this is sition.
	apparently this is not an artifact. apparently this is not an artifact. also, the transmission in the vicinity of 50 seems to be oddly shaped and not at all given by calculation using bulk optical cons edge due to the 5900 i transition seems to sharp and goes much deeper than one would due to an excitor at the first I trans	be OK to 100 Å - 6000 Å like result tants. The be very ld expect. It this is sition.
	apparently this is not an artifact. apparently this is not an artifact. also, the transmission in the vicinity of 50 seems to be oddly shaped and not at all given by calculation using bulk optical cons edge due to the 5900 transition seems to sharp and goes much deeper than one would but is interesting to speculate whether or no due to an excitor at the first & transi- but it is hard to see this because of but it is hard to see this because of	be OK to 100 Å - 6000 Å like result tanta. The tanta. The be very ld expect. at this is sition. ley Jax
h	apparently this is not and found them to a apparently this is not an artifact. Also, the transmission in the vicinity of 50 seems to be oddly shaped and not at all given by calculation using bulk optical cons edge due to the 5900 i transition seems to sharp and goes much deeper than one would be is interesting to speculate whether or no due to an excitor at the first & trans sharp to be possibility has been neggested but it is hard to see this because of short hale lifetime at this point in the	be OK to 100 nº - 6000 n° like result tanta. The - be very ld expect. t this is sition. lay Jak the Buillouin 1.0
hurs -	apparently this is not an artifact. apparently this is not an artifact. also, the transmission in the vicinity of 50 seems to be addly shaped and not at all given by calculation using bulk optical cons edge due to the 5900 i transition seems to sharp and goes much deeper than one would but is interesting to speculate whether or no due to an excitor at the first I trans fuch a possibility has been suggested but it is hard to see this because of short hole lifetime at this point in the gove Abservations should be made on the	be OK to 100 Å - 6000 Å like result tanta. The tanta. The be very ld expect. at this is sition. lay Jax the the film
	apparently this is not an artifact. apparently this is not an artifact. also, the transmission in the vicinity of 50 seems to be oddly shaped and not at all given by calculation using bulk optical cons edge due to the 5900 transition seems to sharp and goes much deeper than one would but is interesting to speculate whether or no due to an excitor at the first & transi- but it is hard to see this because of but it is hard to see this because of	be OK to 100 Å - 6000 Å like result tanta. The tanta. The be very ld expect. at this is sition. lay Jax the the film

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44	28	september	1963

PURPOSE DATE 7/ Today I want to complete at least the run on one SAMPLE: side of Film 4. PURPOSE averall R and T of Film 4 STRESS: DATE 7/20/63 PAGE LOG BOOK 44 SPECTRUM # / 28 Sept 1 SOURCE: SAMPLE: MATERIAL Films 4 CODE Films log 45 ORIENTATION _____TEMP____ MONOCHE THICKNESS_____PREPARATION____ STRESS: TYPE _____ MAGNITUDE _____DIRECTION ____ SOURCE: TYPE Wlamp STRENGTH 61 POLARIZA MONOCHROMATOR: GRATING 30000 RANGE 6500-3500 A ELECTRO SCAN RATE 250 SLIT WIDTH 100-5 DETECTOR: TYPE 62568 TEMP CET SETTING 1070 r RECORDE POLARIZATION ELECTRONICS: PRE-AMP_ Regular PSD. TIME CONSTANT_____3 REMARK RECORDER:_____A___B____C SETTINGS OPERAT PURP SPEED_ DATE REMARKS. (x, y, z) = 3.81, 6.08, 5.00SAMP OPERATOR BMG STRESS The purpose of 28 sept 2 was to check reproducibility by comparing with 26 sept 2. The Is seemed to wander quite badly during This run. SOURCI MONOC DETECT The purpose of 28 sept 2 was to examine the L transition in transmission and reflection. In all POLARI 5 scans were made in the following order. ELECTR (1) IO (Z) IT (3) IO RECORD (4) IR (5) FO The third Io (3) will be used as the final To for tronomission and the initial to for reflection. REMARI 28 Sept 3 is an overall sean of the UV for film of. OPERAT

PURPOSE Examination of 6 Transition: Film 4			12-12-04		22
DATE 7/18/63 PAGE LOG BOOK 45 SPECTRUM # 2		28	Sept	2	
SAMPLE: MATERIAL Film 4 CODE FL 45			0-1-0		
THICKNESSPREPARATION STRESS: TYPEMAGNITUDEDIRECTION				4	
SOURCE: TYPEMAGNITUDEDIRECTION					
MONOCHROMATOR: GRATING 30000 RANGE 6100 - 510	0				-
SCAN RATE 125 SLIT WIDTH 100-3					
DETECTOR: TYPE 62568 TEMP RT			-	1	UNUM
SETTING 1070 V	AND 03 R	1001 003	30/19.		ALL
POLARIZATION	3500		14031	11	TALX
ELECTRONICS: PRE-AMP Regular					
PSD	107188/4015		12.8 3	r	
TIME CONSTANT	1123 00 00 00			ar	
RECORDER:ABC	5163612				7 30
SETTINGS					
SPEED				++	1
REMARKS. $(x, y, z) = 3.81, 6.08, 5.00$					
OPERATOR PMG			100 1 - 22 1	2	
PURPOSE R and T of Film 4		-mell 3.			
DATE 9/28/63 PAGE LOG BOOK 45 SPECTRUM # 3 SAMPLE: MATERIAL Film & CODE FL 45		28 A	ept 3		3200
ORIENTATION TEMP				132	
THICKNESSPREPARATION					
STRESS: TYPEMAGNITUDEDIRECTION			63		+-+
SOURCE: ITPE Dr lame STRENGTH Low					PALS
MONOCHNOMATOR: GRATING 30000 RANGE 3500 - 200	0				
SCAN RATE 250 SLIT WIDTH IAN	208				1 1 1 1 1 1
DETECTOR: TYPE 62.56 S TEMP RT					
SETTING 1630V					
POLARIZATIONFILTER			_		
ELECTROMICS: PRE-AMP				·:	
PSD				_	++
TIME CONSTANT_ 3					
RECORDER:ABC					
SETTINGS					
SPEED					
SPEED REMARKS $(x, y, z) = 3.18, 6.08, 5.00$ OPERATOR PWL 9					

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Justicky & minile the first une on the derive of 20 tept. Italy & minile the first une on the derive of 20 tept. R currency review of today's sculle and the grade test first is an yet unexplained X Itanaition. This is an yet unexplained PURPOSE Review & marked to a second for the test of 28 tept assell a new post unexplained Itanaition. This is an yet unexplained PURPOSE Review & marked to BOOK #4 SPECTRUM # 1 SAMPLE MARKAL REAL & COLOR #4 S ORIENTATION TEMP THORNESS PREAM & COLOR #4 SO tept 2 ORIENTATION TEMP THORNESS PREAM & COLOR #4 SO tept 2 ORIENTATION TEMP THORNESS PREAMP RESOLUTION SURCE: TYPE Da lang STRENGTH down SURCE: TYPE Da lang STRENGTH DETECTOR. TYPE & 256 B TEMP & AT SETTING: 1630' POLARIATION + THIER - POLARIAND + THIER - ELEOTRONICS: PREAMP Regarder POLARIAND + THIER - ELEOTRONICS: PREAMP Regarder POLARIAND + THIER - 1 OCTOM (1963 Toking & nam the 6505-3500 rum on the review in the indicate that none many is needed on the interval any schem that none many is needed on the interval any schem of a mount you the lader of the interval preadless of a mount you the lader during damage.	30 September 1963	and the date of 2.2 lant	£
PURPOSE Revenue e and t of Extend # DATE 2/36/25PAGE LOB BOOK #6 SPECTRUM # 1 SAMPLE MATERIAL # 6/00 FL +5 ORIENTATION TEMP THICKNESS PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE DA Comp STRENGTH Comm MONOCHROMATOR: GRATING 30000 RANGE 3500-2000X SCAN RATE 256 SLIF WIDTH 100 - 5 DETECTOR: TYPE CASS B TEMP BT SETTING 1630 + POLARIZATION - FHITER - ELECTRONICS: PRE-AMP Began. POLARIZATION - FLITER - POLARIZATION - FLITER - POLAR	Telling (sunday) of prepa	the me and op to fight.	-
PURPOSE Revenue & and t of Eilen # DATE 2/36/25 PAGE LOG BOOK #G SPECTRUM # 1 SAMPLE MATERIAL = 1000 FL +5 ORIENTATION TEMP THICKNESS PREPARATION STRESS. TYPE — MAGNITUDE DIRECTION SURCE: TYPE D. ROOM STRENGTH Jam MONOCHROMATOR: GRATING 30000 RANCE 3500-2000X SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. Comp BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. COMP BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. COMP BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. COMP BT SCAN RATE 250 SLIF WIDTH 100 - 5 DETECTOR: TYPE Q. COMP BT SCAN RATE 250 SLIF WIDTH 100 - 5 SETTINGS SETINGS SETINGS SETTI	today & made the price on	dest I in the UV range.	
PURPOSE Revenue e and t of Extend # DATE 2/36/25PAGE LOB BOOK #6 SPECTRUM # 1 SAMPLE MATERIAL # 6/00 FL +5 ORIENTATION TEMP THICKNESS PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE DA Comp STRENGTH Comm MONOCHROMATOR: GRATING 30000 RANGE 3500-2000X SCAN RATE 256 SLIF WIDTH 100 - 5 DETECTOR: TYPE CASS B TEMP BT SETTING 1630 + POLARIZATION - FHITER - ELECTRONICS: PRE-AMP Began. POLARIZATION - FLITER - POLARIZATION - FLITER - POLAR	a currow review of tod	and results and those	
PURPOSE Revenue & and t of Extend # DATE 2/36/3PAGE LOG BOOK #G SPECTRUM # 1 SAMPLE MATERIAL = 100 + 100 FL + 5 ORIENTATION TEMP THICKNESS PREPARATION STRESS: TYPE - MACHITUDE DIRECTION SQURCE: TYPE - MACHITUDE JOIN SQURCE: TYPE - MACHITUDE JOINE SQURCE: TYPE - MACHITUDE JOINT SQURCE: TYPE - MACHITUDE JOINE SQURCE: TYPE - THITUS JOINT SQURCE: TYPE - MACHITUDE JOINT SQURCE: TYPE - THITUS JOINT SQURCE: TYPE - THITUS JOINT	of 28 sent reveals a ver	poorly developed X 23972	_
PURPOSE Revenue & and t of Extend # DATE 2/36/3PAGE LOG BOOK #G SPECTRUM # 1 SAMPLE MATERIAL = 100 + 100 FL + 5 ORIENTATION TEMP THICKNESS PREPARATION STRESS: TYPE - MACHITUDE DIRECTION SQURCE: TYPE - MACHITUDE JOIN SQURCE: TYPE - MACHITUDE JOINE SQURCE: TYPE - MACHITUDE JOINT SQURCE: TYPE - MACHITUDE JOINE SQURCE: TYPE - THITUS JOINT SQURCE: TYPE - MACHITUDE JOINT SQURCE: TYPE - THITUS JOINT SQURCE: TYPE - THITUS JOINT	transition. This is an ye	+ unexplained. AN 3 AUDE	e
DATE 2/32/2 JPAGE LOB BOOK #4 SPECTRUM # / SAMPLE: MATERIAL Friend CODE FL 45 ORIENTATION TEMP THICKNESS PREPARATION STRESS: TYPE - MAGNITUDE DIRECTION SOURCE: TYPE De lang STRENGTH daw- MONOCHROMATOR: GRATING 30000 RANGE 3500-2000R SCAN RATE 250 SLIT WIDTH 100-5 DETECTOR: TYPE & 6256 B TEMP SCAN RATE 250 SLIT WIDTH 100-5 DETECTOR: TYPE & 6256 B TEMP SCAN RATE 250 SLIT WIDTH 100-5 DETECTOR: TYPE & 6256 B TEMP POLARIZATION - FILTER - ELECTRONICS: PRE-AMP & B C SETTING 1630 * POLARIZATION - FILTER - ELECTRONICS: PRE-AMP & B C SETTINGS SPEED. RECORDER: A B C SETTINGS SPEED. SPEED. SPEED. SPEED. SPEED. SPEED. SPEED. Toology & ran the 6500-3500 run on the revecee side of slim 4. The result to date are obeginning to indicate that nonce range in needed on the J anyglifien gain control , say, since the strend of the strend		MONCHRONALGRE GRATING 20 00 RANGE	
DATE 2/32/23PAGE LOG BOOK #4 SPECTRUM # / SAMPLE: MATERIAL Friend CODE F4 45 ORIENTATION TEMP THICKNESS PREPARATION STRESS: TYPE — MAGNITUDE DIRECTION SOURCE: TYPE D2 lang STREINGTH dawn MONOCHROMATOR: GRATING 30000 RANGE 3500-2000R SCAN RATE 250 SLT WIDTH 100-5 DETECTOR: TYPE 6256 B TEMP RT SCAN RATE 250 SLT WIDTH 100-5 DETECTOR: TYPE 100-5 SEA SLT WIDTH 100-5 DETECTOR: TYPE 100-5 SEA SLT WIDTH 100-5 SEA SLT	DIDDOSE PARTER & A T T A T R. H	SCAN RATE A S. SLIT VILLE	
SAMPLE: MATERIAL CLAR 4 CODE F2 45 ORIENTATIONTEMP		30 tept I grant	1
QRIENTATION TEMP THICKNESS PREPARATION STRESS. TYPE — MACINTUDE DIRECTION SOURCE: TYPE De law of the service SOURCE: TYPE De law of the service SOURCE: TYPE De law of the service SCAN RATE 250 SUF WITH 100 - 5 DETECTOR: TYPE 62568 TEMP &T SCAN RATE 250 SUF WITH 100 - 5 DETECTOR: TYPE		SETTING CONTRACTOR	-
THICKNESS PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE SOURCE: TYPE Delation SOURCE: TYPE Delation SOURCE: TYPE Delation SOURCE: TYPE Delation SCAN FATE ZSO SAN FATE SCAN FATE ZSO SUPPER DETECTOR: TYPE Delation JOETECTOR: TYPE Delation POLARIZATION - FILTER PELECTRONICS: PREAMP Delation PSD: "TIME CONSTANT_3" BOETECTOR: RECORDER: A B C SPEED SPEED SPEED SPEED REMARKS (X, J) Z) = 3.18, 6.08, 5.00 SPEED SPEED Tockey Q van the 6500 - 3500 van the SPEED <td></td> <td>POLARIZATION</td> <td>-</td>		POLARIZATION	-
STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE D2 lamp STRENGTH dawn MONOCHROMATOR: GRATING 30000 RANGE 3500-2000Å SCAN RATE 250 SLIT WIDTH 100 - 5 DETECTOR: TYPE 6256 D TEMP RT SETTING /630 - POLARIZATION FILTER ELECTRONICS: PRE-AMP Regular PSD " TIME CONSTANT 3 RECORDER: A B C SETTINGS SETTINGS SETTINGS SETTINGS SPEED REMARKS (X, 7, 2) = 3.18, 6.08, 5.00 OPERATOR &M S Today & van the 6500-3500 run on the reverse side of film X. The recults to date are degrinning to indicate that more range is needed on the d		ELECTRONICS PRE AND	-
SOURCE: TYPE De lange STRENGTH down MONOCHROMATOR: GRATING 30000. RANGE 35200-2000R SCAN RATE 250 SLIT WIDTH. 100-5 DETECTOR: TYPE 6256B TEMP RT SETTING 1630 V POLARIZATION - FILTER - ELECTRONICS: PRE-AMP Regular PSD " TIME CONSTANT_3 RECORDER: A. B. C. SPEED. REMARKS (X, J, Z) = 3.18, 6.08, 5.00 OPERATOR QVU G Today & can the 6500-3500 run on the reverse ide of film X. The results to date are beginning to indicate that noone range is needed on the di			-
MONOCHROMATOR. GRATING 30000 RANGE 3500-2000Å SCAN RATE 250 SLIT WIDTH 00-5 DETECTOR. TYPE 62560 TEMP RT SETTING 1630 V POLARIZATION - FILTER - ELECTRONICS: PREAMP Research TIME CONSTANT 3 RECORDER. A. B. C			
SCAN RATE 250 SLIT WIDTH 100 - 5 DETECTOR. TYPE 6256B TEMP BT SETTING 1630 - POLARIZATION - FILTER - ELECTRONICS. PRE-AMP Bogular PSD " TIME CONSTANT 3 RECORDER: A B C SETTINGS SETTINGS SETTINGS SETTINGS SPEED REMARKS (X, J, Z) = 3.18, 6.08, 5.00 OPERATOR QMG Toology & ran the 6505-3500 run on the reverse side of film A. The center to date are beginning to indicate that more range in needed on the anglifier Jein A. A beauting in needed on the		R 50 10 R	1
DETECTOR: TYPE 6256B TEMP RT SETTING 1630 × POLARIZATION - FILTER - ELECTRONICS: PRE-AMP Regular PSD " TIME CONSTANT_3 RECORDER: A. B. C. SETTINGS SETTINGS SETTINGS SPEED. REMARKS. (X, J, Z) = 3.18, 6.08, 6.00 OPERATOR QVM G 1 October 1963 Today & can the 6505-3500 run in the reverse side of film X. The results to date are beginning to indicate that none range in needed on the difference amplifier gain control, ray, reference thought to the			
SETTING 1630 × POLARIZATION - FILTER - ELECTRONICS: PRE-AMP Regular PSD + TIME CONSTANT 3 RECORDER: A B C A B C A B C A B C A B C A B C A B C A B C A B C A B C A B C A C C C C			
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ELECTRONICS: PRE-AMP Regular PSD. " TIME CONSTANT_3 RECORDER: A B C 300 30 30 300 SETTINGS SETTINGS SPEED REMARKS (X, J, Z) = 3.18, 6.08, 5.00 OPERATOR RM S 1 October (963 Twolay & ran the 6500-3500 run on the reverse side of film x. The results to date are beginning to indicate that more range in needed on the date of the set		CARLENCE AND SELECTION AND SELECTION OF THE SELECTION OF	_
PSD. " TIME CONSTANT_3 RECORDER: A. B. C			_
TIME CONSTANT 3 RECORDER: A B C M 32 SETTINGS SPEED REMARKS (X, J, Z) = 3.18, 6.08, 5.00 OPERATOR QVM S 1 October 1963 Today & ran the 6500-3500 run on the reverse ride of film X. The results to date are beginning to indicate that more range is needed on the d anglifier gain control, say, store of two instead		707A7390	
RECORDER: A B C A BARA JANA SETTINGS SPEED REMARKS (X, J, Z) = 3.18, 6.09, 5.00 OPERATOR RMS 1 October 1963 Today & ran the 6500-3500 run on the reverse side of film 4. The results to date are beginning to indicate that none range is needed on the date of the da			
SETTINGS SPEED REMARKS (X, J, Z) = 3.18, 6.08, 5.00 OPERATOR RMG 1 October 1963 Twolay & ran the 6500-3500 run on the reverse side of film K. The results to date are beginning to indicate that more range is needed on the date of the date o			
SPEED REMARKS (X, J, Z) = 3,18, 6.08, 6.00 OPERATOR RMS 1 October 1963 Today & ran the 6500-3500 run on the reverse side of film 4. The sculta to date are beginning to indicate that more range is needed on the amplifier gain control, say, steps of two instead of ten, also & began aving some thought to the		DALEACE LUG 800KSPEC	
REMARKS. (X, J, Z) = 3.18, 6.08, 5.00 OPERATOR RMS 1 October 1963 Today & ran the 6500-3500 run on the revecee side of film 4. The results to date are beginning to indicate that more range is needed on the d amplifier gain control, say, steps of two instead of ten, also & began airing some thought to the	SETTINGS	SAMPLE MALERAL - SAMPLE SCODE	-
REMARKS (X, J, Z) = 3.18, 6.08, 5.00 OPERATOR BMS 1 October 1963 Today & ran the 6500-3500 run on the revecee side of film 4. The results to date are beginning to indicate that more range is needed on the d amplifier gain control, say, steps of two instead of ten, also & began airing some thought to the		DREMENTATION	
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48 2 October 1963

PURI Last night I made a mount to hold the fyloania DATE Sodine Quarty Damp 400742/cu/F, 120 volt, 400 watt. I am now testing it. The variac setting for the GE instrument lang was at 55.5. SAMI The autput of the sylvania lamp was less than STRES The GE ribbon lamp for the same PM voltage and SOUR slit width. This is because the filament width on the MONO Sylvania is for greater Than that of the GE. However, it did not seem to give appreciably more output at DETEC 3500 à ghan the GE and this was the principle reason for trying it. Hence we will return to the POLAF GE lamp. ELECT 3 October 1963 RECOF Today was spent reducing data of 10 c.T. REMA 5 October 1963 OPER/ PURPOSE Rand T of Film 6 PURF 5 OCT 1 DATE 10/5/63 PAGE LOG BOOK 48 SPECTRUM # 1 DATE SAMPLE: MATERIAL Film 6 CODE F650 SAME ORIENTATION _____TEMP_____ THICKNESS_____PREPARATION___ STRESS: TYPE _____MAGNITUDE_____DIRECTION STRES: SOURCE: TYPE W lamp STRENGTH 64 SOURC MONOCHROMATOR: GRATING 30000 .____ RANGE 6500 - 5000 Today & began experiments MONOG SCAN RATE 250 SLIT WIDTH 100-5 on film 6. In order to DETECTOR: TYPE 62568 TEMP AT minimize second order DETECT SETTING 1100 V diffraction effects, & am POLARIZATION - FILTER C 3 3 - 73 using filter CS 3-73 in POLARI ELECTRONICS: PRE-AMP otequiler The range 6500 - 5000 A ELECTR PSD " TIME CONSTANT 3 RECORD SETTINGS____ SPEED_ REMARKS. (×, 7, 21 = 3.18, 6.08, 5.00 REMAR OPERATOR PMB OPERAT

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	PURPOSE Rand T of Film 6		-	5	oc	TZ	-			- 17	10
	DATE 10/5 162 PAGE LOG BOOK 49 SPECTRUM # 2-			1000			1-				
_	SAMPLE: MATERIAL Frem 6 CODE FL 50	13000-					IPUD.	21 AB	-	1.1%	ng]
	ORIENTATIONTEMP	1EMP				NDI	14.17	(B) AL			-
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	SOURCE: TYPE W long STRENGTH 61	_HitM3:	172			1		34	YT	:308	500
4	MONOCHROMATOR: GRATING 30000 RANGE 5000-3500	RAN			.011		3	QTAI			10N.
	SCAN RATE 250 SLIT WIDTH 100 - 5	112.			FAT	MAD	2				
D	DETECTOR: TYPE 62568 TEMP RT	9MB				_		39Y		OT03	T Q
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_	ELECTRONICS: PRE-AMP		-			41	A-33	14.3		097	17 3
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4	SAMPLE: MATERIAL Film 6 CODE FL 50				- 0	_	_			1	
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_	MONOCHROMATOR: GRATING 30000 RANGE 6100 - 5100						1	_	-		
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	DETECTOR: TYPE 6256 B TEMP RT						12	-		2	
-	SETTING1040					-	-	5			-
1	POLARIZATION FILTER C 5 3 - 73	a la sta		-		_	-				-
11	ELECTRONICS: PRE-AMP Regular	-				32 -	-	-	1	2-1	-
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51 slope of about 4er per Ta", so that if there were 100 divisions of k space in that direction, There should be an energy separation of about of ever for the states invalved in the 1 transition, achiele could be observed. The ramifications and difficulties of identifying such an effect are not well understood right now, but one must point out that only one direction is affected (the direction of the thickness of the film) hence equivalent directions are left continuous thus tending to reduce the chance of observation. A similar effect should be present around the X - 2. structure.

8 October 1963

Today I began examining some of the computed results of Film 6. There seemed to be some indication that the gain going from 33 to 32 was not 10 but a check showed it to be 9.9. This is critical for reflection. The sc explicition, was observed nicely in Films 6. I am now begining the UV run on Film 6.

PURPOSE Rand T of Film DATE 10/8/63 PAGE LOG BOOK 3			8	OCT	1		-Jacoshus
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SCAN RATE 125 SLIT WIDTH 100 - 5	TONERA				870	1 10	UT da	020	\$011
DETECTOR: TYPE 62568 TEMP RT	W LTS			11.61	TAS	3		-	
SETTING 1580V		131		-	-		13/1	190	ECT
POLARIZATION						1/14	1120		-
ELECTRONICS: PRE-AMPRegular		1111					V	A	AR.
PSD				_	.93	A 38	8 3	ONIC	CT N
TIME CONSTANT 3				02	9				
RECORDER: A B		TI	TATZINO	0 38	T				
SETTINGS		8						.03	na'n
SETTINGS						-		10.4	4
				and a spectrum of					
SPEED.				-		~			
REMARKS (x, y, 2) = 3.18, 6.08, 5.00				- 7			633	3	
	00-4				- 6	-2		21	AAB
PPERATOR PMS.					1				

54 9 october 1963		PURPC
PURPOSE R and T of Film 6 (b)	103 12 12 100 001 001 001 00 000 000 000 00	SAMPL
DATE 10/9/63 PAGE LOG BOOK 54 SPECTRUM #_ /	A A A A A A A A A A A A A A A A A A A	SAIVIFL
SAMPLE: MATERIAL France CODE FLOR	9 067 1	
ORIENTATION 61 TEMP	1145/A 822 N	070500
THICKNESSPREPARATION	and - I and I and The constant	STRESS
STRESS: TYPEMAGNITUDEDIRECTION	Vodag & bigan the W lang ran on the reverse side of Film 6.	SOURCE
SURCE: TYPE W lang STRENGTH Gr	W lang the on the	MONOC
MONOCHROMATOR: GRATING 30000 RANGE 6500 - 500 A	SCIN RATE STATE	DETECT
SCAN RATE 250 SLIT WIDTH (00-5	E C	DETECT
DETECTOR: TYPE 62566 TEMP 27	SET THE SET THE SET OF SET	POLARI
SETTING 1100 V	La constation and constation and constation	
POLARIZATION - FILTER CS 3-73	- State and the second provide a second s	ELECTR
ELECTRONICS: PRE-AMP		
		RECORD
TIME CONSTANT		
RECORDER:ABC		
SETTINGS		
		REMAR
SPEED		
REMARKS (X, y, 2) = 3.18, 6.08, 5.00		OPERAT
OPERATOR PM S		PURPO
PURPOSE Randt of Felm 6 (b)		DATE
DATE 10/9/63 PAGE LOG BOOK 54 SPECTRUM # 2	90672	SAMPL
SAMPLE: MATERIAL Film 6 CODE FLSD		
ORIENTATION (b) TEMP	Because it has been	
THICKNESS	observed that the amplifier	STRESS:
	gain control does not seem to	SOURCE
STRESS: TYPEMAGNITUDEDIRECTION SOURCE: TYPESTRENGTHGV	give decade steps, some	MONOCH
	measurementa were taken.	
MONOCHROMATOR: GRATING 30000, RANGE 5000 - 3500 Å	This variation from 10 does	DETECTO
DETECTOR: TYPE 62548 TEMP RT	not affect the transmission	
SETTING 1100V	so much but it raises	POLARIZ
POLARIZATIONFILTER	hell with the reflection.	ELECTRO
ELECTRONICS: PRE-AMP	The values below are mean	
PSD	values:	
	32/33 = 9.95	RECORDI
RECORDER: A B C	31/32 = 10.25	
SETTINGS		
	since these are hard to	REMARK
SPEED	measure, There may be	1. LINFORM
REMARKS. $(x, y, z) = 3, (8, 6.08, 5.00)$	considerable error.	OPERATO
	COTARATORTOTARATOR	OFLAMIC
OPERATOR QWLS		

	PURPOSE Reverse T for film 6 on L transition	55
	DATE 10/9/63 PAGE LOG BOOK 55 SPECTRUM # 3	
3		9 007 3
12000	SAMPLE: MATERIAL Film & CODE FL.50	
	ORIENTATION (b)TEMP	
	THICKNESSPREPARATION	
	STRESS: TYPEMAGNITUDEDIRECTION	
	SOURCE: IYPE W Lange, STRENGTH. 64	
alland X	MONOCHROMATOR: GRATING 30000 RANGE 6100-5100	
. NUKI	SCAN RATE 12.5 SLIT WIDTH 100-5	
	DETECTON IYPE 62568 TEMP RT	
6113 A	SETTINGIOHOV	
	POLARIZATION	
	ELECTRONICS: PRE-AMPRegular	
	PSD	
	TIME CONSTANT_	
10031	RECORDER:ABC	
	SETTINGS	
8	SPEED	
	REMARKS (X, Y, Z) = 3.18, 6.08, 5.00	
	OPERATOR PMg	
A 1390		
	PURPOSE Reverse R for & transition; Film 6	
17U4 8	DATE 10/9/63 PAGE LOG BOOK 55 SPECTRUM # 4	9 OCT 4
	SAMPLE: MATERIAL Films CODE FL 50	
ALAZ S A		10. Alt
	ORIENTATION (6) TEMP	NB: after the runs were completed, it was found
	THICKNESSPREPARATION	
in t	STRESS: TYPEMAGNITUDEDIRECTION	that the reflectance
een to	SOURCE: TYPE Weams STRENGTH GV	settinges were not
ce	MONOCHROMATOR: GRATING 30000 RANGE 6100 - 5100	optimized. This will
len.	SCAN RATE 125 SLIT WIDTH 100-5	necessitate the application
does	DETECTOR: TYPE 6256 B TEMP CT	of a constine factor
sein	SETTING	of 1.09 to the IR data
ee.	POLARIZATIONFILTER_C53-73	of BOCT and GOCT.
n.	ELECTRONICS: PRE-AMP	This came about
n	PSD	because of the offset of
	TIME CONSTANT	the reflecting face of the film when reversing.
		film when reversing.
120010		The 2 setting had to be
	SETTINGS	changed from 5.00 to 6.20
		to optimize the response.
-	SPEED	adjusting the rotation of
	REMARKS (x, y, 2) = 3.18, 6.02, 5.00	the IR mirror showed
		that it already had the
Versen al la serie	OPERATOR PM 3	correct angular position.

50 10 october 1963 to 16 october 1963

This time has been spent reducing data into guppical form. It has been found more convenient to do the elementary calculations by hand on the mourse calculator than to use the 7094. There are several whe reasons for this. First, hand calculations provide changes do not require extensive changes in the programming system. It was found that it is required to know the gain settings precisely an previously noted and minor changes such as there can be easily For incorporated into the band culculations. also, graphing can be done simultaneously with calculation so that errors are discovered quickly and easily. 17 0 several other new requirements were also noted during This period. It seems that gain intervals of 10 are too large because a great deal of inaccuracy occurs at low scale levela. Possibly intermediate gain steps can be had by using the PM power supply There 70 0 up switches and this will have to be tried. the The following measurements have been taken on Film 6: eque bu Overall: 6500-2000 R, R, T, T', R' the A Transition: 6100 - 5100 A, R, T, T', R' I Transition: 3300 - 2300 Å, R, T, T', R' In general the measurements confirm qualitatively the reflectivity measurements taken on bulk material, including the A spin-orbit excitting. However, quantitatively the I structure seems to be much weater than PURPOSE DATE 101 SAMPLE: indicated by The bulk measurements, at least in reflection. Calculations should be done using bulk optical STRESS: T constants for the transmission in order to do any SOURCE: T comparisons here. Some consideration should be given to MONOCHRO The position of the Is gead in this film as it seems to be slightly displaced toward longer wavelengthe show the bulk. Also there appears to be some sort of five DETECTOR: structure about the 1 edge that should be looked at. I have had an idea about an experiment POLARIZAT involving shear in Ge. It may be possible to measure the optical rotation due to twisting a ELECTRONI bar of Ge in M. De meis' equipment. I will have to do some preliminary calculations along this line. It RECORDER has looked at the effects of strain on the reflectivity of Sa, and the 3-5 compounds. Possibly in some of the 3-5's the 201 peak can be split. I we will not the We will now consider a method by which we can REMARKS DM expand the eventual I/Io measurement: OPERATOR

 $M_{f}(B+D/G_{f})$ R= Mfo (Bo + Do/Ggo) where R = I/To = expanded reflection or transmission My, Mgo = multiplying scale factors B, Bo = Bucking signal in chart divisions D, Do = Deflection in chart divisions 64, 640 = Gain factors

For further discussion, see the appropriate file paper.

17 October 1963

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body

Today & began the investigation of whether or not There is fine structure in the A edge of Film 6. To do this, I tried to get both Ir and To an far up on the chart as possible in order to improve the accuracy. I have also found that the above equation holds only when one is able to do the bucking by feeding part of the signal back into the input, which presently I am not able to do.

17 OCT 1

PURPOSE thuchure of - ~ Colse DATE 10/17/63 PAGE LOG BOOK 57 SPECTRUM #___ SAMPLE: MATERIAL Felm 6 CODE FC 50 ORIENTATION (6) TEMP___ THICKNESS_____PREPARATION___ STRESS: TYPE_____MAGNITUDE_____DIRECTION_ SOURCE: TYPE W lang STRENGTH 62 MONOCHROMATOR: GRATING 30000 RANGE 5700-5600 SCAN RATE 50 SLIT WIDTH 100 - 5 DETECTOR: TYPE 6256B TEMP RT SETTING 15-40, 1220 POLARIZATION - FILTER CS 3-73 ELECTRONICS: PRE-AMP Regular PSD TIME CONSTANT_____3 RECORDER:_____A____B____C_ SETTINGS

SPEED_ REMARKS (X, Y, Z) = 3.18, 6.08, 5.00 OPERATOR PMg

PURPOSE structure of -1_ Edge	
DATE 10/17/63 PAGE LOG BOOK 58 SPECTRUM # 2 17 OCT 2	
SAMPLE: MATERIAL Fulm & CODE FLSD	
ORIENTATION (4) TEMP	-
THICKNESSPREPARATION	
STRESS: TYPEMAGNITUDEDIRECTION	
SOURCE: TYPESTRENGIN64	
MONOCHROMATOR: GRATING 30000 RANGE 5700 - 5600	
SCAN RATE 50 SLIT WIDTH 100 - 5	10
DETECTOR: TYPE 62565 TEMP RT	
SETTING 1220, 1450	
POLARIZATION	
ELECTRONICS: PRE-AMP Regular	
PSD. *	
TIME CONSTANT 2	
RECORDER: A B C C	
SETTINGS	
SPEED	
REMARKS. (x, y, z) = 3.12, 6.08, 5.00 DM Voltage used as gain	
Pri Pollage used an gain	
OPERATOR PMS	
18 October 1963	6
M I I I I I I I I I I I I I I I I I I I	
The rearch for fine structure yesterday was not conclusive. 7 OCT 2 yielded some variation at 5660 à but 17 OCT 1 did	
7 OCT 2 yielded some variation at 5660 A but 110011 did	
not. Perhaps the search should be done at lower temps	e e
or with some sort of scale expansion.	
Testa are still underway to debug OPCON2 so that The results on Film 6 can be processed.	Ŭ
the results on Firm 6 can be processed.	
	P
	C C
21 October - 25 October 1963	
This week was spent primarily in trying to get OPCON2 to	RE
This week was spent primarily in trying to get 0900H2 to run with no success. See Clog. I am going to take a	
reflectivity un on Ge sample DE 1621 and then do a run	
m Film 3 which seems from the DK2 curves to have	2
	RE
. A transition shift to higher energies. I should look	SAL
I transition shift to higher energies. I should look not the possible effect of the difference in lattice contants	

	28 October 1963	59
4	PURPOSE Reflectivity of PDE(GZ)	200010
	DATE 10/20/63 PAGE LOG BOOK 59 SPECTRUM # 1	
	SAMPLE: MATERIAL PDE (G2) CODE	28 OCT Z DO 304 STAN
	ORIENTATION TEMP	Shart wonary TEMP
	THICKNESS	Today & began a two -
	STRESS: TYPEMAGNITUDEDIRECTION	fold investigation : (1) the
	SOURCE W lamp STRENGTH 61	reflectivity of a Ge sample
	MONOC	prepared according to
\$9	SCAN RATE 125 SLIT WIDTH 100 - 5	PDE (62) to use as standard
	DETECTUR: TYPE 62568 TEMP RT	date . (2) The use of PM
	SETTING the chart and Log	controla to allow a
	POLARIZATIONFILTER	wider range of scale
	ELECTRUMUS: PRE-AMP_ Regular	expansion.
)	PSD. "	
	RECORDER: A B C	
	SETTINGS	
	SPEED	
501	REMARKS. (x, y, z) = 3.18, 6.08, 5.00	
	OPERATOR PMG	
ELLIS 1	PURPOSE Reflectivity of PDE(GZ)	and the second
)	DATE 10/28 PAGE LOG BOOK 59 SPECTRUM # 2	28 OCT 2
	SAMPLE: MATERIAL POE (62) CODE	20 00/ 2
	ORIENTATIONTEMP	7
12	THICKNESSPREPARATION	
unic.	STRESS: TYPE MAGNITUDE	
did	DUURGE: MIT W Lang, STRENGTH GY	
upes	MUNUCHKUMATOR: GRATING 3000 RANGE 5000 - 3500'S	
that	SUAN RATE 12.5 CHIT WIDTH	
	DELECTOR: TYPE G2368 TEMP	
STALOS .	SETTING see Chart and Log	
18 TOB IST	POLARIZA, J	
1		
	PSD II	
12 to	RECORDER: A B C	
a	SETTINGSBC	
run		
have have	SPEED.	and the second second second
ah .	REMARKS (X, 9, 2) = 3.18, 6.08, 5.00	and a star and a star and
	J fr = J. (0 0.00, 3.00	requirer " adapted and
T NEEDO	PM9	

						2	1	2	*	5 8		
29 OCT 1963												
PURPOSE_ Reflec	tivity of PP.	6(62)								8P 035	19	
DATE 10/29 PAGE	LOG BOOK 60	SPECTRUM #.	1	28 0	ocr ,	008 2	013	A9		<u></u> 31	40	
SAMPLE: MATERIAL_	PDE(62) CI	ODE			633	3		141230	4.54	3.4%	13	
ORIENTATIO	NTI	EMP		TEMP			MC.	14.17				
THICKNESS	P	REPARATION	MOLTAN	PREP.			_	23408	- Ter			
STRESS: TYPE	MAGNITUDE	DIRECTION	MAIT 300		300	TELECOAL				-		
SOURCE: TYPE D2	lamp STREN	IGTH Jow		Brakas	2			1.4				
MONOCHROMATOR: GR	U U			-		-	-					
SCA	N RATE 125	SLIT WIDTH	00-5	-		300						
DETECTOR: TYPE	a las seres deserves a seres a second deserves and			44.31				-		Second		
SETTING	see chart	-						C III	1	an v i v s		
POLARIZATION	FILTE	R		791.0						121150	11.5	
ELECTRONICS: PRE-AMP		1 1				34				1.00 1251		
	PSD ~				1		11	and a start of	1 1 1		14.4.4	
	TIME CONSTANT	3			TUI		and a					
	A B _			2	and ic	100 3	1150					
	_AD				U		A.:			<u>93 040</u>	0218	
SETTINGS	·				141 3			2011	1132			-
		e.t					-	-				
SPEED.							-		22.14			
REMARKS (X, Y, i	z) = .3.18, 6.0	08, 5.00					_					
OPERATOR PM9										лячы. R.) (.Я	390	
										242 241 241 241 241	390	
											390 390 390 390 390 390 390 390 390 390	
			ана на на така Стара на на така Стара на на така на така Стара на така н								AG 201	
OPERATOR PM9		26.3						0A 1A 93		1017 1017 1017 1017 1017 1017	10000000000000000000000000000000000000	
		263								141 (141 141) (141 141) (141 141) (141 141) (141 141) (141)	390 390 40 40 40 40 40 40 40 40 40 40 40 40 40	
OPERATOR PMg	november 19		idining	the .	date				ind	28	AC	
OPERATOR PMg 0 October - 1 This Time	november 19 was spent	t in st	adying	the .	date	ī of		: B a	nd	2 9 .	390 390 42 0 cT.	
OPERATOR PMg 0 October - 1 This Time	november 19 was spent	t in st	udying	the .	date Å o	t of	. 2 	.8 a	und	28.	390 AC AZ OCT.	
OPERATOR PMg 0 October - 1 This Time	november 19 was spent	t in st	idying on and	the .	date Å	t of lid	l z no	8 a ton	und	2 2 2 . 	Det.	
OPERATOR PMg 0 October - 1 This Time	november 19 was spent	t in st	udying on and tas all t 5800	the . 6000	dato à s	t of lid	i z no	.8 a tou	and	2 9 .	ago All All Oct. to-	
OPERATOR PMg 0 October - 1 This Time everal observ (1) The lecrease as is (2) The	november 19 was spent atime were region bets t should. 5900 Å pea	t in ste made : veen 6500 There a L was a	t 5800	6000 . ways	Å b	lid een	no	t in	ble	n - h	to ere.	
OPERATOR PMg 0 October - 1 This Time everal obser (1) The lecrease as is (2) The (3) There ources we	november 19 was spent ations were region beto t should. 5900 à pea was a la	t in ste made: veen 6500 There L was a large dis L.	t soon	6000 A.	å ob at	lid een 352	no I	t au	ble she	n -	to ere.	
OPERATOR PMg 0 October - 1 This Time everal observ (1) The lecrease as is (2) The (3) There ources we as for Th	november 19 was spent ations were region beto t should. 5900 à pea was a l e changes e (1) dillie	t in ste made: veen 6500 There L was a large dis L.	to and tax all to 5800 continu	6000 ways A.	A b at to	lid en 350	no I	tou in l	ble obe	n -	to- ere. the	
OPERATOR PMg 0 October - 1 This Time everal observ (1) The lecrease as is (2) The (3) There ources we as for Th	november 19 was spent ations were region beto t should. 5900 à pea was a l e changes e (1) dillie	t in ste made: veen 6500 There L was a large dis L.	to and tax all to 5800 continu	6000 ways A.	A b at to	lid en 350	no I	tou in l	ble obe	n -	to- ere. the	
OPERATOR PMg 0 October - 1 This Time everal observ (1) The lecrease as is (2) The (3) There ources we as for Th	november 19 was spent ations were region beto t should. 5900 à pea was a l e changes e (1) dillie	t in ste made: veen 6500 There L was a large dis L.	to and tax all to 5800 continu	6000 ways A.	A b at to	lid en 350	no I	tou in l	ble obe	n -	to- ere. the	
OPERATOR PMg 0 October - 1 This Time everal observ (1) The (2) The (3) There ources we as for the as for the last that Usere may	november 19 was spent ations were region bete t should. 5900 Å pea was a l e changed a (1) diffic to is changed uible and	t in st made: veen 6500 There h acge dis alty, t ging to the myst	to and tas all to soon continue this see aguide constinue figures.	6000 A. iiity iiity S. C. Fu	à là at to this with	350 an an an an an	no ise ise ise	to in the second	ble obe	n - to	to- ere. the the fect- be	
OPERATOR PM 9 O October - 1 This Time everal obser (1) The lecrease as is (2) The (3) There ources we as for The bere may was reprod	november 19 was spent ations were region beto t should. 5900 à pea was a la changes a changes to is changes to is changes it may be	t in ste made: veen 6500 There L was a large dis large dis large dis to myste due to	to and tas all to 5800 continue tis se continue tis se continue tis contis continue tis continue tis continue tis continue tis continue tis continue tis continue tis continue tis continue tis continue tis tis tis tis tis tis tis tis tis tis	6000 A. inity S. C. Fu	A b at to the fing	an 350 an in 13 ht.	no ise ise ise	tou in lon, to Le	ble obe	n to	to- ere. the the fect- be	
OPERATOR PM 9 O October - 1 This Time everal observ (1) The lecrease as is (2) The (3) The (3) The curces we as for The lecre may was reprod one here; isturbing d	november 19 was spent atime were region bets t should 5900 à pea was a le changes a changes a changes to is chan be difficult uible and it may be	t in st made: veen 6500 There h L was a large dis utty, t sing to due to us (2).	to and the all to some continue tis see apudly constinue figures figures to was	6000 A. iiity S. Fu red	à b at to this at to	an 350 an in 13 in 13 in 14	no ise ise ise ise ise ise	tou i son to	ble she he he he	n to	to- ere. the the fect- be	
OPERATOR PM 9 O October - 1 This Time everal observ (1) The lecrease as is (2) The (3) The (3) There ources we as for The lect that there may was reprod one here; isturbing d	november 19 was spent atime were region bets t should 5900 à pea was a le changes a changes a changes to is chan be difficult uible and it may be	t in st made: veen 6500 There h L was a large dis utty, t sing to due to us (2).	to and the all to some continue tis see apudly constinue figures figures to was	6000 A. iiity S. Fu red	à b at to this at to	an 350 an in 13 in 13 in 14	no ise ise ise ise ise ise	tou i son to	ble she he he he	n to	to- ere. the the fect- be	
OPERATOR PM 9 O October - 1 This Time everal observe (1) The lecrease as is (2) The (3) There ources we as for the lect that there may isturbing d (fect than it is the in (1) The second one here	november 19 was spent ations were region bete t should. 5900 à pea was a le changes a changes it should it may be ifficulty - been appe	t in st made: veen 650 There acge dis acge dis alty, t ging to due to co (2). aring a	to and to and to soon continue tis se apidly continue fying to adde to all all alor	6000 in the second	A be at to this to this uno	an 350 an in the t.	no ise ise ise ise ise	ton i st he to to to	ble	n to the set	to ere. the the fect- be	
OPERATOR PM 9 O October - 1 This Time everal observ (1) The lecrease as is (2) The (3) The (3) There ources we as for The lect that there may was reprod one here; isturbing d	november 19 was spent atime were region bete t should 5900 à pea was a le changed changed it should it may be ifficulty been appe ph's d	t in st made: veen 650 There a was alty , t ging to due to a wing to a constant due to a constant a puisment photom	n' and tas all t 5800 continue dis se apidly continue fying for all acatte at was at !! ettiplie	6000 in the second	A be at to this for the second	an 350 an 10 (3 10 (3 10 (3) 10 (3) 1	no ise agio agio ise agio ise agio ise agio ise agio agio agio agio agio agio agio agio	tou in the tal	ble she her her her her her her her her her	n to the set	to ere. the the fact -be	

be a probable cause an weither I now to are incident? changing the position of the beam seemed to restore the 5900 i peak to ste proper position In light of the above, it has been decided to more the PM back from its present position so that a froated glass can be inserted and used as a diffusing screen for the light. also, an adapter will be made for the 7102 PM so that it can be used so that it can check the position of the 5900 peak.

4-16 november 1963

most of this time was spent studying for the Russian language exam. The above mentioned changes in the PM housing were made. This cut down the efficiency garte a bit but restored the 5900 peak to its proper place. The 7102 tube did not seem to give good results at all between 5000 Å and 6000 Å. Also, it now appears as though point by - point with simultaneous calculation is much nore accurate and faster than ocanning.

18 november 1963 - 22 november 1963

Various attempto at point-by-point measurement of the reflectivity of etched and poliahed be were made. It seems that trouble (2) of 30 October was cleared up by diffusing the light, but troubles M and (3) remain. Several new Troubles came to light; allignment difficulties giving the wrong magnitude of reflectivity, and non-linearity appearing when different magnitudes of anode resister and PAN voltage were used. It was Then decided to place the PM further back, and remove the frosted glow Then, allignment of To and TR to exactly the same position on the Pri in made by eye. This seemed to work satisfactorily more satisfactory than anything yet. note: The small W lamp burned out, or rather began to fluctuate so badly that it was replaced with a new one. The GE part no. is 9A/T B'k/1. In regard to the nonlinearity problem, the following data was collected:

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2 3500 Å: Whene i 100 m : 64 200 k 870		and a sta		
100 к 820		3500 A : W Ja	unp 100 m : Ge	
100 к 820		4		
100 к 940	anode Rearest			
1 × 1490 .472, .476 c3.7-60 1 × 1380 .476, .476 3500 Å: D. lang: 100 µ: 1 × 1470 .501, .500 1 × 1470 .501, .500 1 × 1470 .501, .500 1 × 1470 .501, .500 1 × 1470 .501, .500 1 × 1470 .501, .570 100 × 920 .572, .573, .577 100 × 920 .572, .578, .579 1 × 1400 .518, .511, .511 1 × 1400 .518, .511, .511 1 × 1400 .518, .511, .511 1 × 1400 .518, .511, .511 1 × 1400 .518, .511, .511 1 × 1400 .518, .511, .511 1 × 1400 .518, .511, .511 2 × .520 × .580 × .578 .518, .517 1 × 13500 × .500 × .518, .517 .518, .517 2 × .500 × .500 × .518, .517 .518, .518 1 × .500 × .518, .517 .518, .518 1 × <				
1 K 1380		940		
3500 Å. D. long: 100 h: 6c 1/k 1470 .501, .600 1/k 1590 .503, .607 C5-7.60 100 k 970 .513, .513, 527 C5 7.60 100 k 920 .520, .512, 513, 517 11k 1460 .511, .513, 527 100 k 920 .520, .512, 513, 517 11k 1460 .518, .511, .511 11k 1460 .588, .511, .511 11k 1460 .580, .511, .511 11k .480, .580, .511, .511 .511, .511 11k .480, .512, .512, .512, .512, .512 .512, .512, .512, .512, .512 11k .500, .512, .512, .512, .512 .512, .512, .512, .512, .512 11k .500, .612, .512, .513, .517 .514, .514 11k .516, .512, .612, .512, .512 .512, .512, .512 11k .510, .514, .514 .514, .514 11k .510, .514, .514 .513, .517 11k .520, .512, .612, .612, .723	1 6	1490	.477,.476 CS 7-60	
1/2 1470	IR	1380	. 476, . 476	
1/2 1470		0		
1/k 1590 .533, 509 CS-7.00 1/0 k 970 .577, 573, 527 CS 7-60 1/0 K 920 .500, 572, 578, 519		3500 A : D2	lasup : 100 p. : Ge	
1/k 1590 .533, 509 CS-7.00 1/0 k 970 .577, 573, 527 CS 7-60 1/0 K 920 .500, 572, 578, 519				
100 K 920 .517, 513, 527 C5 7-60 100 K 920 .520, 518, 518 1 K 1460 .518, 511, 511 Dt was also noted that there is a line in the te long at 4058 A which is about 10 time in the interior at 3500 Å. He was of the filter down take the remained to and disception at 3500 Å is not due to scattered light. It was desided that in order to investigate the rem lineert, problem firther, we would use Krawit, filters with nominal 2270, 40% and 64% town in there filters with nominal 2270, 40% and 64% town in there is a filter of the performance that of the entrance offices having and the following results filters with nominal 2270, 40% and 64% town in there filters with nominal 2270, 40% and 64% town in there filters with nominal 2270, 40% and 64% town in there of the scale of the entrance offices having and the following results filters is 3500 Å : De long : 100 h 1 k 1470 .644 .486 .213 100 k 600 .639, 647 .484, 488 .213, 211 600 k 600 .639, 647 .484, 488 .213, 211 6500 Å : W long : 100 h : (33.73 100 k 600 .653 ,657 .481, 488 .213, 211 6500 Å : W long : 100 h : (53.73 1 k 740 .652 .439 .478 .213, 211 6500 Å : W long : 100 h : (23.73 1 k 1380 .653 .652 .439 .478 .213, 211 6500 Å : W long : 100 h : (23.73 1 k 1380 .653 .657 .481, 480 .214, 218 219 1 k 1380 .653 .657 .491, 480 .214, 211 100 k 850 .643 .652 .439 .478 .213, 211 100 k 850 .643 .652 .439 .478 .211, 228	110			- 8
100 к 920 ,520,572,578,579 1 к 1460 .578,571 9t was also noted that there is a line in the be lange at 4859 R which is about 10 times the interity at 3500 R. He use of the filters downstate the restlered light. at 3500 R. He use of the filters downstate the restlered light. at was desided that in order to innetists the restlered filters with nominal 2278, 4076 and 6475 transmission. Hence filters were placed at the solutions lead of the at officer with hominal 2278, 4076 and 6475 transmission. Hence filters were placed at the following elected attained: 3500 Å: Dr long: 2004 Ausde desister Voltage T 1 k 1470 .649 .486 .213 100 k Goo .6337, 647 .484, 489 .217, 211 600 k Goo .6337, 647 .484, 489 .217, 211 1 k 1380 .652 .478, 476 .214, 221 1 k 1380 .652 .478, 476 .214, 221 100 k 850 .643, 652 .478, 476 .214, 221	1k	1590	.509,.509 (5-7-00	
1K 1460 .518, 511, 511 It was also noted that there is a line in the De long at 4858 A which is about 10 time, the intentity at 3500 Å. The use of the filters elementation the rembed to at 3500 Å. The use of the filters elementation the rembed to at assignment at 3500 Å we not due to investigate the rem- leneering, arthur in roles to investigate the remover filters with nominal 2270, 4070 and 647% termination there filters were placed at the entionce hale of the state of the filters of the second of the second of the there filters were placed at the entionce hale of the autrance optics housing and the following itealts 1 k 1470 1 k 1470 1 k 930 filters vert 930 636 1 k 1470 1 k	100 K	990		
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cut discrepancy at 3500 Å is not due to scallered light." It was decided that in order to innertistic the sen- linearity groblem further, we would case training filters with nominal 2270, 40% and 64% transmission these filters were shreed at the entrance hale of the intrance optics housing and the following results stained: 3500 Å Dr lang: 100 k and Remistre Voltage 1 k 1470	at 3500 A.	The use of the	filters demonstrates the nonlinearity	
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filtera with nominal 2270, 40% and 64% transmission. These filters were placed at the entrance hale of the intrance optics housing and the following results oftained: 3500 Å: De lang: 100 M 1 K 1470	linearity .	aroblem Surther	we would use Kravity	
These filters were placed at the entrance hale of the galaxies results entrance optics housing and the following results afternel: 3500 Å: Dr long: 100 h Anode Resister Valtare 1 k 1 k 100 k 930 636 .486 .217 .686 .486 .217 .686 .486 .217 .686 .486 .217 .686 .478 .217 .686 .478 .217 .686 .489 .217 .2300 Å: W lang: (00 M: (037.73) .00 K .200 Å: W lang: 100 M: C\$3.73 .1 K .1280 .631,.637 .214, .211 .2500 Å: W lang: 100 M: C\$3.73 .214, .211 .200 k .3500 Å: W lang: 100 M .3500 Å: W lang: 100 M .3500 Å: W lang: 100 M .	litter o	ith morningel 7	7.70 48% and 64% transision	
24 1300 k oplices housing and the following results 3500 Å : Dr long: 100 k anode periotor Voltare 1 k 1470	Maria 1:0	A management	I at the particular halo al the	*
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Anode Resister Voltage. 1 K 1470	utrance o	plics housing	and the following results	
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3500 Å : Wlang: 100 pc 100 k 850 .641,.644 .485,.487 .211,.221	flained : Anode Resisto 1 K 100 K 100 K 1 K	3500 Å : . Voltage 1470 930 5300 Å : 1 600 740	and the following results Dr lang: 100 k 	
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100 K 850 .641, 644 .485, 487 .211, 221	flained : Anode Resisto 1 K 100 K 1 K	3500 Å Voltage 1470 930 5300 Å: 1 600 740 6500 Å: 1380	and the following results Dr lang: 100 pc .649 .486 .213 .636 .478 .217 W lang: 100 pc : 03 - 73 .639,.647 .484,.488 .212, .212 .652,.639 .478,.478 .213,.211 W lang: 100 pc : 05 3 - 73 .653,.637 .481,.480 .214,.211	
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	flained : Anode Resisto 1 K 100 K 1 K 1 K 100 K	3500 Å Voltage 1470 930 5300 Å: 1 600 740 6500 Å: 1380 850 3580 Å: 950	and the following results Dr lamp: 100 m .649 .486 .213 .636 .478 .217 W lamp: 100 m : C3 3-73 .639 .647 .484,488 .212, .212 .652 .639 .478 .478 .213,.211 W lamp: 100 m : CS 3-73 .643 .652 .478 .476 .214 .211 .643 .652 .478 .476 .211 .218 Wlamp: 100 m	
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	flained : Anode Resisto 1 K 100 K 1 K 1 K 100 K	3500 Å Voltage 1470 930 5300 Å: 1 600 740 600 740 1380 850 850 850	and the following results Dr lamp: 100 m .649 .486 .213 .636 .478 .217 W lamp: 100 m : C3 3-73 .639 .647 .484,488 .212, .212 .652 .639 .478 .478 .213,.211 W lamp: 100 m : CS 3-73 .643 .652 .478 .476 .214 .211 .643 .652 .478 .476 .211 .218 Wlamp: 100 m	

63 These results seem to indicate that the non-linearity PM or electronico. I have also written letters to several people. asking for samples. See copies. The surroundings of the sample mount and photomultiplier housing have been painted flat black and a light trap placed in front of the P.M. to cut down scattered light. However there still seems to be evidence of nonlinearty in the operation of the PM with anacle resistor. Very cauful measurements were made and the 26 - 27 november 1963 The following table presents the results of the previous week's work on the non-linearity published and also these two days: The sample was made foed polished Ge. Voltage RA R TC=3, 3500 Å, { 100 m, Wlamp 3 days 5 IK 1330 .478 apart. 5 840 100 K . 487 Something (TC=Z, 3500 Å { 25м, Wlamp { 466,.464 1150 100K 1850 IK . 459, .460 TC=3,3500 Å, 100 L Wlomp, 7-60 in .458 , .458 .465 , .464 1K 1430 900 100 K . 464 , 465 . 455 , 454 850 100K 7-60 out feveral hours apart 1k 1320 11 .456,.456 .464,.463 1320 1K 830 100 K 590 100K .513, .512 5300 Å 506, 506 930 IK We note that there is a consistent non-linearity. In principle the higher R should be the non-linear value and hence the 100 k anode resistor seems to be allowing a space charge to build up between the mode and lost dynode.

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usant.

Thought: Would an incandescent Ge or Se filoment have structure in its emission spectrum?

64 29-30 november 1963

DATE 12/4/63 be order to improve the equipment I have designed a backing circuit which should be capable of applying a backing signal to the input signal so that SAMPLE: MAT ORI Ti. scale expansion will be possible. also, a TRESS: TYPE_ sterning patentiometer was purchased from Mallcross JURCE: TYPE_ in order to give the amplifier more range of gain. This will be calibrated when installed, but it is a 20 step job with about 4db per step, JETECTOR: I... indentical to the PE system. Vind.

2-4 December 1963

I recieved from B.A. Joyce a small sample of a silicon film in response to my request. This film was evidently deposited on quart, by varour means. The film itself seemed thick and had a brownish coulour. Its texture was finely groundated and the back surface of the quart, substrate was rough ground. This made for somewhat difficult optical measurements. Also RECORDER: SPEEL REMARKS 2 point OPERATOR____ it was noted that there were some pinholes in the film. In an attempt to get the "big picture" the little sample was mounted on a piece of Cater with Kravity' PURPOSE_Ref DATE 12/4/6. GE cerrent. Unfortunately some of the cement rain under The back of the substrate, but a run was attempted anyway. As for the transmission, it was scattered light limited at about 4800 Å. According to the uffectivity data of PT (60), structure abould be seen in the region of 3800 Å SAMPLE: MAT ORI THI STRESS: TYPE_ and 2800 A. and 2800 Å. The reflectivity picture was pretty dismal. Relative reflectivity had to be studied due to the length of the optical path from sample to PM and the diffusion of light from the sample so that the difference between to and the was fairly large. The reflectivity does not behave at all like the butte material, but rather decreases steadily with decreasing wavelandth. These appears to be no structure at 3800 & but there is a suggestion of constructure at 3800 & but there is a suggestion of JURCE: TYPE_ **ONOCHROMA** JETECTOR: TYP OLARIZATION_ LECTRONICS: something at 2800 Å, and This should be looked at again. Rechager a fetter arrangement can be found for booking at the transmission after the sample has been remounted. RECORDER:____

SETTI

SEI

PURPOSE_____

OLARIZATION_ LECTRONICS: 1

SEIH

REMARKS

PURPOSE Transmission of Alicon boundle DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 1		0451.9
SAMPLE: MATERIAL Juga Cilicon / CODE		
ORIENTATION ? TEMP	4 December O	201848
TI. INNESS ? PREPARATION_		
TRESS: TYPEMAGNITUDEDIRECTION		
JURCE: TYPE W Lamp STRENGTH 62		See 1
JUNOCHROMATO GRATING 30000 RANGE 6500 - 3 500 Å		
SCAN RATE PBP SLIT WIDTH 200 - 2.5		1 28 9
DETECTOR: 1		
		a set a second
OLARIZATION _ FILTER CS 3-73, none		
LECTRONICS: PRE-AMP Regular		
PSD ~		
TIME CONSTANT 2		
RECORDER: A B		
		1.000
SETTINGS		
SPEED		
REMARKS measurements made point - leg-		
print OPERATOR OMG		
PURPOSE Reflection of Sa film sample		
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2		
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL Jource filicon / CODE	H Deren hen (2)	
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL Jource filicon / CODE ORIENTATION ? TEMP	4 December @	
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL Jource filter / CODE ORIENTATION ? TEMP THICKNESS ? PREPARATION	H December @	
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL forget filter 1 CODE ORIENTATION ? TEMP THICKNESS ? PREPARATION STRESS: TYPE MAGNITUDE DIRECTION	4 December @	
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL large filter / CODE ORIENTATION ? TEMP THICKNESS ? PREPARATION STRESS: TYPE MAGNITUDE DIRECTION JURCE: TYPE Warner STRENGTH 6 V	H December @	
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL forget filter / CODE 0 ORIENTATION ? TEMP THICKNESS ? PREPARATION STRESS: TYPE MAGNITUDE DIRECTION JURCE: TYPE W STRENGTH 6 V JUNOCHROMATUR: GRATING 30000 RANGE 6500 - 3 500 Å	H December @	
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL large filter / CODE. ORIENTATION ? TEMP THICKNESS ? PREPARATION. STRESS: TYPE MAGNITUDE DIRECTION JURCE: TYPE MAGNITUDE STRENGTH 6 V JNOCHROMATUR: GRATING 30000 RANGE 6500 - 3500 Å SCAN RATE PBP SLIT WIDTH 200 - 7.5 JETECTOR: TYPE 6256 9 TEMP RT	H December @	
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL larges filtern 1 CODE 0 ORIENTATION ? TEMP THICKNESS ? PREPARATION STRESS: TYPE MAGNITUDE DIRECTION JURGE: TYPE Wagnitude STRENGTH 6 JUNOCHROMATUR: GRATING 30000 RANGE 6500 - 3 500 m² SCAN RATE PBP SLIT WIDTH 200 - 2.5 JETECTOR: TYPE 62 56 9 TEMP RT SETTING See Cheart	H December @	
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL large Alican 1 CODE ORIENTATION ? TEMP THICKNESS ? PREPARATION STRESS: TYPE MAGNITUDE DIRECTION JURGE: THIC U Large STRENGTH 6 V JUNCE: THIC U Large STRENGTH 6 V JUNOCHROMATUR: GRATING 30000 RANGE 6500 - 3500 Å SCAN RATE PBP SLIT WIDTH 200 - 2.5 JETECTOR: TYPE 6256 Ø TEMP RT SETTING Jac Chart	H December @	
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL larges filtern 1 CODE 0 ORIENTATION ? TEMP THICKNESS ? PREPARATION STRESS: TYPE MAGNITUDE DIRECTION JURGE: TYPE Wagnitude STRENGTH 6 V JONOCHROMATUR: GRATING 30000 RANGE 6500 - 3 500 Å SCAN RATE PBP SLIT WIDTH 200 - 2.5 JETECTOR: TYPE 62 56 9 TEMP RT SETTING See Cheart	H December @	
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DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL longe Lilion / CODE ORIENTATION ? TEMP THICKNESS ? PREPARATION STRESS: TYPEMAGNITUDE DIRECTION JURCE: TYPEMAGNITUDE DIRECTION JURCE: TYPENAGNITUDE DIRECTION JURCE: TYPENAGNITUDE DIRECTION JURCE: TYPEMAGNITUDE DIRECTION JURCE: TYPENAGNITUDE DIRECTION JURCE: TYPESTRENGTH 6 1/ JNOCHROMATUR: GRATING 30000 RANGE 6500 - 3500 Å SCAN RATE PBP SLIT WIDTH 200 - 7.5 JETECTOR: TYPESEG 9 TEMP &T SETTINGFILTER CS3 - 73, NOVE LECTRONICS: PRE-AMPREQULAR PSD TIME CONSTANT 2	H December @	
DATE / 2/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL larges Allian 1 CODE ORIENTATION ? TEMP THICKNESS ? PREPARATION STRESS: TYPE MAGNITUDE DIRECTION JURCE: TYPE GRATING 30000 RANGE 6500 - 3500 m² JONOCHROMATUR: GRATING GRATING RANGE 6500 - 3500 m² SCAN RATE JURCE: TYPE 6256 Ø TEMP RT SETTING SETTING Joe Cheart OLARIZATION FILTER CS3-73, NOVE IECTRONICS: PRE-AMP Regular TIME TIME PSD TIME C A B C	H December @	
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL longe Lilion / CODE ORIENTATION ? TEMP THICKNESS ? PREPARATION STRESS: TYPEMAGNITUDE DIRECTION JURCE: TYPEMAGNITUDE DIRECTION JURCE: TYPENAGNITUDE DIRECTION JURCE: TYPENAGNITUDE DIRECTION JURCE: TYPEMAGNITUDE DIRECTION JURCE: TYPENAGNITUDE DIRECTION JURCE: TYPESTRENGTH 6 1/ JNOCHROMATUR: GRATING 30000 RANGE 6500 - 3500 Å SCAN RATE PBP SLIT WIDTH 200 - 7.5 JETECTOR: TYPESEG 9 TEMP &T SETTINGFILTER CS3 - 73, NOVE LECTRONICS: PRE-AMPREQULAR PSD TIME CONSTANT 2	H December Image: Complex interval interv	
DATE 12/4/63 PAGE LOG BOOK 65 SPECTRUM # 2 SAMPLE: MATERIAL Joyce Licon 1 CODE ORIENTATION ? TEMP THICKNESS ? PREPARATION STRESS: TYPE MAGNITUDE DIRECTION JURCE: TYPE MAGNITUDE DIRECTION JURCE: TYPE MAGNITUDE STRENGTH 6 V JNOCHROMATOR: GRATING 30000 RANGE 6500 - 3 500 m SCAN RATE PBP SLIT WIDTH 200 - 2: 5 SCAN RATE JETECTOR: TYPE 6256 9 TEMP RT SETTING Jac Chart OLARIZATION FILTER C\$3-73, none LECTRONICS: PRE-AMP Regular PSD " TIME CONSTANT 2 RECORDER: A B C SETTINGS SETTINGS SETTINGS SETTINGS SETTINGS	Image:	
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61 results of PDE (62). We also talked some of the M (assumed) transition at about 3900 i which I have also abserved in my Ge films. The talk about excitous was most interesting and I should look at Film 4 at low temperatures to confirm my feelings about this. 9 Docember 1963 The following is an extension of the conversion of Cardona's results. See 2 July. This is the 500 Å film (and 1500 Å). Wavelength Energy log Io/I I/IO 1500A 500 Å 1500A 500 A 1.95.10-3 3500 Å 2.63.10-1 3.54 ev .58 2.71 1.95.103 3400 . 59 2.71 3.65 2.57 1.99 2.51 3300 3.76 .60 2.70 3200 3.88 .60 2.67 2.51 2.14 4.00 2.34 2.29 3100 .63 2.64 4.13 3000 2.80 1.70 1.58 .77 1.26 . 10-2 4.27 2900 1.90 4.43 5.24 .10-5 2800 4.28 4.59 5.00 4.30 2700 4.77 6.30 4.20 2600 4.96 2500 4.25 5.62 5.16 4.66 2400 2.18 10 December 1963 The following is the position of the UV peak and dip at the Is transition in Ge Falm 6; at 300°K: Dip in Transmission: 2760 ± 20 Å or 4.49 ± .03 er Peak in Reflection: 2800 ± 20 Å or 4.40 ± .03 er according to the data of Sukes and Schmidt, 25/62), The reflectivity peak is just about where it should be within the above error. However, the absorption edge at the A transition in Film 6 is about 2.17 are which is about .07 ev lingher in energy Than the usually reported value of the reflectivity peak.

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68 11 December 1963

12-13

Today & installed a stepping potentioneter in the amplifier. This potentioneter is a Daven Ther a li SPEC 2208-3, 500K, 20 steps, 4 db/step and is the the -Taken some one as used in the Perkin - Elener 107 Taken amplifier and was ardered from them. He inclusion of this component made it necessary to recoluste the linearity of the amplifier. This was done by trying the been the output within the range that drives the recorder full scale, usually 1.2 volto. The input signal was obtained from the calibrator of a Tektronix 543a scope. note Tlese , with Jain that the gain setting is, and will be, reported in terms of twice the dial plate reading. Input Output Adr D out Gain felling Jain. 3 .4 .4 . 5 mv 1.71 3800 21 . 2 .75 1 1.5 .5 1500 .5 18 .5 .75 2 1.2 600 .5 .5 16 1 .6 5 1.2 .4 .4 240 14 2 .5 10 1.5 150 .5 13 .5 5 .75 3 60 20 1.2 . 5 11 .5 * Th 10 . 6 3 50 n 1.2 .4 24 .4 9 al 20 .5 3 100 14 1.4 .5 8 .5 50 .7 25 3 579 for 200 1.4 .5 .65 7 12. .9 100 7.4 5 3.4 3.4 3 . 8 500 1.7 2 0 1.4 200

It seems as if the "danger point" for non-linearity is gain setting I and under no sercumstances should this be exceeded. If further attenuation is needed, the anode resistors on be switched.

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	12-13 December 1963	81		(39
	These two days I	becom a	languing for I	The installation a	1
	a liquid No crow	stat an	& task the	allowing data or	L
ie l	a liquid Nr cry the new gain cont	tal. The	re are two	sets of data or	10
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y to	These figures were	taken with	ha slit = 10	0 4@ 5mm at 5300	R
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	9/8	1.59	1.58		18
	10/9	1.59	1.59		0/9
	11/10	1.55	1.55		1/10
	12/11	1.60	1.60		2/1
	13/12	1.58	1.57		3/1
	14/13	1.59	1.59		4/1.
	15/14	1.60	1.61		5/1
1	16/15	1.58	1.58		16/1
	17/16	1.57	1.58		17/1
	18/17	1.60	1.61		8/1
	19/18	1.58	1.60		9/1
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100 K /10K 8.32 100 m 700 990 8.68 25 M

It is seen that the 100x setting probably produces non - linear results.

70 & also installed a Hawlett - Pachard 120 AR PURPO scope. It appears an though the load on the DATE / 110 AC ceremiting is beginning to tell and this is probably the last piece of equipment it will be able to take. a measurement of the line voltage inside the cabinet shows it to be 1104. I also had built and installed a filter holder. Had a talk with WP wednesday and he stressed professional development over priority of work. also pointed out that I should stress the vart improvement in my optical constants over Une ... previous ones. The new bucking circuit was tried out and worked JLARIZ fair there seems to be some phase difficulty as one attempts very large bucking signals, but what we have will serve its purpose as we were able to expand to the point where the source noise LEVIN was intolerable. also bucking was tried at the output with the balance control and seems at first glance to operate linearly. more will have to be done on this later. We took up the reflectivity measurements on Film 4 again to get a proper value for these quantities. OPERAT PURPOSE R: Film 4 13 December 1 DATE 12/13/63 PAGE LOG BOOK 70 SPECTRUM #_ / SAMPLE: MATERIAL Falm 4 CODE 14 1 THICKNESS_____PREPARATION_ STRESS: TYPE - MAGNITUDE DIRECTION JOURCE: TYPE W lamp STRENGIN 60 seem MONOCHROMATOR: GRATING 30000 RANGE 6500 - 3500 A bare SCAN RATE P3P SLIT WIDTH 100 M D5mm & am DETECTOR: TYPE 62568 TEMP RT Film SEI 1116 1260 V of 7 OLARIZATION ______FILIER_fee chart seen CLECTRONICS: PRE AMP Regula then PSD. * rang TIME CONSTANT 3 wen RECORDER:_____A___B____C___ SETTINGS SPEED_ REMARKS (x, y, =) = 3.180, 6.08 5.00 OPERATOR PMG

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te. his it voltage	PURPOSE R(1): Film # DATE 12/13/63 PAGE LOG BOOK 71 SPECTRUM # 2	13	s pec	ember	- 2	108 1	
ing	SAMPLE: MATERIAL Film # CODE					189 3	
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4	REMARKS (x, y, 2) - 3180, 6.08, 5.00						
						and the second	
	OPERATOR PMG						1

14 December 1963

today & reduced the data of yesterday. The & (1) curve seems to show a very broad 5900 a peak and a barely discernible. 5400 Å peak at about 5280 Å (2.35ev). I am also now taking data in the UV reflection of Film t. This film has, on seems to have, some sort of film (oil?) on the Ge-air surface and this seems to ricin the UV reflectivity qualitatively. also, there is still some anomaly in the 6000-6500 Å range. This must be due to the PM as almost everything else has been eliminated

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PURPOSE R: Film 4		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	16-20 1
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	30000 RANGE 3500 - 3000	SCAN SALE	dewa
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DATE 12/14/63 PAGE LOG B	00K 72 SPECTRUM # 2	-	Ŧ.
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16-20 December 1963

This week was spent primarily on renovating the nitrogen cryostat so that it could be used with my equipment. a new base was built using a Cenco Vacuum coupling. a trial run was made with B.K.'s new pumping system and it seemed to have no leaks at all. It took quite a lot of liquid No to cool it to the point where the deway spart would hold it without excessive boil off, but once this was accomplished, the temperature on the sample block drapped rapidly to 79°K as recorded by a copper - constantan TC I soldered to it. The autaide got cold but not so cold that condensation took place. The temperature held at 79 °K until the very last drap of N2 was gone. It then rose to 120 °K after 15 min. (2.7 °K/min) and to 250° K (-23°C, -9° F) in 200 min (.85° K/min). all in all, the whole device seems to work well. also This week J. I. finished the sample holders for me with the teflow holding tabs. This meet I also reduced the data of 14 Dec 2 pertaining to R(E) of film 4. Because of the marked indistinces of the 4.4 ev real in the uflectivity of this side, it is hard to pin it down exactly. The results for R'(E) should be The questery progress report was written This week and we had a talk with W.P. The talk revolved mainly around the effect of the built-in stress due to the thermal centraction of the film from its formation tenzerature. W.P. seemed to believe that the ultimate stress would be the same whether or not the film was formed at 700°C or 500°C due to a high surface mobility of atoms and a subsequent "annealing" effect. my opinion was that at such temperatures where the mobility was so high one would probably not abserve a destinat same pattern as one did in the case of Ge at the epitapial temperature so that in this case me could use the concept of thermal contraction from the epitapial temperature. However, these is probably a region near the melting point of Ge in which the alienomenon described by W.P. exists. Work was started one TOPCON3, a grogram to take R, T, R' and make a guess at the Thickness Through the use of a combination of a two-dimensional newton's method and the reguli falsi method,

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7 A In view of the failure of OPCONZ, not too much hope is held out for its success. 23-2 new ideas of the week: The (1) The measurement of the optical properties of on F Wurtzite materials under hydrostatic pressure through the use of an ellipsometer. Such measurements could help identify certain transitions by relating their pressure coefficients to the 2nd structures achler refle for from which they should not be too different. (2) By preparing a careful series of Ge - Si alloys, one might possibly study the effects of a cross-over of the criss and cross conduction band minima doesn exar PDE (and so test some of Peterson's theory. Perhaps what if one gets the minima close enough, one might A use hydrostatic pressure to effect the switchover. (3) We have evidence of seeing the T25' - T.5 of I any transition at around 3800% in our films. One wonders if the S.O. split - off state of 125 - 17.5 in a is allowed. It it is we should check for it. also, strai can one explain the fact that h is an edge and 2 00 Is a read by the curvature of the bands in their vicinity? It seems that a gead in absorption abould other inser arise from rather flat bande, while an edge was from sharp ones. shift find to 1 some 22 December 1963 any this a run is being

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 A</ taken of the 6500 - 5000 A again region using the 7102 PM. Film shar 22 December 1 et. de there was gente a lot of PM voice. also, 5:00 arran defini the reflectivity was al generally too ligh. a ty was made with a th to I 3.18 RA = 100 K, but this a I did not change mad Things much so there Th 11 in grobably not a arou non-linearth here. to S also, RA in grobable real in parallel with a flood RECORDER 100K built - in Rr. sub should try widening inst slit.

23-27 December 1963

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The first part of this week was spent taking R' data on Film 4. Then I discovered an article by Dorovan, ashley, and Bennett in this month's Jos N 5.3, on reflectivity of germanium and germanium films. On the suggestion of WP, I am writing them a letter and for further details, see letter and article. In Their article they mention new structure at around 5000 Å (WP doesn't take it seriously); Therefore, I set up to examine the reflectivity in this region on sample PDE (62). What I got I will send to DAB to see what they think of it. I also set up Film 3 for measurements. R and T of this film showed the A splitting the best of any so far, with the A peaks in reflection being shifted to higher energies by about 100 Å. This is in accordance with my theory that the built-in strain is high enough to shift these peaks. The E read was at 2800 Å ± 10 Å, unchanged from bulk and other film values, as one would expect from the insensitivity of this geal to strain. The 13- 13 real was also observed at 2140 ± 10 A (5.79 ± .03 ev). This may be shifted and a measurement on PDE (62) should be made to find ant. The reflectivity of this sample again seems to be very weak in magnitude. I will have to try some way of cleaning the surface and see if this makes any difference. I can't think of any other season for This. also, if transmission I saw the very sharp edge again and the dip in the A region as I saw in Film 4 although not quite as sharp as Film 4, not sharp enough to gull the so split off edge with et. In conjustion with this, I completed the mechanical arrangements for liquid de work and this will definitely have to be done as soon as possible. also this week I examined The possibility of a transition from the split off valence band to the P.5 conduction band. Group theoretically, such a transition is possible and a search should be made for it. The talk with WP on Friday again centered mostly around the discussion of strain in the film and how to get an independent check on the shift of the A peaks. At was decided to write another letter to sloope and ask if he had any information on The subject and also to ask around and find an

instrument capable of reflection electron diffraction.

76 We also talked about the DAB (63) paper and I have DATE new Ideas: SAMPL (1) Unispial strain may be a way of determining whether or not the 4.4 yeah has X or & symmetry. (2) In view of the recent theoretical discussions on the effect of the Darwin term on the band STRESS: structure of semiconductors, it might be well to SOURCE: consider the effect of high electric fields, although all they may do is shift all the bands the MONOCH DETEL what now follows is the data on each of the wens taken this week. POLARIZI RECORDE **REMARKS** PURPOSE R': Film 4 w/ 7102 OPERATO DATE 12/23/63PAGE LOG BOOK 76 SPECTRUM # 23 December 1 SAMPLE: MATERIAL Film 4 CODE PURPO: ORIENTATION_____TEMP_ DATEL THICKNESS _____PREPARATION___ SAMPLE STRESS: TYPE_____MAGNITUDE_____DIRECTION SOURCE: TYPE W clamp STRENGTH 60 MONOCHROMATOR: GRATING 30000 RANGE 6500 - 5000 STRESS SCAN RATE PBP SLIT WIDTH 200 - 5 mm DETECTOR: TYPE 710-2 TEMP RT MONU. SETTING 1010V, 10K POLARIZATION - FILTER CS 3-73 DETEUIU ELECTRONICS: PRE-AMP_____ PSD. " POLARIZA TIME CONSTANT_____3 ELECI RECORDER: A _____B_ _C_ SETTINGS RECORD SPEED. REMARKS (3.18,6.08, 5.00) This data not plotted OPERATOR PMS OPERATO

have	PURPOSE R': Felm 4 w/7102		77
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	SAMPLE: MATERIAL Film 4 CODE	23 December 2	2
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d.	THICKNESSPREPARATION		
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ugh	SCAN RATE 12 5 SLIT WIDIH 200 - 5		
	DETENSION TYPE 7/02 TEMP RT		
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	PURPOSE R: PDE(62); 5400 A - 4400 n		
	DATE $2/24/G3$ PAGE LOG BOOK 7 SPECTRUM #		
	SAMPLE: MATERIAL $PDE(G2)$ CODE	24 December 1	
1000		d T Velember f	
	THICKNESSPREPARATION_		
	STRESS TYPEMAGNITUDEDIRECTION		1
	MUNU :AIUR: GRATING 30000 RANGE 5400 - 4400		
. S	SCAN RATE 125 SLIT WIDTH 100 - 5		
	DETECTOR: THE G2568 TEMP RT		
and the second s	SETTING 1280 V		
	POLARIZATIONFILTER		
	ELECTION PRE-AMP Res		
	PSD		
	TIME CONSTANT		
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	SPEED		
12	REM. (3.18, 6.08, 5.00)		2 1
a de la compañía de l	OPERATOR_ PMS		
	DPERATOR / MCS		A STARIA
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PURPOSE T: Fulm 3, 5400 - 4400 A	PURPOS
DATE 12/24/64 PACE LOG BOOK 78 SPECTRIM # 2	DATE
SAMPLE MATERIAL Film 3 CODE 24 December 2	SAMPL
ORIENTATIONTEMP	Crimit
THICKNESSPREPARATION	
STRESS: TYPEMAGNITUDEDIRECTION	STRESS
SOURCE: TYPE W lamp STRENGTH GV	STRESS
MONOCHROMATOR: GRATING 30000 RANGE 5400-4400	MONOC
SCAN RATE 12.5 SLIT WIDTH 100 - 5 1 2	MONOC
DETECTOR: TYPE 62568 TEMP RT	DETECT
SETTING 12800	
POLARIZATIONFILTER	POLAR
ELECTRONICS: PRE-AMP. Reg.	ELECTR
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	A CHICA
OPERATOR PMg	OPER/
	OFERA
PURPOSE T= Film 3; 6800 - 5000 R	PU
DATE 12/24/63 PAGE LOG BOOK 78 SPECTRUM # 3	DA
SAMPLE: MATERIAL Film 3 CODE 24 December 3 3 9992	SA
ORIENTATIONTEMP	
THICKNESSPREPARATION	1
STRESS: TYPEMAGNITUDEDIRECTION	STR
SOURCE: TYPEW_langsSTRENGTH6	30-
MONOCHROMATOR: GRATING 30000 RANGE 6000 - 5000	Mu
SCAN RATE 125 SLIT WIDTH 100-5 STAR AN MADE	
DETECTOR: TYPE 62563 TEMP RT	DET
SETTING 1280V	
POLARIZATIONFILTERFILTER	POI
LLECTRONICS: PRE-AMP	ELE
PSD. A	
TIME CONSTANT 3	
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SETTINGS	
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OPERATOR PMG SCIANCE S	
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PURPOSE R: F.	lan 3	nie staan oor je anna drekover maar de							
DATE 12/26/63 PA		79 SPEC	TRUM # /			Ð	1	,	
SAMPLE: MATERIA					26	Vecen	nber	/	
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	rion		ATION						1
STRESS: TYPE									
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	SCAN RATE 12:								
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	,1250								
POLARIZATION									
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PURPOSE R: DATE/2/24/63	Film 3			Z	27	Deco	mber	- Z	
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PURPOSE <u>R</u> . DATE <u>12/24/63</u> SAMPLE: MATER ORIENT	Film 3 PAGE LOG BOOK_ IAL Film 3 ATION	CODETEMP			27	Decs	mber	- Z	
PURPOSE <u>R</u> . DATE <u>12/24/63</u> SAMPLE: MATER ORIENT	Film 3 PAGE LOG BOOK_ IAL Film 3 ATION_ ESS	CODE TEMP PREPA	ARATION		27	Decs	ember	. 7	
PURPOSE <u>R</u> . DATE/2/24/63 SAMPLE: MATER ORIENT THICKN	Film 3 PAGE LOG BOOK IAL Film 3 ATION ESS MAGNITUDE	CODE TEMP PREPA	ARATION		27	Decs	ember	- Z	
PURPOSE R: DATE/2/27/63 SAMPLE: MATER ORIENT THICKN STRESS: TYPE	Eslan 3 PAGE LOG BOOK IAL <i>Eslar 3</i> ATION ESS MAGNITUDE Pelong	CODE TEMP PREPA	ARATION DIRECTION 2 OW		27	Decs	mber	- 7	
PURPOSE R: DATE/2/24/63 SAMPLE: MATER ORIENT THICKN STRESS: TYPE SUBJE: TYPE	Eslan 3 PAGE LOG BOOK IAL <i>Eslar 3</i> ATION ESS MAGNITUDE Pelong	CODE TEMP PREPA STRENGTH	ARATION DIRECTION 2 OW NGE 3900 - ,	2000	27	Decs	ember	. 7	
PURPOSE R: DATE/2/24/63 SAMPLE: MATER ORIENT THICKN STRESS: TYPE SUBJE: TYPE	E. C. 3 PAGE LOG BOOK IAL <i>F. C. 3</i> ATION ESS MAGNITUDE <i>B. Comp</i> GRATING 300 SCAN RATE 12	CODE TEMP PREPA STRENGTH RA	ARATION DIRECTION L OW NGE 3960 T WIDTH	2000	27	Decs	mber	- 7	
PURPOSE R: DATE/2/24/63 SAMPLE: MATER ORIENT THICKN STRESS: TYPE SUBJECTOR: TYPE DETECTOR: TYPE	E. C. 3 PAGE LOG BOOK IAL <i>F. C. 3</i> ATION ESS MAGNITUDE <i>B. Comp</i> GRATING 300 SCAN RATE 12	CODE TEMP PREPA STRENGTH COMP RA S SLIT TEMP	ARATION_ DIRECTION_ 2 OW NGE 3960 - T WIDTH_COO RT	2000	27	Decs	ember		
PURPOSE R: DATE/2/24/63 SAMPLE: MATER ORIENT THICKN STRESS: TYPE SUBJECTOR: TYPE DETECTOR: TYPE	E. C. 3 PAGE LOG BOOK IAL F. C. 3 ATION ESS MAGNITUDE C. C. C	CODE TEMP PREPA STRENGTH RA S SLI1 TEMP 7/0 V	ARATION DIRECTION LOW NGE 3960 T WIDTH R	2000	27	Decs	mber		
PURPOSE R: DATE/2/24/63 SAMPLE: MATER ORIENT THICKN STRESS: TYPE SUBJECTION: TYPE DETECTOR: TYPE SETTING	Eclan 3 PAGE LOG BOOK IAL Fela 3 ATION ESS MAGNITUDE Pelomp GRATING 300 SCAN RATE 12 62563	CODE TEMP PREPA STRENGTH STRENGTH RA S SLIT TEMP FILTER	ARATION DIRECTION LOW NGE 3960 T WIDTH R	2000	27	Decs	mber		
PURPOSE <u>R</u> . DATE <u>22/24/63</u> SAMPLE: MATER ORIENT THICKN STRESS: TYPE SUBJE: TYPE MUNDONKOMATOR: DETECTOR: TYPE SETTING POLAMIZATION	Eclan 3 PAGE LOG BOOK IAL Fela 3 ATION ESS MAGNITUDE Pelomp GRATING 300 SCAN RATE 12 62563	CODE TEMP PREPA STRENGTH COMP RA S SLIT TEMP FILTER	ARATION DIRECTION LOW NGE 3960 T WIDTH R	2000	27	Decs	mber		
PURPOSE <u>R</u> . DATE <u>22/24/63</u> SAMPLE: MATER ORIENT THICKN STRESS: TYPE SUBJE: TYPE MUNDONKOMATOR: DETECTOR: TYPE SETTING POLAMIZATION	AGE LOG BOOK AGE LOG BOOK IAL Film 3 ATION ESS MAGNITUDE GRATING 300 SCAN RATE 12 G 25 G 3 S AMP Rate	CODE TEMP PREPA STRENGTH RA S SLIT TEMP FILTER	ARATION_ DIRECTION 2 OW NGE 3960 - T WIDTH COO RT	2000	27	Deca	mber	- Z	
PURPOSE <u>R</u> . DATE <u>22/24/63</u> SAMPLE: MATER ORIENT THICKN STRESS: TYPE SUBJE: TYPE MUNDONKOMATOR: DETECTOR: TYPE SETTING POLAMIZATION	AGE LOG BOOK AGE LOG BOOK IAL Film 3 ATION ESS MAGNITUDE CAN RATE 2 GRATING 300 SCAN RATE 2 SCAN RAT	CODE TEMP PREPA STRENGTH STRENGTH RA S SLIT TEMP FILTER	ARATION_ DIRECTION 2 OW NGE 3960 - T WIDTH COO RT	2000	27	Decs	mber		
PURPOSE R: DATE/2/27/63 SAMPLE: MATER ORIENT THICKN STRESS: TYPE SUBJECTION DETECTOR: TYPE SETTIN POLAZATION ELECTION: PRE	AGE LOG BOOK AGE LOG BOOK AL Film 3 ATION ESS MAGNITUDE CRATING 300 SCAN RATE 22 GRATING 300 SCAN RATE 22 GRATING 300 SCAN RATE 22 GRATING 300 TIME CONSTAL	CODE TEMP PREPA STRENGTH STRENGTH RA S SLIT TEMP FILTER	ARATION DIRECTION 2 OW NGE 3900 T WIDTH 200 RT	2000	27	Deca	mber	- 7	
PURPOSE R: DATE/2/29/63 SAMPLE: MATER ORIENT THICKN STRESS: TYPE WUNSSINGMATOR: DETECTOR: TYPE DETECTOR: TYPE SETTING POLAZATION ELECTOR: PRE	AGE LOG BOOK AGE LOG BOOK AL Film 3 ATION ESS MAGNITUDE CRATING 300 SCAN RATE 22 GRATING 300 SCAN RATE 22 GRATING 300 SCAN RATE 22 GRATING 300 TIME CONSTAL	CODE TEMP PREPA STRENGTH STRENGTH RA S SLIT TEMP FILTER	ARATION DIRECTION 2 OW NGE 3900 T WIDTH 200 RT	2000	27	Decs	mber		
PURPOSE R: DATE/2/29/63 SAMPLE: MATER ORIENT THICKN STRESS: TYPE WUNSSINGMATOR: DETECTOR: TYPE DETECTOR: TYPE SETTING POLAZATION ELECTOR: PRE	AGE LOG BOOK AGE LOG BOOK AL Film 3 ATION ESS MAGNITUDE CRATING 300 SCAN RATE 22 GRATING 300 SCAN RATE 22 GRATING 300 SCAN RATE 22 GRATING 300 TIME CONSTAL	CODE TEMP PREPA STRENGTH STRENGTH RA S SLIT TEMP FILTER	ARATION DIRECTION 2 OW NGE 3900 T WIDTH 200 RT	2000	27	Deca	mber	- 7	
PURPOSE R: DATE/2/24/63 SAMPLE: MATER ORIENT THICKN STRESS: TYPE MUNISING MATOR: DETECTOR: TYPE DETECTOR: TYPE SETTING POLAZATION ELECTOR: PRE	AGE LOG BOOK AGE LOG BOOK IAL Film 3 ATION ESS MAGNITUDE CAN RATE 12 GRATING 300 SCAN RATE 12 SCAN RATE 12 SC	CODE	ARATION DIRECTION 2 OW NGE 3900 T WIDTH 200 RT	2000	27	Decs	mber	- 7	

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80 30-31 December 1963

PU monday & investigated cleaning the surface of DA of my films by trying several experiments on Ge and Ca Fe surfaces. I applied diffusion sump SAL oil to the surface of a giece of each & then tried cleaning in bailing bengene with an ethyl alcohol since and then I prepared two more pieces and tried cleaning in Fisher STRE RBS 25 cleaning solution followed I by an ettyle alcohol rinae. Both methods seemed to remove the oil while attaching neither the CaFi now the Ge. on Tuesday & ran some reflectivity runs on Ge samples mached and PDE(62), both previously ELE(cleaned with sthyl alcohol. The run on PDEF621 was an effort to locate the 1 peaks as close as possible. However, the results were generally REC disappoint because of what I think was a mal - functioning - of the Hafman reference signal generating diode which was found later, so This experiment will have to be redone. REA PURPOSE Ge Reflectivity: mar Lord 31 December 1 OPI DATE 12/31/63 PAGE LOG BOOK 80 SPECTRUM # 1 SAMPLE: MATERIAL Ge CODE ORIENTATION TEMP -THICKNESS _____PREPARATION__ STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE W Samp STRENGTH 61 MONOCHROMATOR: GRATING 30000 RANGE 6000 -3500 SCAN RATE 125 - SLIT WIDTH 100 - 5 DETECTOR: TYPE 6256 B TEMP RT SETTING 1320 V POLARIZATION - FILTER CSO-53 ELECTRONICS: PRE-AMP_____ PSD TIME CONSTANT_____ RECORDER:_____ A_____B____ _C_ SETTINGS_ SPEED REMARKS OPERATOR PMG

PURPOSE R of PDE(62) : 5900A DATE 12/31/63 PAGE LOG BOOK 91 SPECTRUM # 2 - 31 December 2 SAMPLE: MATERIAL Ge CODE ORIENTATION_____TEMP____ THICKNESS_____PREPARATION___ STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE we know STRENGTH 60 MUNOCHROMATOR: GRATING 30000 RANGE 6000- 5700 SCAN RATE 125 SLIT WIDTH 100 - 5 DETECTOR: TYPE 62568 TEMP RT SETTING 1470 V FILTER CSO-53 POLARIZATION ELECTRONICS: PRE-AMP______PSD_____ TIME CONSTANT____3 RECORDER:______A____B____C_ SETTINGS. SPEED_ REMARKS. OPERATOR DOMS PURPOSE & of PDE (62) : 5400 A DATE 12/31/63 PAGE LOG BOOK 81 SPECTRUM # 3 31 December 3 SAMPLE: MATERIAL Se CODE ORIENTATION ______TEMP____ THICKNESS_____PREPARATION____ STRESS: TYPE_____MAGNITUDE_____DIRECTION___ JOURCE: TYPE W lamp STRENGTH 60 AONOCHROMATOR: GRATING 30000 RANGE 5500 - 5200 SCAN RATE 125 SLIT WIDTH 100-5 DETECTOR: TYPE 6256 B TEMP RT SETTING 1340V OLARIZATION FILTER CSO-53 LECTRONICS: PRE-AMP_ Reg PSD____ TIME CONSTANT 3 RECORDER: _____A ____B _____C SETTINGS. SPEED_ REMARKS OPERATOR OMS

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8 2 2-4 January 1964

PURPOSE. On thursday a liquid No nun was made on Film 4 and on Friday a run was made on Film 3. The transmission of these two films at room temperature had shown an interesting dip in transmission in the vicinity of the h transition. This dip looked suggestive of exciton behaviour, so it was decided to go DATE 1/ SAMPLE: STRESS: T SOURCE: T MONOCHRU to liquid No temperatures. Some simple modifications were made to Cardona's old LNo DETECIUM reportat in order to do the experiment. His was mounted on a table made to straddle the POLARIZATI existing transmission - reflection setup. ELECTRONIN There is a peculiarity in the position of the dip between films 4 and 3. In film 4 the dip accurs to be associated with the first 1 transition (5700 x) and in film 3 with the second A transition. The difference in energies between the dips in looth films is: DEL = (2.46 ev) - (2.20 ev) + = .26 ev REMARKS_ about $\Delta E_{\perp}^{79} = (2.56 \text{ ev})_3 - (2.25 \text{ ev})_4 = .31 \text{ ev}$ OPERATOR_ It is seen that this difference is roughly that of the so splitting measured in reflectivity. However, the DATE / sharpening of the peaks at LNe temperatures was quite SAMPLE sharpening of the please at the unperenties what give noticable, particularly in film 4 indexe the width of the dip appears to be about 200 Å. This is interesting enough to justify going to 1 He temps and this is going to be done. The temperature coefficients of the edges and dips in the two films was measured and found to be: STRESS: SOURCE: DETECTO -2.3.10 4 ev/k° Film 4 : dip: Film 3: dip: -4.5.10 ev/ K° edge: - 3.18.10-4 ev/12 POLARIZA edge: -4.1.10 ev/K ELECTRO The coefficient in film 3 seems to correspond to the value reported by Cardona (4.15.10") while right now the deviation of film 4 is eenexplained. However, this might have something to do with its exitoric behavion, Ehrenriech has suggested that this structure might be RECORDE due to the formation of an exciton at the 1 point. is on a cleaved surface and is quite thick. REMARK: OPERATO

		83
	PURPOSE GN2 on Film 4 at A : T'	SP NE MORELENE A PAGE INCOME SA SE
	DATE 1/2/64 PAGE LOG BOOK 23 SPECTRUM #	2 January 1
3.	SAMPLE: MATERIAL Film & CODE	
C	ORIENTATIONTEMP RT 4 79°K	
	THICKNESSPREPARATION	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	STRESS: TYPE MAGNITUDE DIRECTION	
6	SOURCE: TYPE W Lamp STRENGTH GY	9/8 A A A A A A _
0	MONOCHAU ALOR: GRATING 30000 RANGE 6000 - 5000	1 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2	DETECIUM TYPE 62568 TEMP RT	
ac	SETTING 1190 V	
	POLARIZATION	
	ELECTRONICS: PRE-AMP_ Reg.	
P	PSD_ Rez.	
me	TIME CONSTANT	
in .	RECORDER: A BC	
n.	SETTINGS	
1	SPEED.	
	REMARKS Time between to and IT	
R. I	about 40 min	
	OPERATOR PMG	
- /		
of	PURPOSE LN2 on Film 3 at 1: T' DATE 1/3/64 PAGE LOG BOOK 83 SPECTRUM #_ 1	3 January 1
il :	SAMPLE: MATERIAL Frem 3 CODE	Tadan I had my weekla
ente	ORIENTATIONTEMP_RT & 79°K	Today & had my weekly talk with WP. We
of tring		discussed again the
tuis .	THICKNESSPREPARATION STRESS: TYPEMAGNITUDEDIRECTION	strain problem at
	SOURCE: TYPE MAGNITODE DIRECTION SOURCE: TYPE STRENGTH G V	length and tentatively
ipo	MONOCHROMATOR: GRATING 30000, RANGE 4000 - 4500	decided the followed:
be:	SCAN RATE 50 SLIT WIDTH 200 - 5	C' Contart of the
	DETECTOR: TYPE 6256 B TEMP RT	
-4 1.0	SETTING90	shifted the reflectiont
54 ev/ K°	POLARIZATIONFILTER_CSO-53	qualitative agreement
10 4 ev / K	ELECTRONICS: PRE-AMP	with expected values
40 7	PSD	- (2) This evidence means
te	TIME CONSTANT 3	That the shift in
he the haviour,	RECORDER: A B	+ ransmission edge is
havcour,	SETTINGS	due in part to strain
be		I also showed thim the
	SPEED	LN2 data and he suggested going to LHE
film	REMARKS	suggested going to LHe
	OPERATOR PMg	UPERATOR DE PER
· · · ·	UPERATUR	

		× .
PURPOSE R & T of Film 2		6-10
DATE 1/4/64 PAGE LOG BOOK 84 SPECTRUM #_ 1	4 January 1	0
SAMPLE: MATERIAL Film 2 CODE		I
ORIENTATION	and the second	the The
THICKNESSPREPARATION		Nº 6
STRESS: TYPEMAGNITUDEDIRECTION		the
SOURCE: TYPE a lang SIRENGIH 6 v		The
MONOCHROMATOR: GRAFING 30000 RANGE 6000 - 3500		The
SCAN RATE 125 SLIT WIDTH 100 - 5		5100
DETECTOR: TYPE 6256 B TEMP RT		The
SETTING 1250		oca -
POLARIZATION - FILTER CSO-53		tra
		ove
ELECTRONICS: PRE-AMP		and
PSD Reg		UV.
TIME_CONSTANT		280
RECORDER:ABC		How
SETTINGS		
		obse
SPEED		cent
REMARKS (2.85, 5.66, 5.00)		dist
		anal
OPERATOR PMS		hap
		map
PURPOSE R & T : Felm 2	- 4 January 2	
DATE 1/4/64PAGE LOG BOOK 84 SPECTRUM #-C	- January -	
SAMPLE: MATERIAL Falm 2 CODE	COCT - COLOR AND COCT - COCT	13 g
ORIENTATIONTEMP	an and the second deal and	
THICKNESS PREPARATION	AN GROOM PRACTIC AND	
STRESS: TYPE MAGNITUDE DIRECTION		tras
SOURCE: TYPE Dr lamp, STRENGTH low		of.
MONOCHROMATOR: GRATING 3000 RANGE 3500 - 200	0	of . lev
SCAN RATE 125 SLIT WIDTH 100-5		spl
DETECTOR: TYPE G256 B TEMP RT		The
SETFING 1870-		
POLARIZATIONFILTER_CS 0 - 53 out	t	5
ELECTRONICS: PRE-AMP OZ		
		. 5
		Com
TIME CONSTANT	and a second sec	
		3
RECORDER:ABC		
RECORDER:ABC		
RECORDER:ABC SETTINGS		
RECORDER: A B C SETTINGS		
RECORDER:ABC		5

6-10 January 1964

The better part of this week was spent investigating The procurement of a LHE cryostat. Some of the data taken on Film 2 was plotted up. The transmission was very strong, much stronger than The thickness of the film as measured at IBM. The arrow shows a dip which bottoms out at about 5100 Å, the same as film 3. However, after this the data sheep using. This may be low this acattered light due to the extremely low light transmission. more work should be done here. The overall reflectivity was very similar to films 3 and 4 with a much reduced selfsclivits in the and 4 with a much reduced reflectivity in the UV. The curves of these films seem to be similar in the geometric sense. The E peak was at 2000 ± 10 % the same quaition as in the other films. However, no distinct 13-13 transition could be observed. This week's talk with W.P. was very short and centered mostly around the neaks seen at LNZ. One disturbing flature is that the dip in film 4 is at a different place than in 2 or 3. Ne will see what

13 January 1964

happens at LHe.

Today & plotted up the data on Film 2. The transmission showed no so explitting. I am suspisious of this data because of the extremely low light levels involved. The R(L) curve showed the so splitting along with a shift to higher energies. The position of the reaks are an follows: 5250 Å ± 25 Å ~ > 2.36 ev ± .01 ev } FILM 2 5750 Å ± 50 Å - 2.16 ev ± .02 ev Compare with: 5800 Å ± 50 Å 2.14ev ± .02 ev FILM 3 2.35 ev ± .01 ev 5275 A ± 25 A ----

86 14-17 January 1964 The final decision on the procurement of the the optical cryostat was made during this period and it was decided to give the job to famis Research to build an optical cryostat along the lines of a design by T. Deutsch. lines of a design by T. Deutsch. In order to gain further knowledge concerning The poor UV reflectivity of the films, a study was made on the surfaces of films 2, 3, and 4 Sising The Vickers microscope in the metallurgy Group. This study revealed a granular structure whose particle size was </4. The study was made under dark field illumination using a catoptic condenser. The granulauty seemed to the due to the film itself and not due to irregulaities. in the substrate surface. my results seem to agree well with Hoope's election microscop studies which show a grain size of .5 to 1 4. This is probably caused by the nucleation of the film at different points on the substrate and the consequent growing together of these nucleations as the film thickens. The microstructure of filme on both cleaved and pralished surfaces OPE seemes to be the same. now it is very possible That this granular surface could be the cause of The good IN reflectivity and this will be explored The letter of sloope of 16 January 1964 should be referred to in connection with the above. D SF Tast week & went to a talk by Zewel of NORL on epitapial lead salt films. The part interesting to STR me was that on the strain effect. It appears that Nace has furning stress - strain groperties which make his results substantially different than mine as regards the effect of thermal strain on the optical properties. This weeks talk with W.P. centered around the ULI effect of the poor UV reflectivity on the optical constants. He seemed to indicate that some change of emploses FOL in the interpretation of the results was permissible in that one did not have to claim that the optical constants of the films were "truer" than those obtained by a KK analysia of the bulk reflectivity but rather indicated the present state of the art insofar as the also, this week I attempted to measure the fundamental edge in film 2. The first attempt was made on De meis' equipment was not very successful. a second run was Ca made on The Cary model 14 in the Chemistry Dept. and the results are now being analyzed. OPE

	BUDDOCT PT 1 T 1 T 1 T 2
	PURPOSE "Transmission of Film 2 14 January 1 DATE 1/14/64 PAGE LOG BOOK 07 SPECTRUM #_1
	SAMPLE: MATERIAL Film 2 CODE
- 10-	ORIENTATIONTEMP
	THICKNESSPREPARATION
	STRESS: TYPEMAGNITUDEDIRECTION
	JE: TYPE Globan STRENGTH
ia	MIROMATOR: GRATING CAFE PrimeRANGE ZM - LM
	SCAN RATE of SLIT WIDTH 100 m
S T.	TEMP RT
1	SETTING
4	COLARIZATION FILTER
ric.	LLEUTRONICS: PRE-AMPRegular
	PSD
	TIME CUNDIANI 2
-	RECORDER: A B C
13 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	SETTINGS
the	
the	SPEED
na	REMARKS. This data was taken on the
	equipment of M. Demes
ible	OPERATOR ONG
ible	PURPOSE 17 Transmission of Film 2
d.	DATE 1/17/64 PAGE LOG BOOK 07 SPECTRUM # 1 17 January I
	SAMPLE: MATERIAL Film 2 CODE
	ORIENTATIONTEMP
	THICKNESSPREPARATION
4	STRESS: TYPEMAGNITUDEDIRECTION
t	STRENGTH
che li	RANGE
Jarak	SCAN RATESLIT WIDTH
L L	UEIECIOR: TYPETEMP
L	SETTING
siz	FILTER
in	CLLUTINONICS: PRE-AMP
obtaniel	TIME CONSTANT
eller .	hABC
The	SETTINGS
et sarde garde enties. in obtanied then the the unental neis' was it.	
neis	
was	REMARKS. This data taken on the
t.	Cary 14 in chem. Dept. OPERATOR PMG
1	UPERATUR U THE G

88 20 - 24 January 1964 por the LHE dewar and purchasing other parts. I analyzed the data of 17 January I and found that there was a big dip in an interference fringe right where the direct gap should appear. There are some other curves which suggest a transition from the aplit off valence band and these are being looked at. also I took some more pictures of the film surfaces, this time doing all the films I have. The results seem inconclusive in that I cannot decide whether or not the granularity is inherent in the exitagial growth or in the Cate substrate. I have found a paper by Bonnett and Porteus on reflection from a rough surface of we consider the reflectivity of the Ze peak to be 50% lower in the films than in the bulk, Then their theory indicates an RMS roughness of about 180 Å. From the chotographs the grain tell if these two numbers are consistent. OPE also Film I which is polycrystalline, appears to be quite flat. This film was deposited on a cleaved CaFe surface. However, film 10, which is D also polycrystalline, was deposited on a polished surface and is granular, while Film 2 was epitaxially grown on a cleaved ourface and is granular also. This is all confusing. my investigations this week also included taking STI R and T of film I. Preliminany results indicate poor UV reflectivity. The transmission of this film may not be too good as there seems to be a large number of sinholes. This week I built another lamp holder DE for the w lamp. This means that interchangebility POI fulare.

	PURPOSE R and T: Falm I		89
	DATE 1/26 /64 PAGE LOG BOOK 87 SPECTRUM # /	201 1 1 1	
	SAMPLE: MATERIAL From 2 CODE	26 January 7	
>	ORIENTATION TEMP		St.
	THICKNESSPREPARATION	3.34 6	
	STRESS: TYPEMAGN.IJDEDIRECTION	and the stand	
up	STRESS: TYPE MAGNIJUE DIRECTION		No. 1
YP.	MMATOR: GRATING 30000 RANGE 6000 - 3500	A Star Manager	
	SCAN RATE 125 SLIT WIDTH 100 - 5		
	SCAN HATE 723 SET WIDTH 700-3		
	SETTING 1220 V	Carlos and C	
	A JLARIZATION		
t	LuvikUNICS: PRE-AMP Regular		
	PSD		
	TIME CUNSTANT 3		
	SETTINGS		
	SPEED		
	REMARKS. Io Atability ~ 5%		
to	here here is a subscription of the subscriptio	8 10 10 10 10 10 10 10 10 10 10 10 10 10	
	OPERATOR PMG		
-			
	PURPOSE Rand T: Felm 7		
	DATE 1/26/64 PAGE LOG BOOK 89 SPECTRUM # 2	20 1	
	SAMPLE: MATERIAL Film 2 CODE	26 January Z	
	ORIENTATION TEMP THICKNESS PREPARATION		
	STRESS: TYPE MAGNITUDE DIRECTION		
	MUNUCHROMATOR: GRATING 30000 RANGE 4000 - 2000		
	SCAN RATE 125 SLIT WIDTH 100 - 5		
	DETECTOR: TYPE 62568 TEMP RT		
	SETTING 1850V		
lility	POLARIZATION - FILIER -		
- 0	ELEUTRONICS: PRE-AMP		
	PSD		
	TIME CONSIANT 3		
	SETTINGS		
	SPEED.		
	REMARKS To Stability - 5%		
	ALMANNS		
	OPERATOR PMG-		

90 27 January 1964 PURPOSE_ DATE 2/5 SAMPLE: Today I talked with U.P. and we discussed mainly the effect of a rough surface on the reflectivity and agreed that this could be the reason for the poor UV reflectivity of the films. We also discussed the setting up of an effort in this films and the equipment required STRESS: TY JURCE: 1 MONOCHRO DETECTOR 28 January - 3 February 1964 OLARIZAT This time was spent working on the auxiliary parts to the CHe crystat and on a Trip to LEUIKUNIU IBM at Their request. While at IBM Yorktown I talked about my work with kayes, Turner and stem about my work in an effort to initiate professional contacte with the people there. SI REMARKS 4 February - Thebruary 1964 OPERATOR____ This week was spent making runs on Films 5,7, and 8. also more work was done in conjunction PURPOSE_ with setting up the LHe dewar which was DATE Z/ delivered. It holds LN2 for about 5 hours. SAMPLE: my talk with W.P. This week centered around a new group effort in the thin film area. also, we discussed my trip to IBM. STRESS: TY JURCE: TI .ONOCHRO. JETECTOR: OLARIZATIO LECTRONIC RECORDER:_ SE SF EMARKS____ PERATOR

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94 10 February - 22 February 1964

pho During this period I calculated and plotted the by overall results for films 5, 7, and 8. I also platted up composite curves for most of the gro th films measured to date. The most interesting Ge fact about the transmissivity curves is that po as the Thickness increases, the L-1 dip 411 becomes more pronounced. more measurements need to be taken to see how the other films of fit into this sicture. w all the reflectivity arves show the decrease in amplitude as a decreases. However, very Ca Th interestingly the thinner films display less of a decrease than the thicker ones. This is sl w very likely because a thinner film will have a smallert rms roughness than the thicker an films because the azgregate size will not. have become as great as in the thicker ones. of e a correction to some of the films according to Th the relation for reduced specular reflectance u due to a rough surface (BPGI), viz: sa to $R = Ro exp[-(4\pi\sigma/a)^2]$ pa n and the results show that very nearly bulk eg reflectivity curves result, except below the X-Ei peak where the wavelingth may be too short for the above formula to hold. Here the exponential relation tends to overcounst and this is seen to in 6 cr R be true for films 4 and 8. However, for films 6 lo the exponential seems to work well even here de and the reason for this may lie in the fact that film 6 has a very high X-5 reflectivity compared to the other films and therefore probably has a smaller & so that the exponential law is extended into short wavelength regions. In these di to no to an calculations & was found by taking the ratio of the reflectivity of the film X- I geal to that of the bulk X-Si peak. sa diff 2000 In relation to This problem, another letter was The written to sloope in which & enclosed film 6 and its microstructure microphotographs and asked tim we give his views and opinions on the microstureture granularity and the passibility of getting rid of it by post-annealing. I also asked whether or not be had alreved such structure in this films.

95 In conjunction with this roughness problem, a photomicrograph of a film of PbS sent to V. Prakash by Zemel of NOL was taken. This showed that granular structure was present in these films loo, the grain size being about the same as for my be filmes although the roughness appeared less, possibly because this film was grown off the 21007 Space of Nacl. In order to study the effect if any of the preparation of the CaFe substitute on the Ge film, an experiment was proposed to D. Mac Leod to prepare several Cate surfaces by various methods and then overcost them with a reflecting surface so they could be studied by dark - field illumination. The results will be considered later. Finally a good look was had at the reflectivity spectrum of an etched siece of Ge. The surpose of this was to demonstrate the quality of my equipment and to look very closely at some of the important structure proints. The results were compared against those of DAB(63). The sample was polished and etched in CP-4 according to the procedure outlined in D. mac Leod's log page 17, 2/12/64. This sample has been named mac Leod 2. While making the measurements, several equipment and measurement - taking observations were made considering the difference in results between the W and Dr lamps at the 3500 Å crossover point. The difference on reflectivity is perhaps caused by misallignment between the two lamps while also being due to to drift difference between the sources, whereas any intial difference in transmission is likely to be due to differences in To drift that any differences are not likely to be due to non-linear effects is to be seen in the fact that sometimes there is and sign change in the difference at 3500 Å. For this sample, however, there turned out to be negligible difference in the overlap region. The results above good agreement in structure and amplitude with those of DAB (63). The agreement in amplitude is to was within 2% which I consider excellent. The following and lim gives the correspondence of the reflectivity peaks. 200 Peak mac Leod 2 DAB (63) 5840 ± 10 Å (2.123 ev) (2.119 ev) 5850 A 1-1 5400 ± 20 Å (2.296 ev) 5400 R (2.296 ev) X,S (4.422 ev) 2780 ± 20A (4.460 ev) 2804 A

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96 In addition to This data, There appears to be PURPO some additional structure near the X. I peak. DATE_ This takes the appearance of a bump at or near SAMPL 2540 Å (4.881), a distance of .421 ev from the sharper peak. This may be due to the fact that the X and Is are close together in every STRESS: as concerns their critical points in the joint SOURCE density of states, so close that they cannot presently be resolved in the band structure calculations. Here may be experimental evidence of the X and & transitions appearing separately MONOCI by themselves. However, according to BPB (62), the difference between these two saddle points is POLARIZ only it er. It is also interesting to speculate as to whether or not there is some detail of the band. structure in the <!!!? direction which makes the ELECTRO RECORD 5400 & real much broader than the 5850 R peak. This may be due to a dip in the valence band near 13 which gives a greater density of states for low energy acoustical phonons causing scattering REMARK -off is band. However, such a dip is not indicated in the band structure of BPB(62). OPERAT also, a photomic rograph was made of the surface of max Lood 2 and it appeared locally very flat. This is why even a moteled etched surface can give such good uffectivity in the UV. PURPO DATE_ SAMPL THIFIL and KRAKRO. The THIFIL calculations were made with made to examine what the Francissories of STRESS: thicken films would be. Up to 1 u, the interference fringes tend to mask any useful study of the direct fundamental edge, and more calculations will be done for higher Hicknesses. The KRAKRO MONOCH DETECTO calculations were done on the data of DAB(63) modified by Ebrenseich's higher energy data. There seems to POLARIZ be some minor errors in the program. That will have to be corrected. ELECTRO my talks with W.P. in this period revolved around preparing the letter to sloope and discussing the reflectivity results on mac Lead 2. He is looking for RECORDE some sort of definitive answer to the fearibility of finding the optical constants of the films. also I wrote a letter to Reynolds covering conclusions on my recent trip to Kingston, Poughheepaie, and yorktown. REMARKS OPERATO

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	PURPOSE Ge Reflectivite: mar Leod Z DATE 2/12/64 PAGE LOG BOOK 97 SPECTRUM #_1	12 February 1	
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98 24-28 February 1964 This week I went skiing. DATE SAMP 29 February - 4 march 1964 STRESS SOURCE During this period & set up and performed a LHE experiment on Film 4. The equipment worked fine but apparently & was working at a thin or unusual point on the film because the transmission MONOC DETECT transmission was not as great as during the original LU2 experiment nor was the effect POLARI ELECTR of the sharpening as great, although it was quite noticible. I plan to continue the the work to other films and also look at the behaviour of the Z-X dip in some of the thinner films, as well as possible another look at Film 4. We also had a visit from Cardona and we discussed the possible excitonic nature of the 2 structure. There are apparently two views of the unvature REMARI of the 13 valence I band, one leading to a parabolic density of states and the other to a hyperbolic. The OPERAT bearing of this on the above structure should be investigated. PURP I recieved an answer from Aloope and in general he corroborates all my general suspicious about the rousness of epitaxial films of be on CaFz. However, it appears that polycryptalline films will be much smoother and may possibly have as much structure in there optical response as the DATE SAMP STRESS epitapial ones. We are going to start a thin film effort in MONOC The group with the two new students, and we will start with Ge on CaF2 so I will be able to get DETECT some new films to work with. my talk with W.P. involved discussing the POLARIZ results of the the experiment and Alvapes letter ELECTRO He suggested making polycrystalline films in order to find the optical constants. He seems so fixed on The optical constants that I am going to calculate RECORD them in the 1 range anyway where the roughness error is not too large for some of my epitapial films.

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141	PURPOSE Film 4: T(1): LHe	
12	DATE 3/2/G4 PAGE LOG BOOK 97 SPECTRUM #	
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5-15 march 1964

most of this period was spent studying Russian. T. Shanpland did some LHe work during this period and I was able to select a resistor thermometer. This is one of S. Groves Allen - Bradley 47 a 110 watt carbon resistors for which he has a calibration curve for a 556 s one. I found one that I will use that is 45.4 h at RT and 552 at 2He. This will enable me to use his arve to a fair degree of accuracy. also, the boil-off rate with the present tail unit is about 120 mel the the resistance of the thermometer is being measured by the following arcuit:

1 Meg TO LN K3 Pot. mm 0 5 % -1K 1.5 V + Thermometer To LN K3 Pot.

The voltage drop across a GR resistance box set somewhere near the expected resistance of the carbon thermometer is measured to determine The current which will be about 1.5 yea. The voltage drop across the carbon resistor is then measured and the resistance determined also, the beginning of an effort in the production of this films was started this week by E. Roasi and R. Ludeke. This will initially involve the production of some more germanium films for optical constant investigation and for the investigation of the 1 structure. Also, use will be made of the electron niceroscope. I have instructed D. max Loed in the performance of some experiments on the surface of prepared CaFz (prepared by polishing, etcling, and cleaving). This is to determine if the roughness of the epitopial films is due to replacation of the substrate surface, but since recieving the latest letter from sloope I rather doubt

that the cate surface is the cause of the observed roughness.

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ORIENTATION THICKNESS STRESS: TYPE MAGNITUL 30, 11°E D2 long MU	TEMP RT PREPARATION DE DIRECTION STRENGTH Form TOTS RANGE 7000 - 2000 25 SLIT WIDTH 100 - 5 ICMP RT V FILICK		
ORIENTATION THICKNESS STRESS: TYPE MAGNITUL SU HIPE Dr Lamp MU UMATOR: GRATING 30 SCAN RATE 1 DETEURIN: TYPE 62 56 B SETTING 1890 POLARIZATION ELECTIONICS: PRE-AMP Reg. PSD "	TEMP RT PREPARATION DE DIRECTION STRENGTH Form TOTS RANGE 7000 - 2000 25 SLIT WIDTH 100 - 5 ICMP RT V FILICK		
ORIENTATION THICKNESS STRESS- TYPE MAGNITUL SUL IFE D2 long MUMATOR: GRATING 30 SCAN RATE 2 DETEURIN: TYPE 62 56 B SETTING 1890 POLARIZATION ELECTIONICS: PRE-AMP Reg. PSD 7 TIME CONST RECORDER A SETTINGS	TEMP RT PREPARATION DE DIRECTION STRENGTH Form TOTS RANGE 7000 - 2000 25 SLIT WIDTH 100 - 5 ICMP RT V FILICK		
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ORIENTATION THICKNESS STRESS- TYPE MAGNITUL SUL IFE D2 long MUMATOR: GRATING 30 SCAN RATE 2 DETEURIN: TYPE 62 56 B SETTING 1890 POLARIZATION ELECTIONICS: PRE-AMP Reg. PSD 7 TIME CONST RECORDER A SETTINGS	TEMP RT PREPARATION DE DIRECTION STRENGTH For OUR RANGE 7000 - 2000 25 SLIT WIDTH 100 - 5 ICMP RT V TILICK -		

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6 a The LHE low temperature runs have seemed toadd nothing new to the LN2 data. The results 1) DE/ST is different for different identifiable structure. a recent paper by Dorovan and Bernett reveals and the That this may be due to 6 transitions and A transitions appearing separately when the crystal structure is not perfect. The dip in film 4 occurs at a lower energy than in 5, 3, or 2 (the L energy is supposed to be lower than the A energy) and has a temperature coefficient half that of 5, 3, or 2. This is a topic suitable for further wh lu wi ope sa ED bec pursuit. of The results for film 9 indicate that its thickness must be very close to that of 6 but with a 2) we rougher surface. Otherwise no new results are un obtained. Ker I prepared a schedule of what I think remains to be done for a theses package. This consists of 3 main topics: (1) Optical constants of 6e films sa fr we 20 (2) L, A structure fr (3) Is, X structure us I have attempted to calculate the optical constants of film 6 in the region 5100 - 6100 & name the thickness measured by floope, but I do not think this is going to work out but I well still keep trying. ch 3) wa eff I think the trouble is due to a wrong thickness. As pertains to the examination of the IS, X be ha the personne to the examination of the 25 A structure, I am going to see if I can find what I did in Ge in InS6 and possible Gast. I am sure that a similar broadening in occurring Sin films 6 and 8 but there may be too much noise in 7, at least it seems as if it is not there. I think some low temperature work might be called for here I spent a good deal of this time helping sudete and possi, setting up the gasether ellipsoneter, and fooling with my tramers - throng program. re (R. Se ser an 4) in pr The the der col sel Jan and ve of Eve

6 april - 5 may 1964

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This period was spent engaged in several activities. 1) an electron diffraction goniometer was constructed and tested for doing reflection electron diffraction on the Hitachi. This arrangement seems to work at when the intermediate and projection sens are turned off and the projection aperture opened wide. The beam is first focused to a small spot with the condenser and objective laws. The sample is then moved into the beam and the ED pattern observed. Poor photographs are obtained because the camera only photographs a portion of the phoaphor screen. 2) Various methods of thickness measurements. were tried on the Reichert microscope. These were nomarshi, and multiple beam using some Reichert attachments. neither of these were very satisfactory because of the broadness of the fringes. Several silvered microscope elides were used and sodium and mercury light sources employed. These give reasonably good fringes but the technique may not be for useful on cleaved serfaces. aluminum and chronium master slides will also be tried. 3) The production of some new germanum films was initiated during this period under the efforte of E. Rossi. a suitable substrate heater has been constructed and apparently works well. Trouble has occured in the ense and construction of a reliable source heater and a commercial one (R.D. mathis) has been purchased and awarts trial. several quite thim be films have been produced at substrate temperatures of 600 °C, 500 °C, and 400 °C and await optical measurements. 4) One of the principle reasons for making new films is to determine whether or not the roughness problem can be solved or not. It is thought that problem can be solved or not. It is thought that the making of polycrystalling films would aid in this. Also, the arrangement of the reflectometer-densitometer optics was changed to allow for collecting more of the scattered light. The new set-up I was checked out with Mac Loed 2, and was found to give approximately the right values at 5300 Å and 2800 Å. However all of the new films still give very low values of the reflectivity at 2800 Å, in spite of the fact that they were deposited on cleaved CaFz. Even allowing for a constant error due to macrosoghness

106 did not improve matters because the ratio of the 7) m X peak to the A peaks was about unity Cor all the films. These films were spot - checked at the various d's and no continuous scan was made on them. 5) surface Roushness. Photographs of the surfaces of the new Ge films were talen and very small microstructure was observed on the epitatial films and none on the polycrystalline films. It has been shown by Judeke that all the films made at IBM have extreme surface roughness Catz substrates. an attempt was made to correct for the surface roughness of Film 9 and Film 4/24/64 Ge#1 by simultaneously overcoating them and a flat microscope slide with aluminum and then comparing their reflectivities in the hope of correcting the original reflectivity data. Un fortunately, this did not turn out to the so as the correction actually over corrected in far ultraviolet for both films and did not follow a exp[- [410/4]²] law but actually decreased at a much more rapid rate. I am at present totally at loss for the reason or explanation. Thus "it appears impossible to correct for the roughness by this method. 6) Programs and Calculations: I attempted to calculate some optical constants from reflectint data corrected by the roughness formula, particularly for Film 6. These were only partially successful as there seemed to be a divergence around 3000 & with improper behaviour of n and k around this value. The values most consistent with PT (59) KK values were ablained for a film of 140 & thick, very near the thickness of Film 6 as determined by OPCON 3 from transmission and bulk aptical constants. Some of the troubles at short wavelengths are perhaps due to the transcendental nature of the equations used and perhaps better convergence can be abtained with approximate formulae. also, I will have to rewrite my the program to automatically fit an extaspolation & curve to the high energy aflectivity in accordance with stern's article in SSP15. Bat extrapolations have been the cause of the failure so far to calculate nand & for

mac Leod 2 and DAB (63).

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7) my talks with W.P. centered around the optical 107 constanta and the reflectivity. the experimental difficulties with PURPOSE R # T: 4/24/64 Ge # 1 'sa at DATE 4/24/64 PAGE LOG BOOK 107 SPECTRUM # 1 w 24 april I SAMPLE: MATERIAL 4/24/64 Ge=1 CODE ORIENTATION_____TEMP____ THICKNESS_____PREPARATION____ 5 STRESS: TYPE_____MAGNITUDE_____DIRECTION___ SOURCE: TYPE W lamp STRENGTH GV ma. MONOCHROMATOR: GRATING 30000 RANGE 6000 - 3500 maan DETECTOR: TYPE 6256 B TEMP RT SETTING 12 300 ELECTRONICS: PRE-AMP Qees. ida PSD . TIME CUNSIANI 3 RECORDER:_____A____B_____ C did SETTINGS. SPEED____ 4]2/ REMARKS. 6.03 4.12, 5.00 OPERATOR PMG a PURPOSE R # T: 4/24/64 Ge # 1 DATE 4/24/64 PAGE LOG BOOK 107 SPECTRUM # 2 24 april 2 SAMPLE: MATERIAL 4/24/64 Ge=1CODE ORIENTATION TEMP THICKNESS PREPARATION. id. STRESS: TYPE_____MAGNITUDE_____DIRECTION_ ned SOURCE: TYPE Dr lamp STRENGTH Zow MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000 alues) SCAN RATE 125 SLIT WIDTH 100-5 ed DETECTOR: TYPE 62-56 B TEMP RT of SETTING 1880V con POLARIZATION_______FILTER_____ s at ELECTRONICS: PRE-AMP. Rog. ntal PSD. " TIME CONSTANT 3 RECORDER:______A_____B_____ _C_ m the SETTINGS ź ie. SPEED_ los REMARKS 6.03, 4.12, 5.00 OPERATOR PMG

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SAMPLE: MATERIAL FILMG CODE	25 april I
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SOURCE: TYPE w lamp Strendth Gr	
MONOCHROMATOR: GRATING 30000 RANGE 6000-3500	
SCAN RATE 125 SLI 1. JTH-100-5	
DETECTOR: TYPE 62-56 B TEMP RT.	
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MONOCHROMATOR: GRATING 30000 RANGE 4000-2000	
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DETECTOR: TYPE 6256 B TEMP RT	
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	PURPOSE & Correction: 4/24/64 Ge#1
	DATE 4/29/64 PAGE LOG BOOK 109 SPECTRUM # 1
000.00	SAMPLE: MATERIAL 4/24/64 Ge#/ CODE
29 April 1	ORIENTATIONTEMP
	THICKNESSPREPARATION A? coat
	STRESS: TYPEMAGNITUDEDIRECTION
	SOURCE: TYPE W lange STRENGTH 60
	MONOCHROMATOR: GRATING <u>30000</u> , RANGE 6000 - 3500
	SCAN RATE 125 SLIT WIDTH 100-5
	DETECTOR: TYPE @256 B TEMP RT
	POLARIZATIONFILTER
	ELECTRONICS: PRE-AMP_ Reg
	TIME CONSTANT 3
	RECORDER:ABC
	SETTINGS
	SPEED
	REMARKS 6.03, 4.12, 5.00
	OPERATOR PUG
29 april 2	PURPOSE R Correction: 4/24/64 Ge#1
	DATE 4/29/64 PAGE LOG BOOK 109 SPECTRUM #
	SAMPLE: MATERIAL 4 /24/64 60#/CODE
	ORIENTATIONTEMP
	THICKNESSPREPARATION_ al Coast
	STRESS: TYPEMAGNITUDEDIRECTION
	SOURCE: TYPE Dr. Lamp STRENGTH Low
	MONOCHROMATOR: GRATING BOORD, RANGE 4000-2000
	SCAN RATE 125 SLIT WIDTH 100-5
	DETECTOR: TYPE 62568 TEMP RT
	SETTINGSTOV
	POLARIZATIONFILTER
	ELECTRONICS: PRE-AMP
	PSD
	TIME CONSTANT_ 3
	RECORDER: A BC
	SETTINGS
	SPEED
	REMARKS 6.03, 4.12, 5.00
	OPERATOR PMS.

SAMPLE: MATERIAL Film 9 CODE ORIENTATION TEMP THICKNESS PREPARATION al cost RESS: TYPE MAGNITUDE DIRECTION NURCE: TYPE & lamp STRENGTH 6 & DNOCHROMATOR: GRATING 30000 RANGE 6000-3500 SCAN RATE 125 SLIT WIDTH 100-5 TECTOR: TYPE 6256 B TEMP RT SETTING 1220V LARIZATION FILTER ECTRONICS: PRE-AMP Reg. PSD " TIME CONSTANT 3 CORDER: A B C SETTINGS SPEED MARKS 3.71, 5.57, 5.00 ERATOR PMG	30 38 22 . 10 20 10 20 10 10 20 10 20 10 10 20 10 10 10 20 10 10 10 10 10 10 10 10 10 10 10 10 10							
ORIENTATION TEMP THICKNESS PREPARATION al cont RESS: TYPE MAGNITUDE DIRECTION PURCE: TYPE W Lowp STRENGTH 6 V DNOCHROMATOR: GRATING 30000 RANGE 6000 - 3500 SCAN RATE /25 SLIT WIDTH 100 - 5 TECTOR: TYPE 62568 TEMP RT SETTING 1220V LARIZATION FILTER PSD 4 TIME CONSTANT 3 CORDER: A B C SFEED MARKS 3.7/, 5.57, 5.00 ERATOR PMG								
THICKNESS PREPARATION al cost RESS: TYPE MAGNITUDE DIRECTION NURCE: TYPE Jame STRENGTH GJ NOCHROMATOR: GRATING 30000 RANGE 6000 - 3500 SCAN RATE 125 SLIT WIDTH 100 - 5 TECTOR: TYPE GZ568 TEMP SETTING 12201 LARIZATION FILTER ECTRONICS: PRE-AMP Reg. PSD " TIME CONSTANT 3 CORDER: A B C SETTINGS " MARKS 3.71 SST, S.00 " ERATOR PMG								
RESS: TYPE MAGNITUDE DIRECTION URCE: TYPE & Concertion STRENGTH G & DNOCHROMATOR: GRATING 30000 RANGE G000-3500 SCAN RATE 125 SLIT WIDTH 100-5 TECTOR: TYPE G256 B TEMP PT SETTING 1220 V LARIZATION FILTER PSD # TIME CONSTANT 3 CORDER: A B C SETTINGS SPEED MARKS 3.71, 5.57, 5.00 ERATOR PM G PURPOSE & Correction : Friem 2								
URCE: TYPE URCE: TYPE UNOCHROMATOR: GRATING 30000 RANGE 6000 - 3500 SCAN RATE 125 SCAN RATE 125 SCAN RATE 125 SLIT WIDTH 100 - 5 TECTOR: TYPE 62568 TEMP 67 SETTING 72207 LARIZATION FILTER PSD " TIME CONSTANT 3 CORDER: A B C SETTINGS SPEED MARKS 3.71, 5.57, 5.00 IMARKS 3.71, 5.57, 5.00 IMARKS PURPOSE R Correction: Film 2								
DNOCHROMATOR: GRATING 30000 RANGE 6000-3500 SCAN RATE 125 SLIT WIDTH 100-5 TECTOR: TYPE 6256 B TEMP PT SETTING 1220V LARIZATION FILTER ECTRONICS: PRE-AMP Reg. PSD " TIME CONSTANT 3 CORDER: A B C SETTINGS SPEED MARKS 3.71, 5.57, 5.00 ERATOR PMG								
SCAN RATE 125 SLIT WIDTH 100-S TECTOR: TYPE 62566 TEMP PET SETTING 1220V LARIZATION FILTER ECTRONICS: PRE-AMP Reg- PSD " TIME CONSTANT 3 CORDER: A B C SETTINGS SPEED MARKS 3.71, 5.57, 5.00 ERATOR PMG								
TECTOR: TYPE 62568 TEMP PET SETTING 1220V LARIZATION FILTER ECTRONICS: PRE-AMP Reg. PSD " TIME CONSTANT 3 CORDER: A B C SETTINGS SETTINGS SPEED MARKS 3.71, 5.57, 5.00 ERATOR PMG								
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DATE 4/30/64 PAGE LOG BOOK 110 SPECTRUM # 2	AD							-
SAMPLE: MATERIAL Film 9 CODE	IA2						r	
ORIENTATION TEMP		1000						
THICKNESSPREPARATION al Coat		1						a
RESS: TYPEMAGNITUDEDIRECTION								0
DURCE: TYPE D2 lamp. STRENGTH Jour								0
ONOCHROMATOR: GRATING 30000. RANGE 40 CT- 2000								0
SCAN RATE 12 5 SLIT WIDTH 100-5	num							
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SETTING 1970	1.201	1.						
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	UQN							
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	and a second							
ERATOR 6 MS								

6 may - 11 may 1964

In order to attempt to capture as much of the scattered light as gossible, a rearrangement of the Reflectometer Densitometer optics to one of the original forms was made. That is, the 62568 PM was moved very close to the mirrors and the light was forced as sharply as possible on the sample position. However, as it turned out, this did not seem to improve the UV reflectivity of the films appreciably. Inot measurements were made on both epitapial and polycrystalline samples of new Ge films. The amplitude of the X-Z peaks seemed to be about the same as the A seaks. This is an improvement over the epitatial Ge films on "polished" CaFz but is still no where near that expected by the bulk material. In order to gain some perspective on our film work, reflectivity measurements were made on an epitoxial film of PbS on NaCle (10) and on a cleaved PbS surface. The results compared excellently with each other and with those of Cardona on cleaved PbS. There was a slight tailing off at 2200 due probably to a roughness effect. microphotographs showed a degree of structure in the PbS film about like that in the Ge films but apparently here the effect is smaller. The cleaved Pb5 surface showed no structure under nicroscopic examination. apparently the ionic solide are going to be easier to work with I wonder if the effect of roughness has anything to do with whether or not one is working aff a d cill face on a <1007 face. The following is a compilation of the formation data of some of the thin films that have been made to date. 4/24/64 Ge#1

Aource temp: unknown due to poor thermal contact to BN boat Aubstrate temp: 600 °C Exposure time: 4 min. Recelt: red film, probably epitaxial,

5/2/64 Ge#1 fource - Substrate : 13.5 cm Aubstrate temp: 600°C fource temp: 1300°C Exposure time: 5 min. Result: red, probably epitaxial, quite mich

112

5/2/64 Ge # 2 Result: no film

5/2/64 Ge # 3 fource - Substrate: 13.5 cm substrate Temp: 400 °C fource Temp: 1300 °C Exposure Time: 5 min Result: Oranse Film, probably polycuptalline

5/2/64 Ge# 4 Source - Substrate : 13.5 cm Aubstrate Temp: 500 °C Source Temp: 1300 °C Exposure Time: 5 min Result: Orange Film, probably polycrystatline

5/3/64 Ge # 1 source - substrate : 13.5 cm Aubstrate Temp: 600 °C Source : 1300 °C Exposure time : 8 min Result: Red film, propably epitarial, quite thin

5/11/64 Ge#1 Source - Substrate : 19.5 cm Aubstrate Temp: 500°C Source: 1050°C Exposure Vine: 5 min Result. Very thin, red or pink

	PURPOSE R: 5/3/64 Ge#1
6 may 1	DATE 5/6/64 PAGE LOG BOOK 113 SPECTRUM #
	SAMPLE: MATERIAL 5/3/64 Ge#1 CODE
	ORIENTATIONTEMP
	THICKNESSPREPARATION
	STRESS: TYPEMAGN TUDEDIRECTION
	SOURCE: TYPE W lang SIRENGIH 60
	MONOCHROMATOR: GRATING 30000 RA.IGE 6000-3500
	SCAN RATE 125 SLII W. J.H. 100-3
	DETECTOR: TYPE 62563 IENT ET
	POLARIZATION
	ELECTRONICS: PRE-AMP
	TIME CUNSIANI 3
4.34	RECORDER:ABC
	SETTINGS
-	
	SPEED
	REMARKS 6.33, 4.00, 4.64
	OPERATOR PMG
	PURPOSE R: 5/3/64 Ge#1
6 may 2	DATE 5/6/64 PAGE LOG BOOK 113 SPECTRUM # 2
	SAMPLE: MATERIAL 5/3/64 Ce = 2 CODE
	ORIENTATIONTEMP
	THICKNESSPREPARATION
*	STRESS: TYPEMAGNITUDEDIRECTION
	SOURCE: TYPE Dr lamp STRENGIH /
	MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000
	SCAN RATE 125 SLIT WIDTH 100-3
	DETECTOR: TYPE 62563 TEMP RT
	SETTING
	POLARIZATIONFILTER
	ELECTRONICS: PRE-AMP 223
	PSD
	TIME CONSTANT
	RECORDER:ABC
	SETTINGS
	SPEED
	REMARKS 6.33, 4.00, 4.64
	OPERATOR_PM9
	Oga M

411	PURPOSE T: 5/3/64 Ge #1	
ana dada	DATE 5/6/64 PAGE LOG BOOK 114 SPECTRUM # 3 6 May 3	
	SAMPLE: MATERIAL 5/3/646=#1 CODE	5
	ORIENTATION TEMP	
	THICKNESSPREPARATION	
	STRESS: TYPEMAGNITUDEDIRECTION	
	JURCE: TYPE W lamp STRENGTH Gr	
	MONOCHROMATON: GRATING 30000 RANGE 6000 -3500	13.
	SCAN RATE 125 SLIT WIDTH 100-3	
	DETECTOR: TYPE 62566 TEMP RT	
	SETTING 1200	
	POLARIZATIONFilfERFilfER	
	ELECTRONICS: PRE-AMP Reg	
	PSD	
	TIME CONSTANT_3	
	RECORDER: A B C	
	SETTINGS	•
	SPEED	8
	REMARKS ?, 4.00, 4.64	
	OPERATOR & W.G	
	PURPOSE T: 5/3/64 Ge 4 DATE 5/6/64 PAGE LOG BOOK 114 SPECTRUM # 4 6 May 4	
		1
	SAMPLE: MATERIAL 5/3/67 Ge#1 CODE	
	ORIENTATIONTEMP	
	THICKNESSPREPARATION	124
1	STRESS: TYPEMAGNITUDEDIRECTION	
	SOURCE: TYPE Dr lang STRENGTH 1	
	MONOCHROMATOR: GRATING 30000 RANGE 4000-2000	
	SCAN RATE 125 SLIT WIDTH 100-3	
	DETECTOR: TYPE 6256 TEMP RT SETTING 1830 V	
	POLARIZATIONFILTER	
	ELECTRONICS: PRE-AMP	
	PSD	
	TIME CONSTANT_2	
	RECORDER:ABC	
	SETTINGS	
	SPEED	
	REMARKS ?, 4.00, 4.64	
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	PURPOSE R: NOR Pbs Film	115
8 may 1	DATE 5/8/64 PAGE LOG BOOK 115 SPECTRUM # 1	a de se
	SAMPLE: MATERIAL NOR P& 3 Film CODE	
	ORIENTATIONTEMP	
	THICKNESSPREPARATION	
	STRESS: TYPEMAGNITUDEDIRECTION	
	SOURCE: TYPE w lamp STRENGTH & -	
	MONOCHROMATOR: GRATING 30000 RANGE 6000-3500	
	SCAN RATE 125 SLIT WIDTH 100 - 3	
4	JETECTOR: TYPE 62568 TEMP RT	1
	SETTING 12100	
	POLARIZATIONFILTER	
	PSD "	
	TIME CUNSTANT 3	
	RECORDER: A B C	
	SETTINGS	
5	SPEED	
	REMARKS 6.89, 4.44, 3.51	
	OPERATOR PMS	
	PURPOSE R: NOR PES Film	
8 May 2	DATE 5/8/64 PAGE LOG BOOK 115 SPECTRUM # Z	
	SAMPLE: MATERIAL NOR P65 Film CODE	
	ORIENTATIONTEMP	
	THICKNESSPREPARATION	
	STRESS: TYPEMAGNITUDEDIRECTION	
	SOURCE: TYPE Dr long, STRENGTH /	
	MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000	
	SCAN RATE 125 SLIT WIDTH 100-3	
	DETECTOR: TYPE 6256 S TEMP RT SETTING 1860 -	
	POLARIZATIONFILTER	
	ELECTRONICS: PRE-AMP	
5	PSD	
	TIME CONSTANT 3	
	SETTINGS	
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1 11 11 11 11 11 11 11 11 11 11 11 11 1	REMARKS 6.89, 4.44, 3.51	
	OPERATOR_PMS	

PURPOSE R: NOR PbS Criptal	a 2 1
-DATE 5/9/64 PAGE LOG BOOK 116 SPECTRUM #_1	9 may 1
-SAMPLE: MATERIAL NOR P65 Crystal ODE	
ORIENTATIONTEMP	
THICKNESSPREPARATION	
STRESS: TYPEMAGNITUDEDIRECTION	
JUURCE: TYPE W lame STRENGT 61	
MONOCHROMATON: GRATING 30000 RANGE 6000- 3500	
SUAN RATE 12.5	
JETECTOR: TYPE 62568 TEMP RT	
Sciims 12100	
POLARIZATIONFILTER	
CLECTRUNICS: PRE-AMP	
PSU	
TIME CONSTANT	
RECORDER:ABC	
SETTINGS	
SPEED.	
REMARKS 6.87, 3.95, 4.28	
OPERATOR PMS	
C	
PURPOSE R: NOR Pbs Cungtal	
PURPOSE R: NOR P65 Constant DATE 5/9/67 PAGE LOG BOOK 116 SPECTRUM # 2	9 May 2
PURPOSE R: NOR PES Congentral DATE 5/9/67 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIANOR PES Congette CODE	9 May 2
DATE 5/9/67 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIAL P65 Control	9 May 2
DATE 5/9/67 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOGE P65 Control ODE ORIENTATION TEMP	9 May 2
DATE 5/9/67 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIAL BOR Pb5 Contraction ORIENTATION TEMP THICKNESS P PREPARATION	9 May 2
DATE 5/9/6 7 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOGE Pb5 Contraction ORIENTATION TEMP THICKNESS P PREPARATION STRESS: TYPE MAGNITUDE DIRECTION	9 May 2
DATE 5/9/67 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIAL BOR Pb5 Contraction ORIENTATION TEMP THICKNESS P PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE P2 Lowe STRENGTH 1	9 May 2
DATE 5/9/6 7 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Contraction ORIENTATION TEMP THICKNESS P PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE P2 Source STRENGTH 1 MONOCHROMATOR: GRATING 30000, RANGE 4000-2000	9 May 2
DATE 5/9/6 7 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Control Code ORIENTATION TEMP THICKNESS D PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE D2 Long STRENGTH 1 MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000 SCAN RATE 125 SLIT WIDTH 100 - 3	9 May 2.
DATE 5/9/6 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOOR Pb5 Contractionde ORIENTATION TEMP THICKNESS D PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE D2 Longe STRENGTH 1 MONOCHROMATOR: GRATING 3000 RANGE 4000 - 2000 SCAN RATE 125 SLIT WIDTH 100 - 3 DETECTOR: TYPE 62568 TEMP RT	9 May 2
DATE 5/9/67 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Control Code ORIENTATION TEMP THICKNESS D PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE D2 Longe STRENGTH 1 MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000 SCAN RATE 125 SLIT WIDTH 100 - 3 DETECTOR: TYPE 62568 TEMP RT SETTING 18560	9 May 2
DATE 5/9/6 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Control Code ORIENTATION TEMP THICKNESS D PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE D2 Journe STRENGTH 1 MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000 SCAN RATE 125 SLIT WIDTH 100 - 3 DETECTOR: TYPE 6256 B TEMP RT SETTING 18500 POLARIZATION - FILTER -	9 May 2
DATE 5/9/6 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Control Code ORIENTATION TEMP THICKNESS P PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE D2 Longe STRENGTH 1 MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000 SCAN RATE 125 SLIT WIDTH 100 - 3 DETECTOR: TYPE 62568 TEMP RT SETTING 18560 POLARIZATION FILTER FILTER	9 May 2
DATE 5/9/6 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Contractionde ORIENTATION TEMP THICKNESS P PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE P2 for strength 1 MONOCHROMATOR: GRATING 30000, RANGE 4000 - 2000 SCAN RATE 125 SLIT WIDTH 100 - 3 DETECTOR: TYPE 6256 B TEMP RT SETTING 18500 POLARIZATION FILTER FILTER PSD "	9 May 2
DATE 5/9/6 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Control Code ORIENTATION TEMP THICKNESS D PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE D2 Journe STRENGTH 1 MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000 SCAN RATE 125 SLIT WIDTH 100 - 3 DETECTOR: TYPE 6256 B TEMP RT SETTING 1856 U POLARIZATION FILTER FILTER ELECTRONICS: PRE-AMP Can PSD " TIME CONSTANT 3	9 May 2
DATE 5/9/6 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Control Code ORIENTATION TEMP THICKNESS P PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE D2 Longe STRENGTH 1 MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000 SCAN RATE 125 SLIT WIDTH 100 - 3 DETECTOR: TYPE 62568 TEMP 27 SETTING 18560 POLARIZATION FILTER ELECTRONICS: PRE-AMP 200 PSD " TIME CONSTANT 3 RECORDER: A B C	9 May 2
DATE 5/9/6 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Control Code ORIENTATION TEMP THICKNESS D PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE D2 Journe STRENGTH 1 MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000 SCAN RATE 125 SLIT WIDTH 100 - 3 DETECTOR: TYPE 6256 B TEMP RT SETTING 1856 U POLARIZATION FILTER FILTER ELECTRONICS: PRE-AMP Can PSD " TIME CONSTANT 3	9 May 2
DATE 5/9/67 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Contraction ORIENTATION TEMP THICKNESS P PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE D2 forme STRENGTH 1 MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000 SCAN RATE 12.5 SLIT WIDTH 100 - 3 DETECTOR: TYPE 62.56 B TEMP 27 SETTING 18560 POLARIZATION - FILTER - ELECTRONICS: PRE-AMP 220 PSD " TIME CONSTANT 3 RECORDER: A B C SETTINGS	9 May 2
DATE 5/9/67 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Contraction ORIENTATION TEMP THICKNESS P PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE Dr Low STRENGTH 1 MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000 SCAN RATE 12.5 SLIT WIDTH 100 - 3 DETECTOR: TYPE 62.56 B TEMP RT SETTING 185.50 POLARIZATION FILTER FILTER ELECTRONICS: PRE-AMP Ray PSD " TIME CONSTANT 3 RECORDER: A B C SETTINGS	9 May 2
DATE 5/9/67 PAGE LOG BOOK 116 SPECTRUM # 2 SAMPLE: MATERIALOR Pb5 Contraction ORIENTATION TEMP THICKNESS P PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: TYPE D2 forme STRENGTH 1 MONOCHROMATOR: GRATING 30000 RANGE 4000 - 2000 SCAN RATE 12.5 SLIT WIDTH 100 - 3 DETECTOR: TYPE 62.56 B TEMP 27 SETTING 18560 POLARIZATION - FILTER - ELECTRONICS: PRE-AMP 220 PSD " TIME CONSTANT 3 RECORDER: A B C SETTINGS	9 May 2

12 may - 18 may 1964

During this period several experiments were performed with the object of finding the cause of the decline of the UV reflectivity of the Ge films. This entailed depositions on substrates of different materials, chemical examination of the films, and a determination of the conditions as studied by reflectivity methods. One of the films 5/3/64 Ge #1, was placed in an HF bath to see what would happen. The film immediately broke loose from the substrate and floated to the surface of the HF, but no further disolving took place and there were several large pieces floating around. Various attempts to pick these pieces up intact failed but if a well-studied attack were made, it could probably be done. Some of the film pieces were put ind CP-4 where they dissolved upon agitation of the etch (rather Strange, as one would expect them to be dissolved by themselves with no outside agitation). The object of this was to determine crudely the amount of GeO2 present. The result indicates that it cannot be present in extremely large quantities. An experiment was performed to find out if there is any oxidation of a germanium surface under high temperatures in a medium vocuum. The following are The results:

Surface Treatments	Reflection	ity
	Reflectii 5300 Å	2800Å
be polished by . 1 m sinde "B"	46.2 %	57.0 %
1 min. etch in fresh CP-4	48.3%	68.07
after heating to 600°C in 5.10° mm He vacuum for 1/2 hr., Then, cooling for 1/2 hr. helore	49.0 %	69.0 %

taking out. before

after HF rinse for 1 min. 49.4 % 69.0%

This material then became the substrate for 5/18/64 Ge #1.

					de la companya
Film	substrate Parametera	source Parameters	Run Time	Reflectivity 5300 A 280	°X
5/3/64 Ge #1	CaFe, 600°C, Cl.	IBM Be, 1300°C (54)	8 min.	42.5%	36.3%
5/2/64 Ge#1	Ca Fz, 600°C, cl.	IBM 66, 1300°C (54)	S wine.	33.6%	40.8%
5/15/64 66#1	Glass, 500°C	IBM Ge, ~ 1300°C (60)	5 min.	37.0% 33.1%R	47.5 % (glass opaque)
5/15/64 6e#2	Fuzed quety, 600°C (42)	IBM & e, ~1300°C (55)	5 min.	37.5 % 33.9 % R	47.5 % 51.5 % R
5/17/64 Ge#1	Polished MIT Ge dulate	tate		46.7 70	65.0 %
5/17/64 6e #1	Pol. 6e, 2600°C (42)	IBM 62, 2 1300°C (55)	10 min.	39.6 %	30.0 %
5/18/64 Ge#1	Etched Ge, ~ 600°C (42)	IBM Ge, ~ 1300 C (55)	10 min.	41.2 %	41.2 %
5/18/64 6#2	CaFe, ~ 600°C (42)	MIT 6e, ~ 1300 °C (55)	2 min.	46.0 70	61.7%
5/18/64 Ge#3	Substrate, etchech (PDE (62)) Ge	with	HF iwas	44.8 %	65.0 %
5/18/64 66#3	Etched Ge, 2 600°c (42)	MIT Ge, ~ 1300 °C (55)	3 min.	43.7%	57.0 %
				4	
		9	cru y al a go y a site r c a f	a b b	7 17

119 The conclusion to be drawn from the table on page 118 is that the situation improved markedly when we changed sources over to max Lead 2 type source material which we know to be intrinsic. The only thing constant between films made at IBM and here is the source material and it now appears that this is contaminated. The 2800 R reflectivity of film 5/18/64 #2 Ge is the best I have seen and it was the first try with the new material. The results of 5/18/64 Ge # 3 are a bit disappointing, but is much better than before. Certainly more work must be done. One could even see the difference in the monitor slides where the MIT material gave a "light" shade and the IBM a "dark" shade. One could actually see the film on 5/18/64 Ge#1 but not on 5/18/64 62 #3. The source of the contamination must be neutral in its action because none of the structure energies in the old films in changed at all This suggests either Ge Oz or dissolved carbon in the IBM germanium coming from the carbon crucibles. This week I wrote a letter to Donovan, et al., generally authining my results to date.

120 19 may - 23 June 1964

This period sow intensive activity in the production and measurement of Ge films on CaFe, fuzed 20 quarty, and Ge substrates under high and low deposition rates, and with different source holders. severally, a 2800 R reflectivity of about 58% was the best that we were able to obtain on bath fuzed quarty and germanium and CaFr substrates Donovan reports a value of about 65% for fuzed quarty substrates at temperatures below 625 °C. I believe that the primary cause of this decrease in reflectivity is surface roughness. Electron diffraction studies were made on the Hitachi electron microscope and the results were pretty much as expected, that is, the high substrate temperature films were epitapial with varying amounts of twinning while the low temperature. and the ones deposited on fured quarts were polycupstalline. The fuzed quarts samples showed especially broken Debye - Scherrer rings Photomicrographic studies of the film surfaces indicate various desues of roughness, the films on germanium substrates being especially susceptible to roughness. a much better idea has been obtained of the effect of strain on the reflectivity of the films by studying in detail film 5/18/64 Ge#2 (CaFz). It appears as though the strain in the films produce of stress of 8800 atm. as determined by the shift of the A seaks. However, the Z-X seak seems to be shifted anomalously too much but this may be due to the envelope of the roughness effect, or perbaps to some unknown effect because the plane of the film contains the crop direction. In relation to this effect, it is expected that there will be a shift to longer wavelengthe of the reflectivity peaks because of the differential thermal expansion in the case of when the substrate is fuged quarty (see page 42). In this case: XFE = .546.10-6/°C (0-800°C) dge = 5.75 10 6/°C

Differential stress = 2900 atm in uniaxial tension

SUMMARY	OF	FILM	RESULTS	FROM	5/15/	64	TO	6/11/64

	SUMMARY	OF FILM	1 RESULT	S FROM	5/15/64	TO 6/11,	164
PG.	FILM NUMBER				SOURCE POWER	SOURCE - SUBSTRATE DISTANCE	VACUUM SYSTEM - PRESSUR
	5/3/64 Ge*1 (Ca Fz)	600°C (38)	BN BOAT	IBM GE	1300°C (54-5)	5.3 "	NRC <1
a	5/2/646e#1(CaFz)	600°C (38)			1300°C (54-5)		
	5/15/64 Ge [#] 1 (Glass)	500°C			(60-5)		
	5/15/64 Ge#2 (FQ)	>600°C (42)			(55-5)		
	5/17/64 Ge#1(96e)	7600°C (42)			(55-5)		
_	5/18/64 Ge # 1 (EG)	>600°C (42)			(55-5)		
a	5/18/64 Ge#2 (CaFz)	> 600° (42)		OLD MIT GE	(55-5)		
	5/18/64 6e#3 (E6e)	>600°C (42)			(55-5)		
					(55-5)		
					(50-5)		
d	5/23/64 Ge#1 (CaFz)	> 600°C (42)			(45-5)		
					(45-5)		
					(50-5)		
				NEW LINCOLN Ge			
<i>a</i> .							
		N					
4							
	6/6/64 Ge#1 (EGe)	750°C (55)			(53-10)		
	6/8/6460#1(FQ)	750°C (55)			(50-10)		
	6/10/646e#1(FQ)	780°C (55)			(50-10)	11 "	
8	6111/64 Ge#1(FQ)	585°C (37)	II		(50-10)		
	ABBREVIATIONS	YO = RAN OUT	HAC SETTING	PU= PM UP	FS =	FOCUS ON SA	MPLE
		$= \frac{1}{5/3/64 6e^{*1} (CaF_2)}$ $= \frac{5/3/64 6e^{*1} (CaF_2)}{5/15/64 6e^{*1} (CaF_2)}$ $= \frac{5/15/64 6e^{*1} (CaF_2)}{5/15/64 6e^{*1} (CaF_2)}$ $= \frac{5/18/64 6e^{*1} (FG)}{5/18/64 6e^{*1} (FG)}$ $= \frac{5/18/64 6e^{*1} (FG)}{6}$ $= \frac{5/20/64 6e^{*1} (CaF_2)}{6}$ $= \frac{5/23/64 6e^{*1} (CaF_2)}{5/23/64 6e^{*1} (CaF_2)}$ $= \frac{5/23/64 6e^{*1} (CaF_2)}{5/23/64 6e^{*1} (CaF_2)}$ $= \frac{5/30/64 6e^{*1} (CaF_2)}{6/23/64 6e^{*1} (CaF_2)}$ $= \frac{6/1/64 6e^{*1} (CaF_2)}{6/3/64 6e^{*1} (CaF_2)}$ $= \frac{6/2/64 6e^{*1} (FG)}{6}$ $= \frac{6/2/64 6e^{*1} (CaF_2)}{6/3/64 6e^{*1} (CaF_2)}$ $= \frac{6/2/64 6e^{*1} (CaF_2)}{6/3/64 6e^{*1} (CaF_2)}$ $= \frac{6/2/64 6e^{*1} (FG)}{6/3/64 6e^{*1} (FG)}$ $= \frac{6/4/64 6e^{*1} (FG)}{6/3/64 6e^{*1} (FG)}$ $= \frac{6/8/64 6e^{*1} (FG)}{6/3/64 6e^{*1} (FG)}$	$\sum_{n=1}^{\infty} \sum_{n=1}^{\infty} ND MBEP. TEMPERATURE = 5/3/64 Ge#1 (CaFa) 600 °C (38) = 5/2/64 Ge#1 (CaFa) 600 °C (38) = 5/15/64 Ge#1 (CaFa) 500 °C (38) = 5/15/64 Ge#2 (FA) >600 °C (42) = 5/18/64 Ge#2 (FA) >600 °C (42) = 5/18/64 Ge#2 (CaFa) > 600 °C (42) = 5/18/64 Ge#2 (CaFa) > 600 °C (42) = 5/18/64 Ge#1 (CaFa) > 600 °C (42) = 5/28/64 Ge#1 (EGe) > 600 °C (42) = 5/28/64 Ge#1 (EGe) > 600 °C (42) = 5/31/64 Ge#1 (EGe) > 600 °C (42) = 6/3/64 Ge#1 (EGe) > 600 °C (42) = 6/2/64 Ge#1 (EGe) > 600 °C (40) = 6/2/64 Ge#1 (EGe) > 600 °C (40) = 6/5/64 Ge#1 (EGe) > 600 °C (40) = 6/5/64 Ge#1 (EGe) 700 °C (50) = 6/6/64 Ge#1 (EGe) 750 °C (55) = 6/8/64 Ge#1 (FA) 750 °C (55) = 6/8/64 Ge#1 (FA) 750 °C (55) = 6/10/64 Ge#1 (FA) 750 °C (55)$	$\frac{2}{2} \sum_{n=1}^{\infty} NDMBER TEAPERATURE CONFIGURATION = $13/646e^{n}1(CaFa) 600°C (38) BN BORT 0. $1/2/646e^{n}1(CaFa) 600°C (38) = $1/5/646e^{n}1(CaFa) 500°C (42) = $1/5/646e^{n}1(Re) > 600°C (42) = $1/16/646e^{n}1(Re) > 600°C (42) = $1/20/646e^{n}1(Re) > 600°C (55) = $1/20/646e^{n}1(Re) > 50°C (55) = $1/20/646e^{n}1($	$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \\ \end{array} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

-		00000000		P144.		PEOULCO		
	TIME OF RUN - THICKNESS	DEPOSITION RATE	CONFIGURATION	0	SECTIVITY 3500 Å	RESULTS 2800 Å	SURFACE TEXTURE	ELECTRON DIFFRACTION RESULTS
5			PU-FS	42.5%		36.3 %		HOVED BY HF)
	5 min		PU-FS	33.6%		40.8%	VR MR P	
_	5 min		PU-FS	37.0% 33.1%R		47.5%	VR	
	5 74172		pu-FS	37.5% 33.9%R		47.5% 51.5%8	VR	
_	10 min		PU-FS	39.6% 46.7%5		30.0% 65.0% 5	VR	
_	10 min		PU-FS	41.2 %		41.2.76	VR	
_	Emin		PU-FS	46.0%	41.6%	56.5%	VS MS P	LP
	3 min		PU-FS	43.7% 44.8%5		57.07 65.073	VR	
_	30 s		PU-FS	43.2%	39.2 %	52.0%	VS MS(?) P	LP:DS
-	205 (300 Å)	(15 R/s (900 R/m)	PU-FS	52.7%	41.6%	54.6%	VS MS P	LP
_	603		PU-FS	35.4%	37.4% W 38.6% D2	50.0%	V5	LP
	5 min		PU-FS	42.2% 47.0%5	35.7% 45.0%5	43.67 63.385	VR MR (Extremely)P	LP:KL
	603		PU-FS	42.67. 43.375	37.7% 41.2%5	48.5% 57.67.5	VR MR P	
	11.5 s		PB-FM	42.7 %	40.0 %	53.4%	VS	
	11.5s	*	PU-FM	40.8%	42.5 %	56.6%	VS MS P	LP: FAINT DS
	/3 s		PU-FM	37.3%	26.1%	23.4%	Very Rough P	LP
	305						Very Rough	
1	1min.						Very Rough	
Ī	47s		PU-FM	39.8%	40.6%	51.5%	VS	
	25s(ro) (10s)		PU-FM	34.9%	36.6%	47.5%	VS	
Ţ	25s(ro) (10s)	e	PU-FM	44.1%	44.8%	58.5%	VS (UR)	
J	145		PU-FM	44.5%	44.9%	56,8%	VS (SUB. (Dirty)	24
	20s(ro)		PU-FM	45.5 %	43.670	57.8%	VR (SUB. DIRTY)	
	155(?)		PU-FM	42.2%	38.4%	44.7%	VR (DIRTY)	
Ι	18s (?)				40.190 35.670 R	46.370 50872	VR	DS(T)
I	(?) 205				47.6% 35.8% 48.8%		VS.	DS(T)
1	= VISIBLY RODGH	MR	= MICROSCOPIC	ALLY ROUGH	P= PHOTOGRAPH			
S	= VISIBLY SMODT	TH MS =	e 11	SMOOTH				

- a. Very Hich b. Thickness = 5/21/64 Ge#1 (CaF2) c. Thickness > " d. Thickness < "

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	-				
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			minor	= Forus on	
			sample	20	
			Back	= 13 20	
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		The Reflectivity	20	of Oplical Unangement	Cheer
	(69.5)	51.0 P2		(after HF)	
	72.6		51.4	mac tead 2	PB-FM ; 100-5
		47.2 Dz			
	64.5	M 5.2 M	47.0	mac Lead 2	PU-FM ; 100-5
	(65.0)	49.0 Dz			
	67.7	47.0 W	51.2	mac Jead 2	PB-FM : 100-5
	(1.19)	47.0 Dz			
	64.5	M S:HH	49.2	mac deod 2	PB-FS ; 100-5
	(11)	53.4 Pr			
	72.4	45.0 W	49.9	mac deud 2	PB-FS : 100-3
	(64:8)	46.5 Dz			
	65.7	45.8 W	47.0	macted 2	PU-FS : 100-3
	2800 Å	3500 Å	5300 %		
2		Kellbelinity		Aample	Optical arangoned
12					

123 measurements were made using mac Leod 2 as a standard under different optical configurations. The results are on page 122. It is seen that generally the reflectivity is better when the light is focused on the mirrow rather than on the sample. This is very likely because of the spherical abberation of the mirrors which, when is FS position, caused some light to miss the diagonal mirrors. However, a considerable difference in reflectivity is noted between the PU and PB positions at 5300 R. The reason for this is at present unexplained but it may be tied into the fact that in the PU position, the large angle of incidence of the light causes a peculiar response in the photomultiplier. The PB position not only gives the right answer but is also athetically more pleasing because the light covere the Juhole PM cathode thus assuring a more uniform response to both IR and Io. In order to investigate the effect of the surface roughness a little more thoroughly I computed what the theoretical reverse reflectivity should be based on the following model. SUBSTRATE FILM RT = R + (I-R)R'(I-R)+ (1-R)R'RR'(1-E) + (1-R) R'RR'RR' (1-R) + · · . RT = R+ T2 R' 1 - RR' R R' Take for Ge: n = 2.50; k = 4.25; R(air) = 67.0% Take for FQ: n = 1.50 R = .040; $T^2 = .92$ R' = .559RT = 56.4 % Let us consider two films on FQ; and Reflectivity at 2800 A: Front Reflectivity 70 Difference Film Back Reflectivity 70 Difference 50.8 (M) 56.4(c) 9.9 % 6/10/64 Ge#1(FQ) 30.9% 46.3 (M) 67.0(C) 49.0(M) 56.4(c) 13.1 0% G[11/64 Ge#1(FA) 58.6 (M) 67.0(c) 12.5%

D	a. 072 						
125	6000-5000	PU-FM:100-5	00//	m	R	Mackeod 2	6 JUNE 1
	4000- 5000		1720				5 JUNE 2
125	6000 - 3500	PU-FM: 100-5	00//	ę	R	6/5/64 Gc#1 (FQ)	S JUNE 1
	400-2000		1850				28 MAY 2
125	6000 - 3500	PU-FS: 100-3	1230	۴ŋ	R	5/23/64 6e#2 (EGe)	28 MAY 1
	0002 - 000/1		1850				ET MAY 2
125	6000 - 3500	PU-FS: 100-3	1230	η	8	5/18/64 (Se#2 (CaF2)	27 MAY 1
	4000-2000		1850				26 MAY 4
	6000 - 3500		1230			S/25/64 (Substrate)	26 MAY3
	4000- 5000		1850				26 MAY 2
125	6000-3500	PU-FS= 100-3	1230	3	8	5/25/64 6e#1 (E6e)	26 11941
	4000-5000		1850				23 MAY2
125	6000-3500	PU-FS: 100-3	1230	η	Q	5/23/64 (EGe)	23 MAYI
-	4000 - 2000		1850		-		21 MAY2
125	6000-3500	PU-FS: 100-3	1230	ŝŋ	RAT	5/21/64 60#1 (CaF2)	21 MAY 1
	6000 - 3500		1240	2	٢		20 MAY 3
	1000 - 2 000		1850	69	R		20 MAY 2
125	6000 - 3500	PU-FS: 100-3	1240	m	R	5/20/64 Ge #1 (CaFz)	20 MAY 1
Kan	Range	Optica	PM Voltage	Time Const.	Measurament	sample No mea	Run No
1.24	23	: 5/19 - 61	Measurementes	of Oplical M	annum .	3	

a letter was recieved during This time from T.M. Donovan of the NOL group at China Lake. There is a program in this semiconductor films in this group. He has gotten 65 70 reflectivity at the 2800 A group, but not for a film in which both I glake appear. I still feel that the reduction in amplitude of this reak is due to a texture effect such as roughness, but I plan a program on FR substrates anyway. Also, during this time I made a trip to IBM and spoke with many people at Yorktown. I have communicated with Nowich of Yorktown concerning the possibility of attaining epitatial films of silicon or silicon substrates and possibly substrates of sther materials. other malerials.

126 24 June - 22 July 1964

During this period a study was made of germanium filmes deposited on FQ substrates at various deposition rates and substrate temperatures in that their optical reflectivity in the region 6000 Å to 2000 Å as a function of these parameters was measured with particular attention being paid to the amplitude of the Z,X peak. The following is the experimental procedure used to fabricate the films: In r u Experimental Procedure for 6e Films on F& substrates 2 al (1) Do two sets of experiments: (a) 4 films - same degosition rate, different substrate t n de temperature. (b) 4 films - same ST, different DR all FQ slides to be cut from the same big slide. -4 f (2) Substrate Cleaning: (a) Wash in detergent (b) Wash in HNO3 (c) Wash in two batter of fresh acetone (d) Dry in N2 stream Wipe with Ross Optical Lens Tissue (e) (3) Source Preparation and Procedure: (a) Use W (.005) boats. Weigh before use. N (b) use Etched Ge (CP-4) from Rediker. Weigh before use. n (c) Hopefully evaporation rates will not be such as a to require the changing of source usaterial from run to run during the different substrate temperature experiment. DI gi (4) Evaporation Procedure : l (a) Rough out slowly. th (b) keep LNZ in cold trap at all Times. w (c) Put DP on at 25 microns and let pump u (d) Bake out substrate at about 750 °C for 20 min. R and then reduce to operating temperature and record. m (e) Bring up source heater to prescribed level and The record Variac setting and meters. h (8) Open shutter for prescribed time and read.
(9) Seare substrate at Temp for 5 min., Then reduce slowly.
(h) Open bell jor when ST is about 50°C an P

127 (5) fig Parameters: (a) source - substrate distance = 10 5/8." (b) jig cleaned of PbS by HNO3 bath. (c) substrate TC spot welded to Ta substrate holder nium vilion plate. (d) Use Rossi'a original jeg in NRC system. as In the carrying out of the above procedure, it was not immediately known what the deposition rates were as sit turned out, one of the runs had l to such a low rate that a film was hardly formed at 2 all. also, the run at high substrate temperature turned out to be almost useless for optical neasurementer as it was very rough and th discontinuous. Therefore, two previous FQ runs were used to "fill in" the data. The final film disposition turned out to be: slide Variable ST, Constant DR Variable DR. Constant ST 7/2/64 Ge # 1 (FQ) ··· 450C 7/2/64 Ge #3 (FQ) 7/2/64 Ge# 2 (FQ) 7/3/64 Ge#/ (FQ) ··· 300 °C 7/1/64 Ge#3 (FQ.) ··· 600 °C 7/3/64 Ge#2 (FQ) 6/10/64 Ge#1 (FQ) ··· 780°C 6/11/64 6e#1 (FQ) ··· 25°C 10 JULY 1 \$2 The film listed as 10 JULY 1 # 2 is a measurement made on an opaque amorphous film obtained from a monitor slide used during one of the runs. The DR was probably quite high. 0 trate a chart has been made which gives the gain for various gain switch ration over the linear range of the amplifiers in order to expedite the reduction of data. also a new grogram witten by myself and B. Koaichi has been used to calculate I/To but I think it will prove seldom efficient for me to use it. The gain chart is on page 128. As regards the results: There is apparently no in. meaningful dependence of the Z, X peak on DR. However, nd There is the expected dependence on ST, with a really high ST giving good structure but goor Z, X amplitude due to roughness. note that several Z, X lowly. peaks are of the order 63-6472 in amplitude.

35 ms	GAIN CHART 13 DECEMBER 1963
585112	5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
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¥	
00	
t0	155 2.48 3.92 6.23 9.97 15.15 24.9 3.98 63.3 101.3 161.1
11	160 2.53 4.02 6.43 10.16 16:05 25.7 40.8 65:3 103.9
2	1 1.58 2.51 4.62 6.35 10.03 16.05 25.5 40.8 64.9
<u>S</u>	1.59 2.54 4.02 6.35 10.16 16.16 25.9 41.1
14	1.60 2.53 3.99 6.39 10.16 16.26 25.9
15	1 1.58 2.50 3.99 6.35 10.16 16.16
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	SUMMARY			13/64		
	ALSO OTHE	R MISC		ESULTS		
50	FILM NUMBER	SUBSTR		1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	SURFACE TEXTURE	ELECTRON DIFFRACTION
2.0		1 1	3500 A	2800 Å		RESULTS
	7/1/64 Ge#2 (FQ)	72000			VR (BROKEN)	DS: FINE LINES
	1/1/04 00 6 (14)	80:730°C 751				10.11000 STREED
	7/1/64 (1070) (771)	00-7500,00				
	7/1/64 Ge#3 (FQ)	600°C	48.8%	63.770	VS	S: BROKEN
		80:780°C35	w			
	7/2/64 Ge#1(FQ)			59.6%	VS	DS: BROAD
		BO: 780°C, 22m		1		
	7/2/64 Ge#2 (FQ)	300°C	62.370	57.8%	vs	DS: BROAD
	1-1-100 (-0)	80: 780°C, 30m	ĸ			
				-		
	7/2/64 Ge#3 (FQ)		(47.8%)	60.0%	VS	DS: BROKEN
		80: 90°C, 20m	l			
	7/2/64 Ge#4(FQ)	600°C	17.0%	26.5%	TOO THIN TO BE VISIBLE	DS: (BROAD LINES)
	1 - 10. UC TIPE	80:780°C, 20m				
						VEAU
	7/3/64 Ge#1 (FQ)		48.5%	63.8%	VS	D3 . BROKEN
-		BO: 780°C, 23 w	<u> </u>			
	7/3/64 Ge#2 (FQ	1000	45.3%	56.3%	VS	DS: VERY BROKEN
	11 stor Ge 2 [FOR	BO:780°C, 201		50.510		DOTTINT DROKETO
		60.1000,000	n			
	7/1/64 Ge#1/CaFz	600°C	43.7%	53.2%	VS	DS: FINE LINES
		BO: 720°C, 30	2			
		0.544	47.3 %	46.7%	VS	DS: VERY BROAD
	10 JULY 142	25°C	71.3 10	-70.7 10	43	US: FERT BROAD
	*					
. 0	4/18/64 6e#1 (CaF2	596°C				
	ul ale esta la s	1 6 4 . 80				
a	4/23/64 Ge#3 (Cat	600 %				
d	4/24/64 Ge#1 (Cat	600°C	FD TO STUD	Y ITS ROUGI	INESS	
k	5/1/646e#1 (CuFe	1550°C				
	1 1/1 / 4- 10 5			54		-
0	5/2/646e#2 (CaF2	500°C				
	1 5/11/646e# 1 (CaFe	510°C				
				-		
6	10/13/64 Ge#1 (CaFe) 600°C (PI	9			
	1 1 1 1 1 1 1 1					
a	L 10/15/64 Ge#2/lat	2 580°C (PI	9			
-	12/8/64 Ge#1 (CaF	:				
	rejejer de Mary	-1				
	12/4/64 Ge#1 (Cat	z)				
			1 l	1	I	I
		1. 5.0.5				

							100		1
		OF RESUL R MISCEL		GE FILMS DE POSITIONS			ZED QUAN	ETZ AND	C
	FILM	SUBSTRATE		SOURCE	SOURCE POWER	SOURCE - SUBSTRATE DISTANCE	VACUUM SYSTEM - PRESSURE	TIME OF RUN - THICKNESS	D
			3.5458 W(.005)	New Lincoln Ge . 32043	(25-5)	10 5/8 "	NRC 1.10-6	1213	
	They at it.	BO: 730°C 75 m (55)							-
	<i>▼/1/64 Ge[#]3 (FQ)</i>	600°C (38) BO:780°C35m (55)			(25-5,6)		< 1.10	12/5	
	7/2/646e#1(F&)	450°C (22.5) Bo: 78°C, 22m (55)	-	.3242 g added	(25-5,6.2)		5.10-7	121.5	
	7/2/646e [#] 2(F&)	300°С (12) 80: 780°С, 30т (55)	-		(25-5,6.3)		8.15-7	1215	
	7/2/64Ge#3(FQ)				(25-5,6)		8-10-7	1215	
	7/2/64 Ge#4(FQ)		4.4439 g W (.005)	New Lincoln Ge . 3/60 5	(18.5-5,52)		8.107	3605	
	7/3/64 Ge [#] 1 (FQ)				(30-5,6.6)		8.107	903	
	7/3/64 Ge#2 (FQ)			.3243g added.	(35-5)		5.107	145	
	7/1/64 Ge#1/CaFz)		3.545 g W(.005)	Now Loncoln Ge. . 32045	(25-5,6.1)		2.10-6	92s	
		25°C	?	?	Ş		?	5	
	ulalu (#1(c. 5)	501%	- ent		1525°C	15 cm	VEECG <1.105	10 min	
	4/18/64 6e#1 (Ca.Fz) 4/23/64 6e#3 (Ca.Fz)		Ta Boat	IBM Ge	1050-1110 °C		VEECG 10</td <td>10 mm</td> <td></td>	10 mm	
d	4/24/64 Ge#1 (Ca5)	600°C	8N BOAT		?			4 min	
b	5/1/646e#1 (CuFz)	550°C	W Boat		1300°C		NRC < 1.105	5 min	
d	5/2/646e#2 (CaFz)	500 °C	BN Boat		1315°C	13-5 cm		5 mm	
d	5/11/646e# 1 (CaFz)	510°C	BN Boat		1040°C			5 min	
		600°C (PA7m)			VAR45, 138, VI.7		Little NRC C/10		
		580°C (PA5m)	W Boat	Rediker Ge	VAR 50, 2136, VI.85	23/4 "	Little NRC 21.105	62 500	
	12/2/64 Ge#1 (CaFz								-
	12/4/64 Ge#1 (CaFz	· · · · · · · · · · · · · · · · · · ·					II		
									_



VARTZ AND CAFE SUBSTRATES FROM 7/1/64 TO 7/3/64

	TIME OF RUN - THICKNESS	PEPOSITION	OPT CONFIGURATION		FLECTIVITY 3500 Å	2800 Å	SURFACE TEXTURE	ELECTRON DIFFRACTION RESULTS	
56	1215	1 1	NO MEASUREMENT	L 1			VR (BROKEN)	DS: FINE LINES	
-6						10 - 1 - 1		PRAKEA	F
2	12/5		PB-FM	50.2%	46.8%	63.7 %	VS	DS: BROKEN	F
7	11.1.5		PB-FM	62.170	55.6%	59.8%	VS	DS: BROAD	E
-7	1215		PB-FM	60.5%	62.376	57.8 %	VS	DS: BROAD	
5-7	1215		PB-FM	57.0%	47.8%	60.0%	VS	DS: BROKEN	
57	3605		PU-FM	12.1%	17.0%	26.5%	TOO THIN TO BE VISIBLE	DS: (BROAD LINES)	
107	90s		98-FM	50.0%	48.5%	63.B %	νs	DJ: BROKEN	
-7	145		PB-FM	48.1%	45.3%	56.3%	VS	DS: VERY BROKEN	
0-6	92s		PU-FM	45.4%	43.7%	53.2%	VS	DS: FINE LINES	
?	5		PB-FM	45.6%	47.3 %	46.7%	VS	DS: VERY BROAD	
105	10 min								
	10 mm								F
	4 min		THIS FILM W	AS ALVMINI	RED TO STU	UDY ITS ROU	BHNESS		F
105	5 min								P
	5 mm								F
	5 min								E
	2 min								E
1.105	62 sec								E
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STATUS EN LIGHT

	P	dummary of	Optical mea	Measuramentes:	7/6 -	+1/2	30
Run no.	Sample No	measurement	Time Const	pri voltage	Optier	Range	Acan
6 3027 1	7/3/64 Ge#2(FQ)	2	M	1230 V	PB-FS:100-5	6000-3500	125
6 JULY 2				1930 V		1000 - 2000	
JULY	7/3/64 6e#1 (FB)			1240 V		6000 -3540	1
プリムソ				1940 V		4000 - 2000	
2027	7/2/64 6e#3 (FQ)			1240 V		6000-3500	
JULY				1940 V		400-5000	
	7/1/64 6e#3 (FQ)			1240 V		6000-3500	
2067				1940 V		10002-000A	
7 3424 1	7/2/64 Ge#1 (FQ)			1240 V	~	6000-3500	
すって				1940 V		400-2000	
	7/2/64 Ge#2 (FQ)			1240 V		6000-3500	
7 3044 4			*	1930 V		14000 - 2000	
9 37447 1	6/11/64 6e#1 (FQ)			1230 V		6000 - 3500	
TULY				1950 V		4000-5000	
702	6/10/64 Ge#1 (FQ)			1240 V		6000-3500	
9 5024 4				1970 V		4000-5000	
10 3444 1	Amorphous Ge			1230 V		6000-3500	
10 JULY 2				1950 V		4000-2000	
14 2027 1	RT: Bulk be: RY(EX)	() R4		1820 V		3000 - 2000	0
14 30242	LHE: BSIK GE: R"(Z,X)	2					
CARPECTINAS	NO. 3					NT T. Ar	¥ .: u 7

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vovelen	sthe	of the Hg	the article 1 the article 1 a Acta, Val 17 factor to e	emission	line
spectru	m, t	-aken from	The article I	y twenden	g and
Thereau	le, y	pechochimic	a alca, Val !!	, NO.O, PP	819-856.
the app	ropria	e conversion	a factor to e	bectron voll	e is:
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d (vac)	<u>(Å)</u>	bource	2 (JACO) (Å)	Deviatio	n (Å)
2289		Cd	2281	- 8	
2145		Cd	2137	- 8	- Sea
2139		Zn	2/30	- 9	a No contra
2063		Zn	2054	- 9	- Annalas
2241		ed	2232	- 9	44 0
2330		Cd	2321	- 9	and the second
2484		49	2475	- 9	1 1 1 1 1 1 1
2537	-	Hg	2528	- 9	A Carlos and
2653		HS	2647	- 6	- Cabrie
2700		Hg	2694	- 6	1 22 3 2
2754	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	HS	2748	- 6	- Andrew
2805	A Section States	HS	2799	- 6	
2882	<u>.</u>	Cd	2875	- 7	and the second
2894		Hs .	2888	- 6	get and
2968	the second	Hg	2962	- 6	
3022		Hg	3016	- 6	1 Name and Sal
3127		Hg	3120	- 7	The same s
3342		Hg	3338	- 6	
3468		Cd	3462	- 6	1000 - 200
3612		Cd	3607	- 5	
3651	100	Hs	3647	- 4	
4048	200	Hs	4045	- 3	and the second
4360		Hg	4356	- 4	
5462		Hg	5460	- 2	dont 1
5792		Hg	5791	- 1	
"					
ġ	22	JULY 1964 -	쇏渡祸밥돜훣븮휮탒뼒붭긿э 昭 븮 브란케티란 탁백해먹됟 놀 만테트 곧 무다!	非常无限的 化盐 化化化合物 化合物 化合物 化合金 化合金	ROM JACO
+10-	7 4	EADING FOR	5000 Å BLAZED	GRATING	
CORRECTION TO OBTAIN L (UN (A)					
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	.10	.15 .20 .2		.45 .50 SACO) (M)	.55 .60

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132 In order to further investigate a shoulder found near the 5, X peak when examining the reflectivity of bulk germanium (see macded 2 and log page 96), I measured carefully the reflectivity of the bulk Ge in the region 3000 & 2000 & with a TIO & resolution using Zallen's R" reflectivity capsule and performing the experiment at room and liquid belium temperatures. -0 Four pieces of germanium were steled and mounted in the sample holder (etchant = CP.4). The etched surfaces were rather rough and due to this and other probable optical inefficiencies (windows, etc.) the actually reflectivity at 2800 A Th was about 54 % instead of the expected 72% however, The This was sufficient to do the experiment. 2 - (a nominal 47 2, 110 watt carbon resistor was mounded I fee on the cold finger near the sample. Earlier measurements showed that the actual room temperature resistance was 44-R while that at 4.2 °K was 525 R. The calibration becau reso curve used was that of Groves - Holland for Grove's Carbon "D" resistor thermometer. The Life resistance of this shou disc resistor was 568 at 4.2°K. However, the approximate stat inverse slope in the region 4-6 °K is: dT/dR = -6.56.103 in "K/-R. assuming that this inverse slope does not change in much from resistor to resistor, the temperature error two at about LHe due to the difference in temperature. resistors at LHE is only about . 3 °K. Hence we should Two get accuracy to well within a degree without having to calibrate each resistor separately. Our resistor was cemented to the cold finger wett GE low temperature cement and, using the circuit shown on page 101, the equilibrium resistance with 1.2 liters of He in the dewar was 437 r or a temperature very a. close to 5°K. Con The resultant curves were plotted up and the data analyzed in the following way: The Z, X peaks were so sharp that they could be located t 5 Å. This was done (the peaks were also quite symmetrical for a considerable potation of their height), the result corrected according to page 131 and converted to electron-volto. For be the shoulders, an asymptotic continuation of the E, X peak was made, at each temperature, under the shoulder and then subtracted out. The resulting geaks were quite asymmetric so that the position of the "half gower" point was arbitrarily chosen to be measured. It was guessed that the position could be determined exact to within ± 10 Å. The results. Ho w th were as follows:

133 nd Z, X Peak Positions: 293 °K : 4.452 ± .008 ev 5°K : 4.517 ± .008 ev Fe $dE/dT = -(2.26 \pm .56) \cdot 10^{-4} ev/ek$ in 1 the Shoulder "Half Reak Power" Positions: 293 °K: 4.893 ± .020 ev . the 4.963 ± .020 eV 5°K : dE/dT = - (2.43 ± 1.39) · 10 4 ev/K° ical The two previously reported temperature coefficients for le Z, X peak are those of Cardona and Somers 2800A ever, The § - (1.8±.5).10-43 and Jules and Schmidt §- (2.5±.5).10-43. I feel that mine is more accurate than either of these because of the R4 sharpening and the much greater energy ted ente resolution. vas With regard to an explanation of the origin of the shoulder, the picture is still unclear. A theoretical discussion of the structure in the joint densit of states for bands 4-5 and bands 4-6 is contained in Benst's paper on band structure of Ge and Se tion this te 6.56.103 in PR 134, A1337, & B (64) 3. It seems to me that there are re two possible explanations of this shoulder: (1) The finite energy difference between the following two 4-5 transitions: now Two 4-5 transitions: auld to Singularity Type Transition Theoretical Energy as M1 (100) - $\chi_4 - \chi_1$ 3.6 ev ce. 12 M2 (330) 24-21 3.8 ev le a possible way in which these two singularities could combine to give the observed structure is sketched ery below : 20 iderable ling JX ce_ 12 11 2 1 ÷ However, the theoretical separation for Ge is about . 2 ev while the observed difference between the geat and the shoulder is: - be uld to. 293°K : .441 ± .028 er 5°K : .446 ± .028 ev

134 This is more than twice the theoretical prediction, although it is unknown at this time whether on pres not the resolution (not absolute values) of the. Pro theoretical calculation is sufficient to decide this whi assignment negativel. also, if a transition occurs at a different symmetry point than another transition, one might expect, although not necessarily so that the temperature coefficients am 100 10-3 su might be different. Here we see that this is app probably not the case. (2) In The III-I compounds the conduction band of degeneracy at X is removed and one abserves a The secondary seak nead the 3,× peak. Although in germanium (The above splitting is observed by to law esreenaway, PRL 9, 97) there is no solitting, there could possibly be a 4-6 transition from A5 - D2' 1 am a short distance away from X: which would be analogous to the TIT-I's. On the III-I's the wh an every separation between X5-X, and X5-X3 is about . 4 ev, the amount observed here. The na ba principle difficulty with this interpretation is tr that Brust gives no exidence of a critical point in The 4-6 transitions that could be assigned to an 05 - D' . However, the closeness of the two temperature it fi coefficients would bend to substantiate this interpretation It would be interesting to follow this work up with a similar measurement on Gasto or n 07 In As to see if this shoulder exists independently of X5-X3. If so, this may favor interpretation (1) to above, and, if not, forour interpretation (2). dis Por There may be a reason for the frequency-dependent (nature of the PU and PB positions as noted on log page 122 which is based on the refractive effect of su ver the PM window. From Inell's low: Sun On = no smor where $\Theta_{R} = angle of refraction, <math>\Theta_{L}$ for incidence and \mathcal{N}_{R} ghe refractive index of the PM quarty window. Consider: Θ_{L} \mathcal{N}_{R} \mathcal{A} \mathcal{O}_{L} 45° 1.461 5300Å 28.9° 45° 1.477 2500Å 28.6° 45° 1.495 2800Å 28.2° \mathcal{N}_{R} see that as $\mathcal{A} = \mathcal{A}$ \mathcal{O}_{L} \mathcal{O}_{L} \mathcal{O}_{L} To and IR become more nearly overlaped as I decreases, while in PB position or is so small that the effect of quarty dispersion does not effect the degree of Is and the overlap. This could be why PU and PB give different results at 5300 Å but the same at 3500 Å and 2800Å. still, the variation in Br in PV above may still be too small to explain the whole effect.

Auring this time we also recieved a file preprint of a paper by Jon Towe on the aptical Properties of non-Constalline Semiconductors in which he studies the optical properties of amprophous Ge deposited on fused quarts at room tamperature and at vacuums of around 10-5 for also he deposited a film with the substrate heated to around 450°C which was apparently polycrystalline. Several results are of importance to me: (1) Tanc interprets the reduction in reflectivit in 135 tis una (1) Tanc interprete the reduction in reflectivity in the UV region of the polycupatalline film as due to scattering from a rough surface obeying a d" law. (2) In the far - UV region, the reflectivity of the amonghous be and crystalline be is nearly identical which indicates that the amonghour be has a 21 smooth surface as in this region the reflectivity is governed by plasma effects in the valence of band which is not changed very much on the transition from the criptalline to amonghous states. (3) as I have alsocied faint DS rings in out amorphous 60 reflection electron diffraction patterns, amorphous Ge reflection election diffraction patterns, it may be interesting in the future to make be films on cold substrates in order to further reduce long-range order and then study the optical effects. (4) In Tavic's polycrystalline film, it is very hard to tell whether on not there is abserved the distortion of the A fine structure observed by Porroran and now by me. (5) It is intended to send Tane a ature lation. 172 very near future. film work in the ider: rition reises, the legree 8 and 2800 Å.

136 23 JULY - 27 September 1964 The activity during this period centered around refacting and understanding measurement techniques for reflectivity experiments using the present design of ufflectometer. One of the first investigations made involved the lay por obl eul ha one reflectivity discrepancy for certain films when the source lamps were changed at 3500 Å. This ac investigation was made using X-Ray film at to the proper size and placed near the sample position and also in front of the PM evo on as T(W) Dz wi the to approximately at Bothe W and Dr sur sample position, superposed str 1 = 3500 R each taken separately pas PM lot ver by lug ele mi by refl to PM window position, two both Wand De superposed d = 3500 k, W lamp, Fo and IR ongerposed reau at PM window. tobelo This study indicated that the Dr lump provides a point, not line, source and that there was a small vertical affect in its image with respect to the line image of the W source. This was also shown by the fact that the reflectivity discrepancy was adversely affected by closing down the slitt height and favorably affected by increasing the slit height. no effect was noted by changing the slit width. All to

when the Dr lamp elevation was situated properly 136 by closing down the slit height to a minimum and positioning the lamp until maximum output was obtained, the reflectivity discrepancy disappeared almost entirely. In general, the results of this study have shown that this descrepancy was a geometrical one all along and not something else, like e - the en This allignment Procedure cut During this period, an allignment procedure was evolved which gives reasonable reproducible results on our standard moc 200d 2. The steps involved are PM as follows: (a) Center the sample between the two diagonal mirrors with the use of a scale. The mean distance between the two mirrors is 3/4" so that the sample surface to reflectivity diagonal mirror is 3/8" (b) Pick out the most likely spot on the sample surface and position the sample so that the beam strikes it there. (c) The PM face is covered with a piece of white pasteboard with a round hale cut in it for the PM window. Position the diagonal nurrois so that both the to and the beams are superposed. adjust vertical alignment so that superposition takes place by turing the "flat" leg on the kinematical mount. (d) If desired, make final adjustment by using high light intensity and low PM voltage to electronically aid in the allignment of the dissonal mirrors. Allign for maximum output for both to and IR. (e) sean the sample surface over a small area by using the X-y nucrometer screws until optimum reflectivity at a particular wavelength is obtained. sometimes, for rough samples, this should be done twice once in the visible and once in the UV. This method appears to give reasonable reproducible to with macteod & as long as one in careful -0 e resulta to HF etch, wash, and position carefully, as can be seen below : Date Preparation R: 5300 Å 3500A 2800 R a to to 8/31 none 47.1 64.6 51.8 8/31 HF & Wash 50.8 49.9 70.9 on 9/2 none ity . 68.0 52.0 50.5 9/17 none 50.3 47.5 65.6 HF & Wash 9/18 49.9 70.4 the 52.5 e See also 17AV6 1 \$ 2 for scan reproducibility; They are nearly equal To 12 FEB 142.

	demmany of O	Ogtical measurements	. 7/23-	3/27	138
Run No.	Sample No measurament I	Time coust PM Voltage	Optics	Rauge	Sean
17 AUG 1	macted 2 R	3 1260 1	100-5 PB-FM	6000-3500	125
17 406 2		2000 V		4000 - 200 D	
18 AUE 1	CH - 274	1340 V		600-3500	
18 AUG 2		2170 V		4000 - 2000	
1 SEPT 1	CH-26/	1260 1		6000 - 3500	
ISEPT 2		2000 V		4000 - 2000	
25EPT 1	cH-261	1240 V		6000 - 330 0	
2SEPT 2		1980 1		4000 - 5000	
3 SEPT 1	CH-274	1250 1		6000-3500	
35EPT2		2040 V		4000 - 2000	
15 SEPT 1	cH-272	1250 V		(000 - 3500	
155EPT 2		2000 /		0002-000h	
16 5E PT 1	5/21/64 Ge#1 (Cafe)	1250 V		6000-3500	
16 SEPT 2		1990 V		4000 - 2000	
17 SEPT 1		1250 V		6000-3500	
17 5EPT 2		2 1990 V		4000-5000	
185EPT 1	5/18/64 Ge#2 (lake) R	3 1250 V		6000-3500	
185EPT 2		2000 V		4000-5000	
		• •			
		also noi		n (n Il io sc	in PM

PM Trouble 139 some trouble has developed with the 62568 PM in that at high light levels and low voltages, the PM gives a strongly non-linear reaponse. This is probably due to a gasay situation resulting from (maybe) excessive anode current. However, it appears that at normal operating conditions the non-linearity screens: measured (3500n) Slits = 100 c 5 mm nominal Valtage = 1850V W Dz 33.1 33.4 33.7 47.9 48.0 48.5 also, the tube non appears to be about twice as noisy as mac Elrange. Roughness of 6/10/64 Ge#1 (FQ) (RB-RF)/RB $\lambda(u)$ RE RB RB-RF .60 .064 . 522 .458 .123 .55 .053 .525 .101 .472 .445 .057 .50 .502 .114 .412 .45 .056 . 468 .120 .154 .395 .40 .072 .467 .500 .406 .094 .188 ,35 .434 .152 586 .30 .259 .672 .411 .261 .25 . 388 356 .611 20 .255 .417

140

To Drift Correction Let (Io)i be measured at to and (Io); at t;, all at the same wavelength. with drift, we have: Hu D leing the drift fraction. assuming the drift to be linear with time, the drift rate is: (Io)g = (1-D) (Io), S Su $D_{L} = D$ Fr ts - tr De We assume that Dr is the same for all wavelen, the Se of Io. The question is, then, if we know Dr A and have measured to and I, how do we apply a correction to the quotient I/Io in order to accomadate the drift rate? zu de sl Each point in the "true" Io, that is, the To that is actually accuring while I is being measured, will be different from the "measured" Io th to by the relation: Totre = (1-DrT) To measured where T is the time interval between equal ep wavelengths in I and Ismeaned and is constant eve and very nearly equal to the time of one scan when To and I are run consecutively. Hence the true ratio is given by: m pr R = re (I-DAT) Io X 17 where to is understood to be the "measured" quantity. If we define the correction factor, Cg, to be: el 52 re Cg = 1- DrT $\sigma_{L} \quad C_{f} = 1 - D \frac{T}{t_{f} - t_{L}}$ For a sean rate of 125 Å/min, T= 20 minutes for a 6000 Å-3500Å sean and T= 16 minutes for 4000 Å-2000Å. For the visible scan range, the Is drift is checked at 5300A. This means that: ty-t_ = 34.4 min For The UV region: ty - tr = 28.95 min $C_f = 1 - .581 D$ Hence: Cg" = 1 - .553 D

Films from Catlin

On July 31st, I recieved 3 Ge films on CaFe from Humphries of the University of Virginia Materialos Acience Sroup. These films have the following parameters: <u>CH-274</u> <u>CH-261</u> <u>CH-272</u> Aubstrate Temperature 300°C 350°C 300°C Film Thick news 1200±100Å 1200±100Å 540±40Å Deposition Rate 400Å/m. 70Å/m 320Å/m

Generally, the results on these films indicate little A structure and a 20, X amplitude no better than my films. There seems to be no terrible distinction between different film as regards structure dependence on film parameters, although the S, X amplitude was the lowest for the theinest film.

other matters

I have made measurements on some of my old epitacial be on cater films with the view toward eventually calculating optical constants, using much more careful allignment than previously.

I also discussed my memo on the fuged quart project, the 25 × investigation and the CaF2 report. It seemed to be the general concensus that I continue on to calculate optical constants. (note 0/2) I am also going to try an effort on etched be substrates in order to see whether or not I can make an epitacial film whore reflectivity will match that of the substrate.

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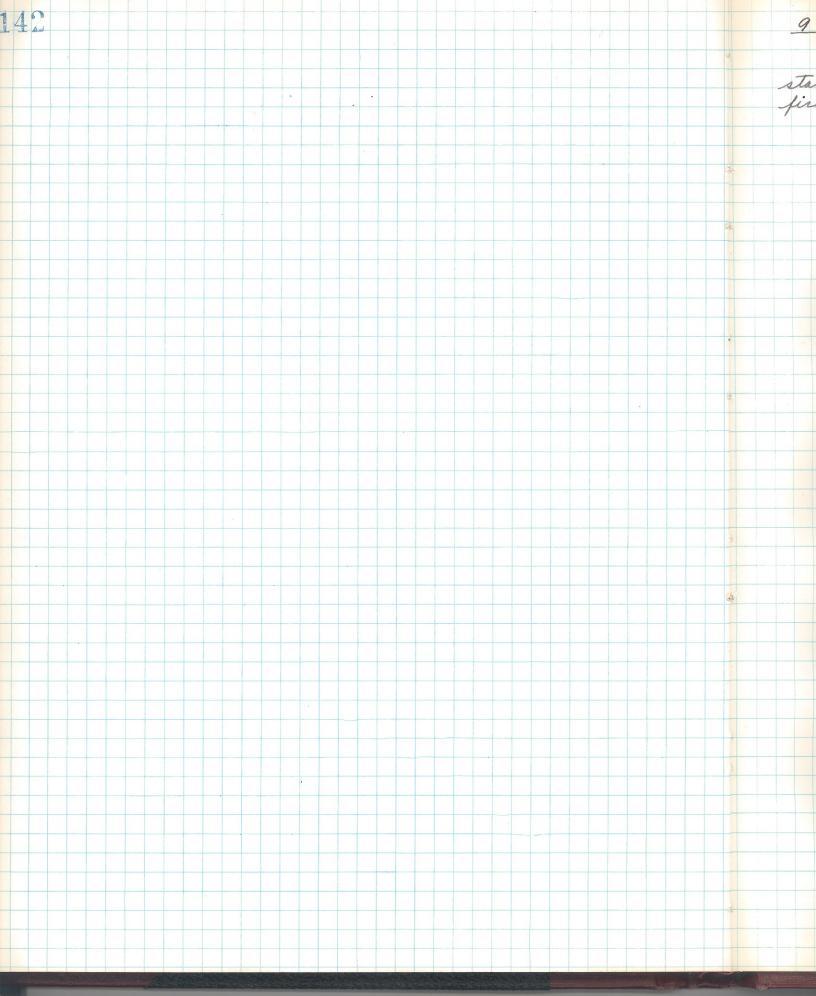
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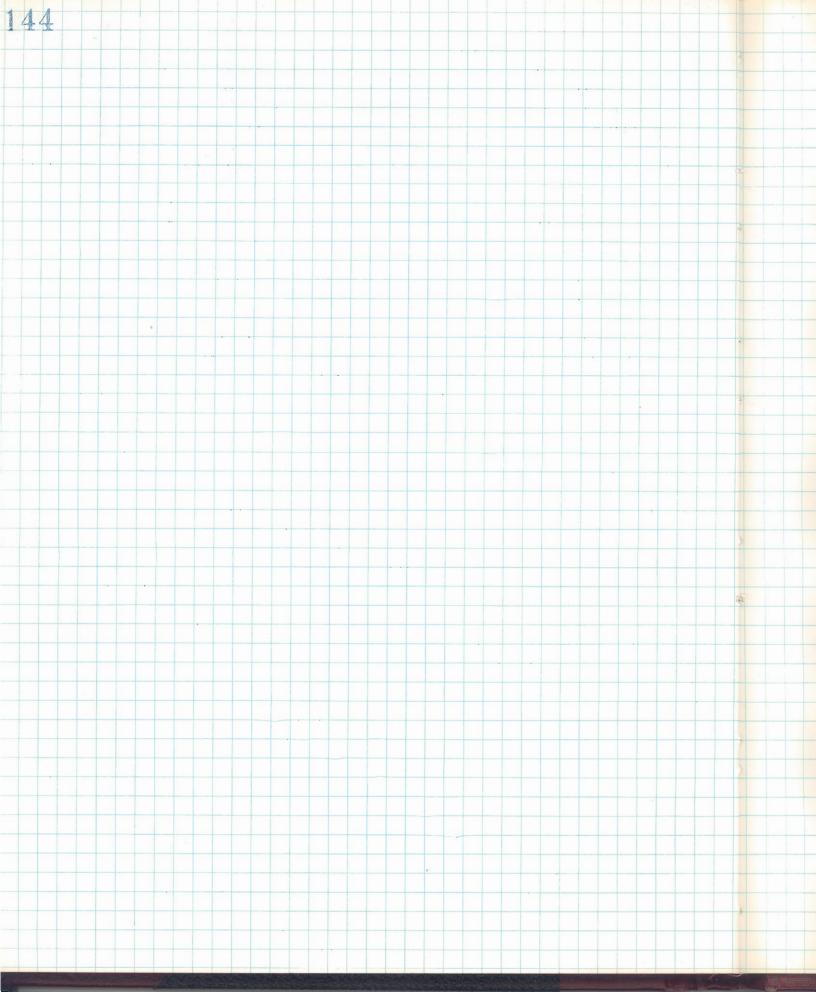
ly

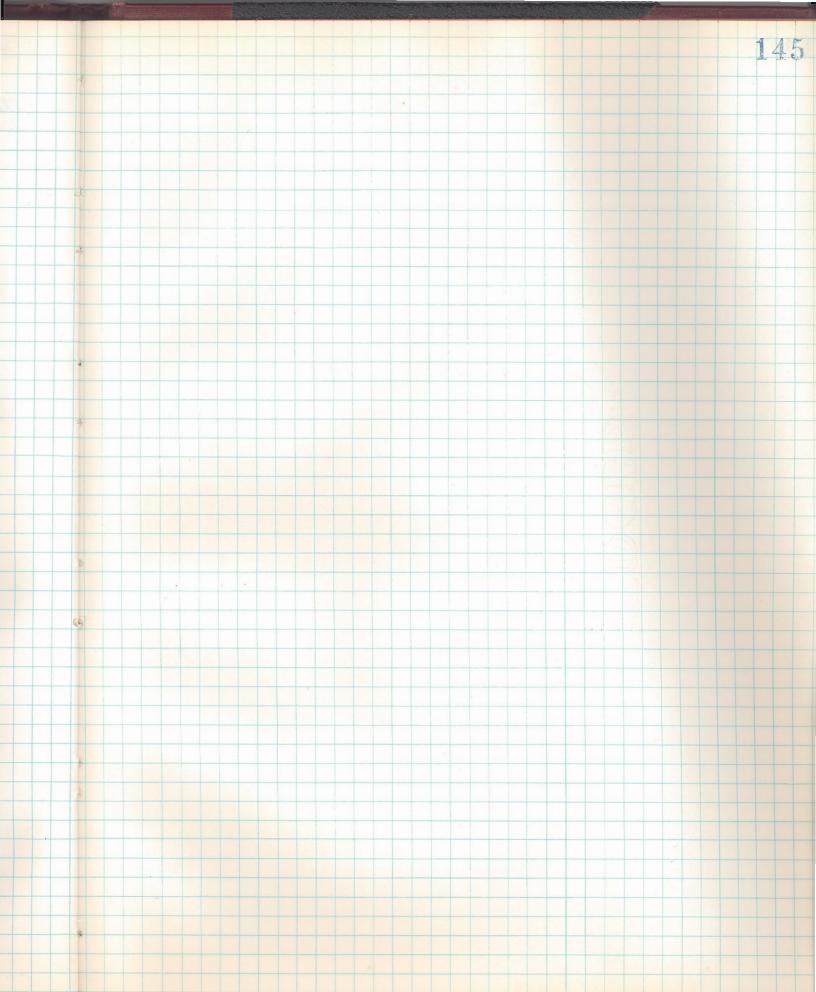
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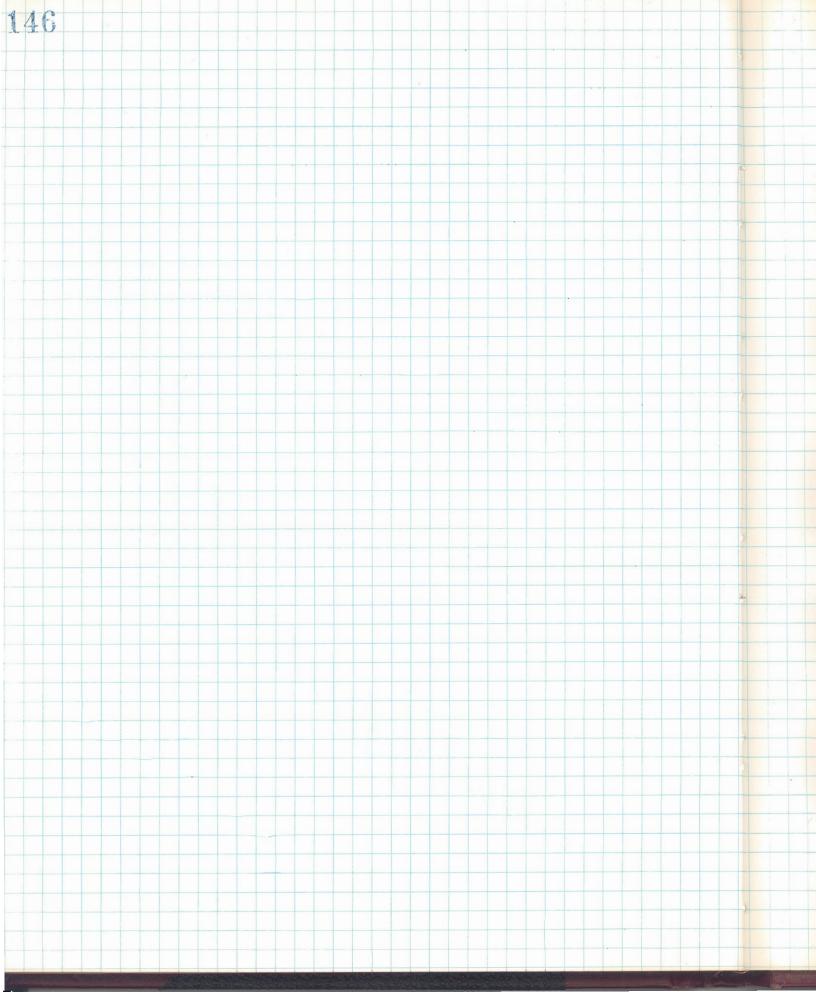
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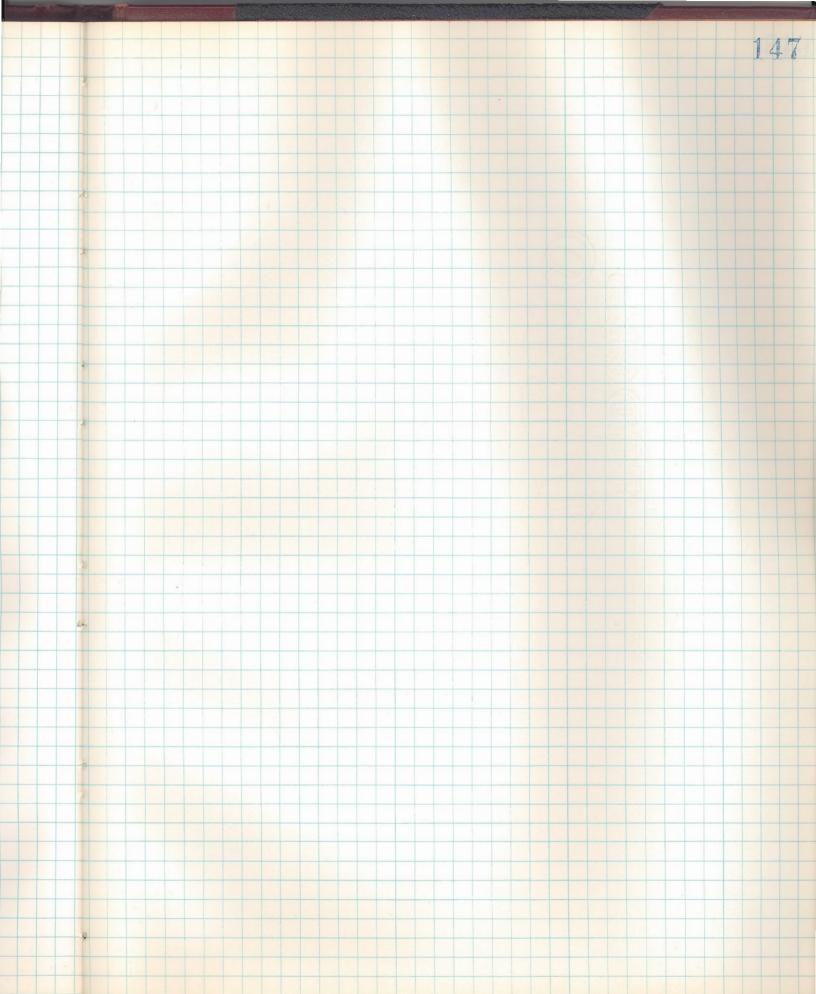


143 9 MAY 1965 today, two years to the day since this log was started, on my thirtieth birthday, I finished the first draft of my thesis.

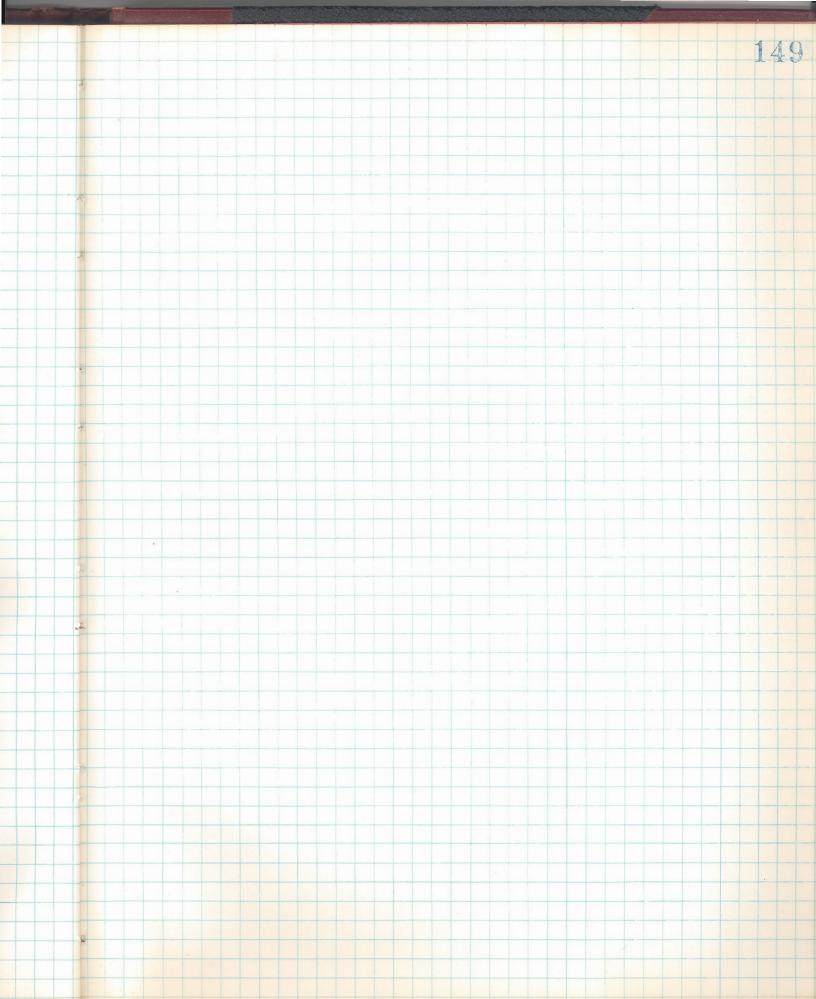


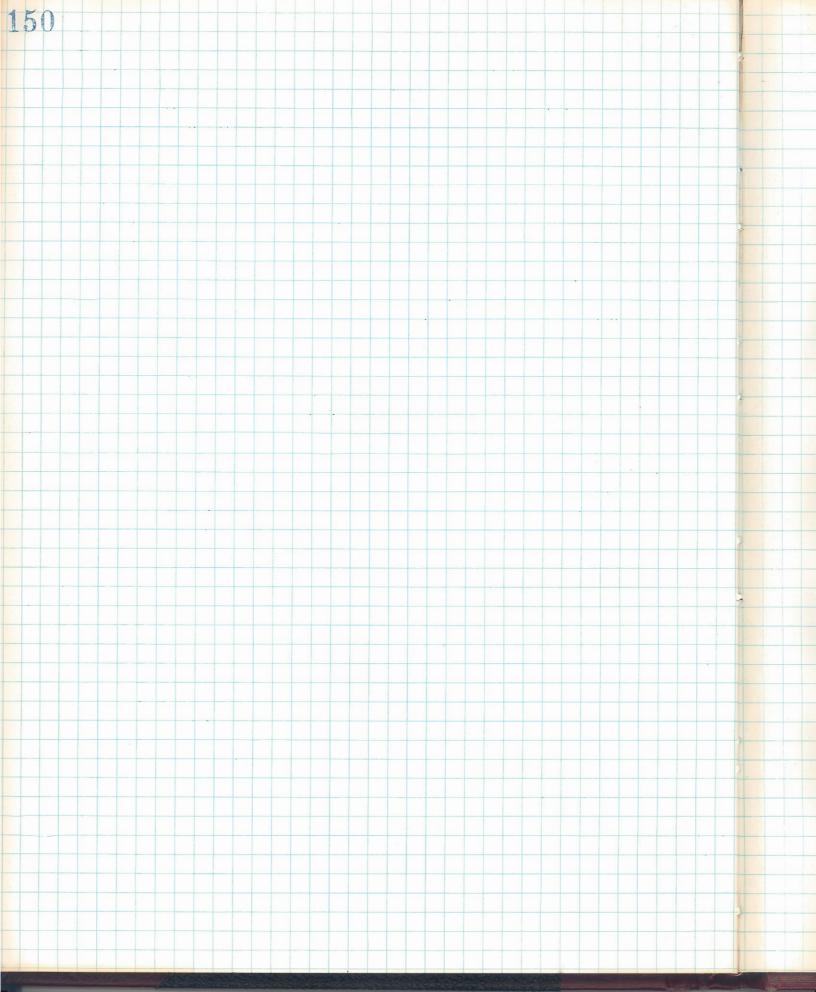


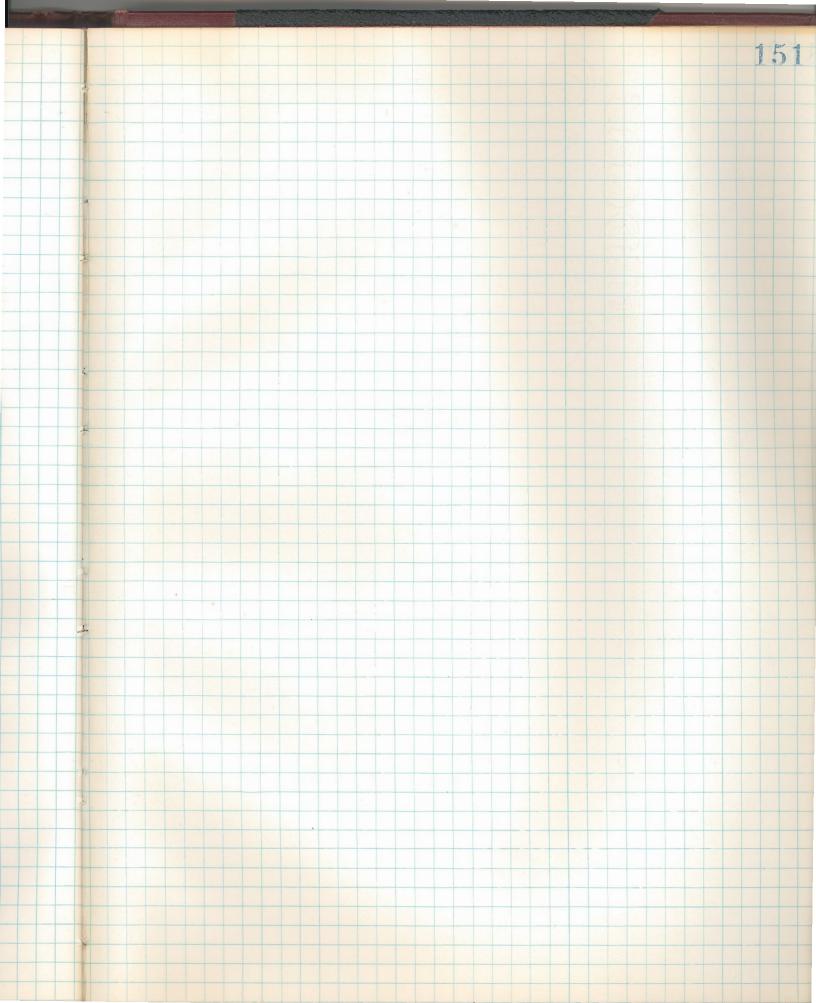


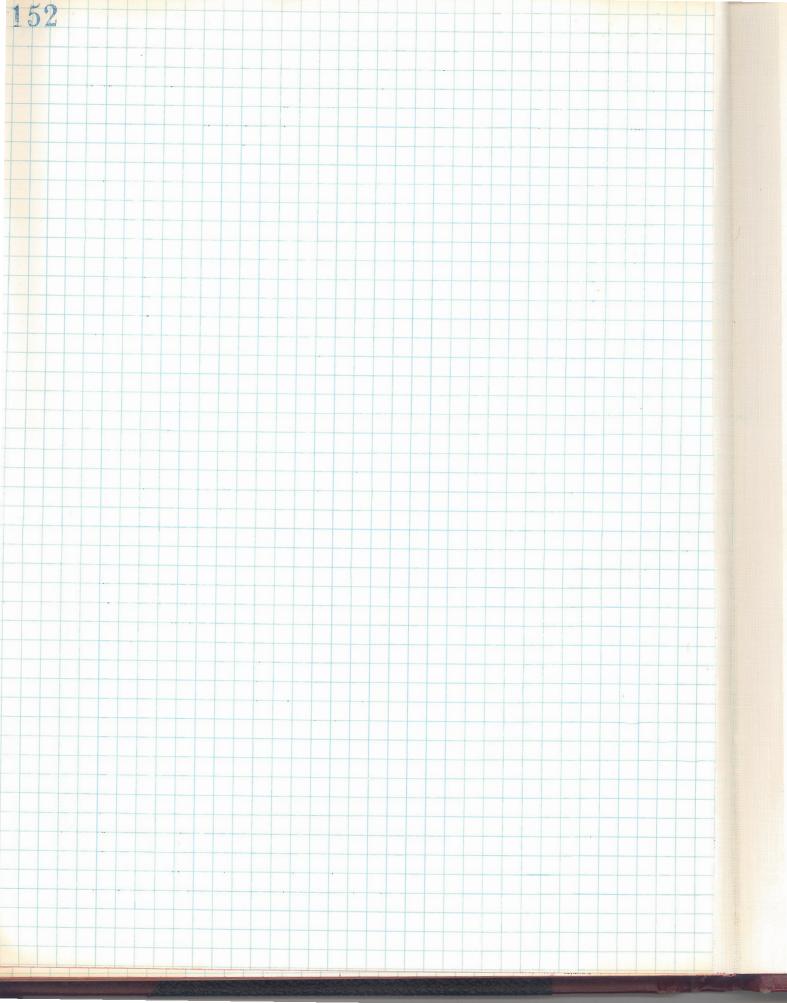






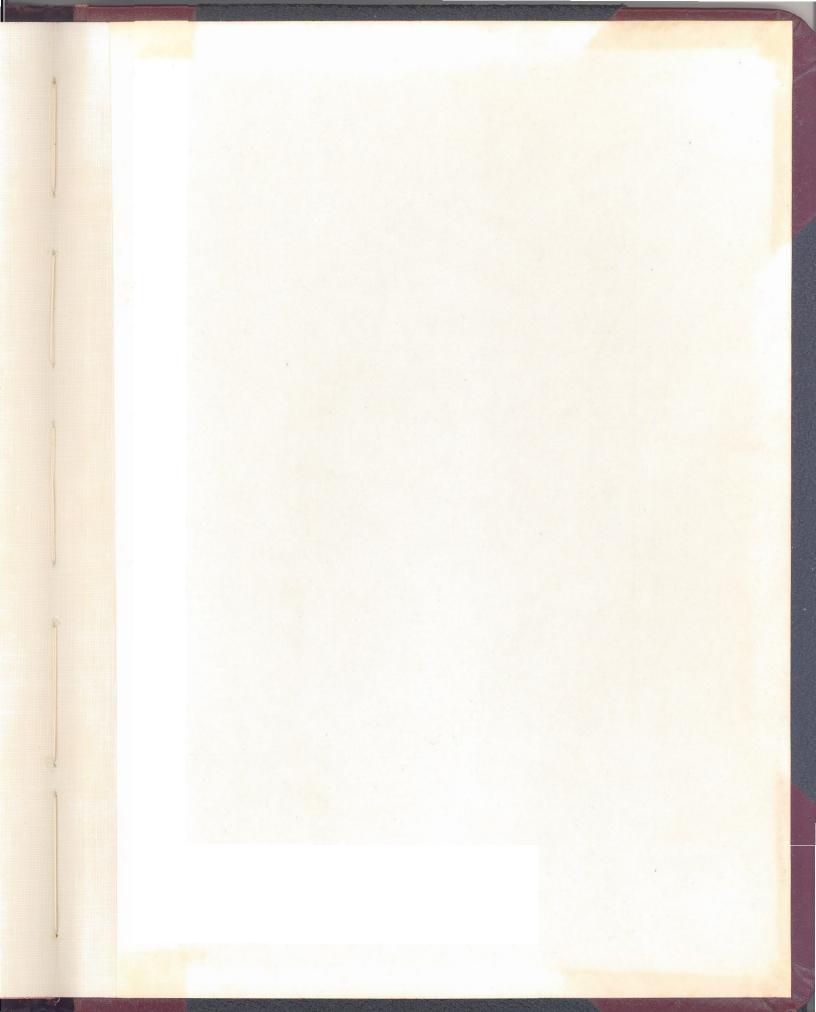


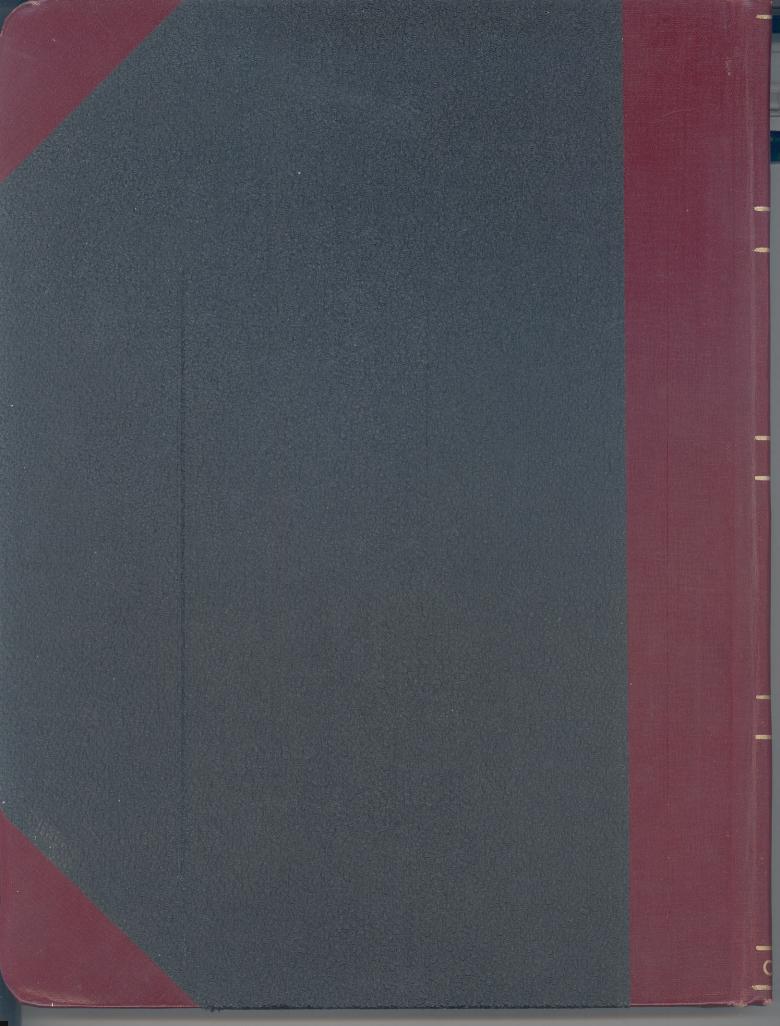












DATE 9/24/63 PAGE LOG BOOK 39 SPECTRUM # 2 SAMPLE: MATERIAL Ge CODE PDE (62) ORIENTATION 2007 TEMP RT THICKNESS PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: 11PE W Lawy STRENGTH G W MONO WATOR: GRATING 30000 RANGE 6500 - 3500 Å SCAN RATE 250 SLIT WIDTH 200 - 5 DETECTOR: TYPE 6256 TEMP RT SETTING 070 - POLARIZATION - FILTER ELECTRONICS: PRE-AMP Regular TIME CONSTANT 3 RECORDER: A B C				Sep		
SAMPLE: MATERIAL_GC CODE_PDE (62) ORIENTATION CODE_PDE (62) ORIENTATION TEMP_RT THICKNESS PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: I.PE WATOR: GRATING SCAN RATE_ SCAN RATE_ SCAN RATE_ SCAN RATE_ SCAN RATE_ SETTING 1070 % POLARIZATION FILTER ELECTRONICS: PRE-AMP PSD " TIME C RECORDER: A				Sep		
ORIENTATION <···· > TEMP RT THICKNESS PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: I.I.P.E Warman STRENGTH G MONO WATOR: GRATING 3 0 000 RANGE 6500 - 3500 R MONO SCAN RATE 250 SLIT WIDTH 200 - 5 DETECTOR: TYPE G 2556 G TEMP RT 5 DETECTOR: TYPE G 256 G TEMP RT SETTING 1070 % FILIER 1000 % POLARIZATION FILIER 1000 % 1000 % PSD " TIME CONSTANT 3 RECORDER: A B C			21.	Sep		
THICKNESS PREPARATION STRESS: TYPE MAGNITUDE DIRECTION SOURCE: I.PE W Lamp STRENGTH G U MONO MATOR: GRATING 3 0 000 RANGE 6 500 - 3500 Å MONO MATOR: GRATING 3 0 000 RANGE 6 500 - 3500 Å DETECTOR: TYPE G 2 55 G SLIT WIDTH 200 - 5 DETECTOR: TYPE G 2 55 G TEMP P POLARIZATION	ed 313 313 314 315 317 317 317 317 317 317 317 317 317 317		21.	Sep		
STRESS: TYPE - MAGNITUDE DIRECTION SOURCE: 11PE W Lamp STRENGTH G U MONOUMATOR: GRATING 30000 RANGE 6500-3500 Å SCAN RATE 250 SLIT WIDTH 200-5 DETECTOR: TYPE 6255 G TEMP 27 SETTING 2070 FILTER ELECTRONICS: PRE-AMP Performer PSD " TIME CONSTANT 3 RECORDER: A B C			21.	Sep		
SOURCE: I.PE W Lamp STRENGTH G W MONO MATOR: GRATING 30000 RANGE 6500 -3500 Å SCAN RATE 250 SLIT WIDTH 200-5 DETECTOR: TYPE 6256 G TEMP 27 SETTING 1070 V POLARIZATION FILTER ELECTRONICS: PRE-AMP Pequem YSD " TIME CONSTANT 3 RECORDER: A B C	A		21.	Sep	+	
MONOJMATOR: GRATING 30000 RANGE 6500-3500 Å SCAN RATE 250 SLIT WIDTH 100-5 DETECTOR: TYPE 6255 6 TEMP 27 SETTING 1070 FILIER ELECTRONICS: PRE-AMP Pequeban PSD " TIME CONSTANT 3 RECORDER: A B C			21.	Sep	+	
DETECTOR: TYPE 6256 TEMP 27 SETTING 1070 - FILIER ELECTRONICS: PRE-AMP Performance PSD " TIME CONSTANT 3 RECORDER: A B_C		3101	21.	Aep	+	
DETECTOR: TYPE 6256 TEMP 27 SETTING 1070 POLARIZATION FILIER ELECTRONICS: PRE-AMP Performed PSD " TIME CONSTANT 3 RECORDER: A B_C	000 1013 	3 107	21.	sep	+	
POLARIZATION		3007	21.	Aep	+	1
ELECTRONICS: PRE-AMPPSD" PSD" TIME CONSTANT RECORDER:ABC	A INA Juna Juna Juna Juna	_3001			it i	2
ELECTRONICS: PRE-AMPRECORDER:ABC		3007				
TIME CONSTANT	- Onshi				1.07	11
TIME CONSTANT		2	12.00	5 A		-
RECORDER:ABC	1.					
			07 S			-
	Shar					
		1 10	·	1		
SPEED.	83 1.4					
REMARKS. (X, 7, 2) = 4.18, 6.08, 5.00		1.4		01		
			1			
OPERATOR PMC		. and	mhu	ent		
PURPOSE Reflectivity of Ge, PDE(62)	T		-	-		
DATE 2/21/63 PAGE LOG BOOK 39 SPECTRUM #_3						
SAMPLE: MATERIAL Ge CODE POE (62)						1000
ORIENTATION <u>CITERAL</u> TEMP RT				-	1	
THICKNESSPREPARATION		1		-	*	
STRESS: TYPE MAGNITUDE DIRECTION						
SOURCE: TYPE Dz lamp SIKENGIH low (ccw))		_			
MONOCHROMATOR: GRATING 30000 RANGE 3500 - 2000 9						
SCAN RATE 250 SLII WIDTH 100 - 5		21		les	t 3	-
DETECTOR: TYPE 62568 IL			1			
SETTING 16294						
	-					
ELECTRUMUS: PRE-AMP Regular			-			
PSD			-			
TIME CUNSTANT 3						
RECORDER:ABC				1.		
SETTINGS	-					
			-			
SPEED						
REMARKS. $(x, y, z) = 4.18, 6.08, 5.00$	-					
ALMARINO. (1771-) - 7.10, 0.03, 3.00		-	-			
OPERATOR OMO			-		-	

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39

Born today: one child, female, ~ 4 kg, ~ 5.	o cm,
Today & an trying to make a reflecte on sample Ge: mached which was polis as high degree of care as DM could mus	mae wen
on sample Ge: mardoed which was polis	hed with
as mys degue of care as DM could mus	teo.
	2 (9x1 - 923972) 4
PURPOSE Reflectivity of Ge: maitred	
DATE 3/03/03 PAGE LOG BOOK 40 SPECTRUM # 2 23 Sept	7
SAMPLE: MATERIAL Poliched Ge CODE	
ORIENTATION CITED TEMP RT	
THICKNESSPREPARATION_Polic	Longen and
STRESS: TYPEMAGNITUDEDIRECTION	
SOURCE: TYPE On lange STRENGTH low	
MONOCHROMATOR: GRATING 30000 RANGE 3500- 2000 A	
SCAN RATE 250 SLIT WIDTH 100 - 5 8	
DETECTOR: TYPE C256B TEMP RT	HITT22
SETTING 1610 -	
POLARIZATIONFILTER	03102
ELECTRONICS: PRE-AMP	A ANALY ANALY
PSD. *	
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	SAMPLE, MATE
SPEED	13190
REMARKS $(x, y, z) = 4.18, 6.08, 5.00$	IDI AT
STURION	3977 - 223972
OPERATOR SMO	9Y10-309102
	arhudar boylor
The Singhing grandurge 1. Phys. C. 212	1 4 1
The finishing procedure followed by DM is as (1) Rough lap with Buchler #1200	follows:
- The day and Ju H. O-	
(3) Polished with Linde "A" my log :	
(4) Final polish with Linda "B" on beeswax	·
It is hoped that this produced a highly ref	

n

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	PURPOSE Reflectivity of Ge: mac Loed	1
		1
109. E	DATE 9/23/63 PAGE LOG BOOK 4' SPECTRUM # 2 Z3 Sept 2 SAMPLE: MATERIAL Queiled Ge CODE	-
TA1		-
run	ORIENTATION <u>CONTRACT</u>	
th	THICKNESSPREPARATION	
	STRESS: TYPEMAGNITUDEDIRECTION	
agral L	SOURCE: TYPE N lang STRENGTH 61	
and a second	MONOCHROMATOR: GRATING 30000 RANGE 6500-3500A	
- here	SCAN RATE 250. SLIT WIDTH 100 - 5	
	DETEVIUR: TYPE 6256B TEMP RT	
	SETTING 1070 V	
	POLARIZATIONFILTER	
	ELECTRONICS: PRE-AMP Regular	
100	PSD 4	
	TIME CONSTANT	
	RECORDER:ABC	
00384 - C	SETTINGS	
E	SPEED	
	REMARKS (x, y, z) = 4.18, 6.08, 5.00	
	OPERATOR BMC	
AUG I III		
TAO -	24 lest 1 south	
SAN SAN	24 September 1963	
	spent today processing the data of 24 sept.	
20-21		
	25 feptember 1963	
2:	I motalled the data of 23 dept. also, tonig	ht
000	block out In and IT when needed. I made a measured of the satio of scattered light to incident light for the shitler in the to	
0333	of the ratio of scattered light to incident is it in	Len
	the shutter in its two positions, using an aluming	1
	merror as a sample. The results are.	ect
1301		-
	Shutter blocking Io; Is/I. = 1.8.10-4	
		-
	thatter blocking IR; Is/IR = 1.15.10-4	-
		-
1	The situation is more serious in The IR bloching position than in the Is blocking position as in to	-
	position than in the I head in the IR bloching	1
	to vous position as in to	he
and a large		

42 PURPO: latter the will be incident on the PM and DATE Is a It should be true at all times. However, in the former case, IT is incident on the SAMPL PM and there may be situations where Is ~ IT. We shall have to watch for these situations. STRESS: SOURCE: MONOCH 26 september 1963 DETECT Let us consider the consequences of the difference in linear thermal expansion coefficients of Ge and POLARIZ Ca Fz. If we assume that the bulk of the CaFe substrate ELECTRO in so great that the Ge film does not stress it at all and that the expansion and contraction of the Ge film is governed by the Cate substrate, and that the film - substrate system is unstrand when the film is being formed, we arrive at the following landions: RECORD following equationa: Alcare = Alge REMAR AlcaFr = lacaFr AT OPERAT Olge = lage AT - lF Sir $F = \frac{(\chi_{Ge} - \chi_{Ca}F_{e}) \Delta T}{S_{i}}$ 27 Here we use So without regard to crystal orientation. ita (300°K, TDC) dge = 5.75.10-6 Taking : of $\alpha_{caF_2} = 19.5.10^{-6}$ (CRC) app DT = - 550°C cm²/dyne (TDC) SII = . 98.10-12 seen gue Then: edg F = 77.10° dyne/cm² = 7700 atru. sha det now, according to POE (62), a uniadial stress of due about 4100 atm causes a shift (in compression) in the principal 1 reflectivity pead from about 5840 Å to about 5854 Å. An bui sho This is about sort a topic for investigation on the films and we shall begin to look for this by examing film 4 which appears to be a rather thick film. you son see arl

	PURPOSE Overall R and T of Film 4
	DATE 9/24/63 PAGE LOG BOOK 43 SPECTRUM # 2
1 5	SAMPLE: MATERIAL Film 4 CODE Film log 45
IT.	ODIENTATION
& / ·	THICKNESS PREPARATION 26 Sept 1
	STRESS: TYPE
812	SOURCE: TYPE w lamp STRENGTH GV
200	MONOCHROMATOR: GRATING 3000, RANGE 6500-3500 Å
dwi i	SCAN RATE 250 SLIT WIDTH 200-5
	DETECTU. TIPE G256B TEMP R7
e	SETTING 1080 V ROTAL NUMBER
d	POLARIZATIONFILTERFILTER
strate	ELECTRONICS: PRE-AMPRegular
t	PSD
	TIME CONSTANT
d	RECORDER: A B C
a	
	$\frac{SPEED}{REMARKS} = 3.81, 6.08, 5.00$
22	REMARKS (A, 7), 2) 5 3.01, 0.00, 3.00
0	OPERATOR_ PMG
8	27 September 1963
TE	
lion,	The uffectivity of Film 4 seemed to be too low for its apparent thickness so I checked the adjust it
	its agracent thickness so I checked the adjustment
	of the diagonal minore and found them to be ok so apparently this is not an artifact.
	apparently this is not an artifact.
	seems to be addly shaped and not at all like results given by calculation using bulk optical constants. The
	given my calculation using bulk optical constants. The
	sharp and goes much deeper than one would expect.
Ł	due to an ever this is
	Juch a possibility has been suggested by Jax
	but it is had to the the thespeaked by Jak
	short hale lifetime at This and the
hus	
m 4	
	- muching shanders of the marca
	artifact.

28 september 1963	That a series proti LOC BOOK
	A LEANER MATERIAL S
Today I want to complete at least side of Film 4.	The run on one
side of Film 4.	
PURPOSE averall R and T of Film 4	<u>99110268</u>
DATE 7/2 0/6 3 PAGE LOG BOOK 44 SPECTRUM #	8 sept 1
SAMPLE: MATERIAL Films 4 CODE Films log 45	o sept I
ORIENTATION	SCAN RATE
THICKNESSPREPARATION	
STRESS: TYPEMAGNITUDEDIRECTION	K AND A AND
SOURCE: TYPE W lamp STRENGTH 6V	
MONOCHROMATOR: GRATING 30000 RANGE 6500 - 3500 A	LEECTRONICS THE AMP
SCAN RATE 250 SLIT WIDTH 100-5	TRIE CONST
DETECTOR: TYPE 62563 TEMP CET	
POLARIZATIONFILTER	
ELECTRONICS: PRE-AMP	
PSD	the second se
TIME CONSTANT	
RECORDER:ABCC	
SETTINGS	
SPEED	
REMARKS (X, Y, Z) = 3.81, 6.08, 5.00	
	and the state of t
OPERATOR &MG	
OPERATOR BMG	
	X ALLANDA ALLANDA
The survose of 28 sent I was to cher	to reproducibility
The purpose of 28 sept 4 was to check by comparing with 26 sept I. The To seems	I to wander
write badly during This run	10 10 1 L 20 1 L
The surgers of 28 sent 2 unas to exam	using the h
The purpose of 28 sept 2 was to examination in transmission and reflected	in frall
scans were made in the following	g order:
(1) Io	
(Z) IT	
(3) Io	A second and a second as a
(4) IR	A Charles A Charles and A Charles
(5) Fo	Sala and sala a
The third To (3) will be used as the	final to for
transmission and the initial to for ref	Cection.
28 Sept 3 is an overall sean of	the UV for
film 4.	

01.1.000	tion of a tra	usition :	Film 4					
DATE 7/28/63 PAG	E LOG BOOK	45 SPE	CTRUM #2		28	Sept	2	
SAMPLE: MATERIAL	Film 4	CODE	FL 45	-				
ORIENTAT	ION	TEMP		-				
THICKNES	S	PREPA	RATION	-				
CTDESS. TYPE	MAGNITUDE		DIRECTION	-				
SOURCE. TYPE 3	lang_	STRENGTH_	61	-				
MONOCHROMATOR: G	RATING 3000	PRAN	VGE 6100 - 5100	-				
.S	CAN RATE 125	SLIT	WIDTH 100-3					
DETECTOR: TYPE	6256B	TEMP	PT					•
SETTING	1070 V							
POLARIZATION	-	FILIER		-				
ELECTRONICS: PRE-A	MP_ Regu	lan						
	PSD			-				
	TIME CONSTAN			-				
RECORDER:	A	_B	C					
SETTINGS				-				
				-				
SPEED			· · · · · · · · · · · · · · · · · · ·	-				
REMARKS. (X,	7, 2)= 3.	81,6.08	, 5.00	-				
OPERATOR PM	IG							
and the second s	and the second se				_			
PURPOSE C					20			
SAMPLE: MATERI			PECTRUM # 3		68	Sept		
UKIENI	ATION							
	r00	PREF	ARALIUN					
THICKN	ESS							
THICKN STRESS: TYPE	MAGNITUD	E	_DIRECTION					
THICKN STRESS: TYPE SOURCE: TYPE	MAGNITUD Dz lamp.	ESTRENGTH	DIRECTION	0				
THICKN STRESS: TYPE SOURCE: TYPE MONOCHNOMATOR:	MAGNITUD Dz lamę. GRATING 300	ESTRENGTH @@R	DIRECTION ANGE 3500 - 200					
THICKN STRESS: TYPE SOURCE: TYPE MONOCHNOMATOR:	MAGNITUD Dz lamp. GRATING_300 SCAN RATE_2	ESTRENGTH 	DIRECTION					
THICKN STRESS: TYPE SOURCE: TYPE MONOCHNOMATOR: DETECTOR: TYPE	MAGNITUD Dz lamp GRATING 300 SCAN RATE 2 62 56 8	ESTRENGTH 202R 50SL TEMP	DIRECTION ANGE 3500 - 200 IT WIDTH 100 - 5 RT					
THICKN STRESS: TYPE SOURCE: TYPE MONOCHNOMATOR: DETECTOR: TYPE SETTING	MAGNITUD Dz lamp GRATING 300 SCAN RATE 2 62 56 8 (63)	ESTRENGTH 200R 50SL TEMP 0 1/	DIRECTION ANGE 3500 - 200 IT WIDTH 100 - 5 RT					
THICKN STRESS: TYPE SOURCE: TYPE MONOCHNOMATOR: DETECTOR: TYPE SETTING POLARIZATION	MAGNITUD Dz lamp GRATING 300 SCAN RATE 2 62 56 6 (63	ESTRENGTH 20R 50SL TEMP 0 1/ FILTER	DIRECTION ANGE 3500 - 200 IT WIDTH 100 - 5 RT					
THICKN STRESS: TYPE SOURCE: TYPE MONOCHNOMATOR: DETECTOR: TYPE SETTING	MAGNITUD Dz lamp GRATING 300 SCAN RATE z 62 56 8 (63) 	ESTRENGTH = 0R 5 0R 5 0R 5 0R TEMP 0 FILTER 5 0	DIRECTION ANGE 3500 - 200 IT WIDTH 100 - 5 RT					
THICKN STRESS: TYPE SOURCE: TYPE MONOCHNOMATOR: DETECTOR: TYPE SETTING POLARIZATION	MAGNITUD Dz lame GRATING 300 SCAN RATE 2 62 56 6 (63 (63 (63 AMP Ces	ESTRENGTH 	DIRECTION ANGE 3500 - 200 IT WIDTH 100 - 5 RT					
THICKN STRESS: TYPE SOURCE: ITPE MONOCHNOMATOR: DETECTOR: TYPE SETTING POLARIZATION ELECTROMICS: PRE-	MAGNITUD Dz lame GRATING 300 SCAN RATE z 62 56 6 (63) (63) (63) (63) (63) TIME CONSTA	ESTRENGTH 	DIRECTION ANGE 3500 - 200 IT WIDTH 100 - 5 R.T					
THICKN STRESS: TYPE SOURCE: TYPE MONOCHNOMATOR: DETECTOR: TYPE SETTING POLARIZATION ELECTROMICS: PRE- RECORDER:	MAGNITUD Dz lamp GRATING 300 SCAN RATE 2 62 56 6 (63) AMP Ces PSD TIME CONSTA A	ESTRENGTH 	DIRECTION ANGE 3500 - 200 IT WIDTH 100 - 5 R.T					
THICKN STRESS: TYPE SOURCE: ITPE MONOCHNOMATOR: DETECTOR: TYPE SETTING POLARIZATION ELECTROMICS: PRE-	MAGNITUD Dz lamp GRATING 300 SCAN RATE 2 62 56 6 (63) AMP Ces PSD TIME CONSTA A	ESTRENGTH 	DIRECTION ANGE 3500 - 200 IT WIDTH 100 - 5 R.T					
THICKN STRESS: TYPE SOURCE: ITPE MONOCHNOMATOR: DETECTOR: TYPE SETTING POLARIZATION ELECTROMICS: PRE- RECORDER: SETTINGS	MAGNITUD Dz lamp GRATING 300 SCAN RATE 2 62 56 6 (63) AMP Ces PSD TIME CONSTA A	ESTRENGTH 	DIRECTION ANGE 3500 - 200 IT WIDTH 100 - 5 R.T					
THICKN STRESS: TYPE SOURCE: TYPE MONOCHNOMATOR: DETECTOR: TYPE SETTING POLARIZATION ELECTROMICS: PRE- RECORDER:	MAGNITUD Dz lamp GRATING 300 SCAN RATE z 62 56 8 (63) AMP Ces PSD TIME CONSTA A	ESTRENGTH #0R 50 SL TEMP_ 0 V FILTER_ 	DIRECTION					

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40 23 september 1963 PL Born today: one child, female, ~ 4 hg, ~ 50 cm, DA labelled Reborah Jean. SA Today & am trying to make a reflectance wer on sample Ge: mardoed which was polished with as high degree of care as DM could muster. STR SOU MOI PURPOSE Reflectivity of Ge: maitaed DATE 9/23/63 PAGE LOG BOOK 40 SPECTRUM # 1 23 sept 1 DET SAMPLE: MATERIAL Palial Ge CODE____ ORIENTATION CITY TEMP RT POL THICKNESS_____PREPARATION Police ELE STRESS: TYPE _____MAGNITUDE _____DIRECTION SOURCE: TYPE Oz lamp STRENGTH low MONOCHROMATOR: GRATING 30000. RANGE 3500- 2000 A REC SCAN RATE 250 SLIT WIDTH 100-5 DETECTOR: TYPE 62569 TEMP. RT SETTING_____1610 / REM PSD. * OPE TIME CONSTANT 3 RECORDER: A B SETTINGS 24 SPEED. REMARKS. (X, J, Z) = 4.18, 6.08, 5.00 OPERATOR SMO 25 The finishing procedure followed by DM is as follows: (1) Rough lap with Buchler #1200 2 [2] Fine lap with 34 AlzO3 blo (3) Polished with Sinde "A" on becawax (4) Final polish with Linda "B" on beerwax of Th It is haved that this produced a highly reflecting flat surface with minimum damage and defect. m 4

10 FRUIT 5/13/64 10 6/11/64

N MATERIAL	SOURCE POWER	SOURCE - SUBSTRATE DISTANCE	VACUUM SYSTEM - PREBSURE	TIME OF RUN - THICKNESS	PATE	CONFIGURATION	TICAL REI 5300A	FLEC
1 1	1		1	1 1		1		1
IBM GE	1300°C (54-5)	5.3 "	NRC <1.105	8 min		PU-FS	42.5%	
	1300°C (54-5)			5 min		PU-FS	33.6%	
	(60-5)			5 พเพ		PU-FS	37.0% 33.1%R	
	(55-5)			5 min		PU-FS	37.5% 33.9%R	
	(55-5)			10 mm		PU-FS	39.6% 46.7%5	;
	(55-5)			10 min.		PU-FS	41.2 %	
OLD MIT Ge	(55-5)			Emin		PU-FS	46.0%	41.0
	(55-5)			Зтип		PU-FS	43.7% 44.8%5	5
	(55-5)			30 s		PU-FS	43.2 %	39.
	(50-5)			205 (300 Å)	(15 A/s (900 A/m)	PU-FS	52.7%	41.0
	(45-5)			603		PU-FS	35.4%	37.4
	(45-5)			5.min		PU-FS	42.2% 47.0% 5	35.
	(50-5)			605		PU-FS	42.67 43.379	37.7
NEW LINCOLN Ge	(60-5)			11.5 s		PB-FM	42.7 %	40.0
	(60-5)			11.55		PU-FM	40.8%	42.5
	(65-5)			/3 s		PU-FM	37.3%	26.6
	(65-5)			305				
	(65-5)			Imin		0		1 .
	(60-10)			47s		PU-FM	39.8%	40.6
	(90-10)			255(ro) (105)		PU-FM	34.9%	36.
	(49-10)			25s(ro) (105)		PU-FM	44.1%	44.8
	(50-10)			145		PU-FM	44.5%	44.9
	(53-10)			ZOS(ro)		PU-FM	45.5 %	43.0
	(50-10)			155(?)		PU-FM	42.2%	38.4
	(50-10)	11 "		18s (?)		PU-FM PB-FM	43.6% 35.3% R	40.1
	(50-10)		t	(?) 205	1	PU-FM PB-FM	42.2% 31.6% R 45.2%	
PU= PM UP PB= PM BAC	and the second of a local distance with the second s	FOCUS ON SI	the second s	= VISIBLY RODG		= MICROSCOPIC	ALLY ROUGH SMOOTH	Pe

	GE FILMS DE POSITIONS			UZED QUAN	RTZ AND	CaFe SUL	SSTRATES	FROM 7/11
RATION	SOURCE MATERIAL	SOURCE POWER	SOURCE - SUBSTRATE DISTANCE	VACUUM SYSTEM - PRESSORE	TIME OF RUN - THICKNESS	DEPOSITION RATE	OPT CONFIGURATION	TICAL REFL 5300 Å
W (.005)	New Lincoln Ge . 3204 g	(25-5)	10 5/8 "	NRC 1.10-6	1.1	1 1	NO MEASUREMENT	1 1
		(25-5,6)	1	< 1.10 6	12/5		PB-FM	50.2%
	.3242g added	(25-5,6.2)		5.10-7	121 s		<i>PB-F</i> M	62.1%
		(25-5,6.3)					PB-FM	60.5%
		(25-5,6)	1	B-10 ⁻⁷	1215		PB-FM	57.0%
w(.005)	New Lincoln Ge . 3160 5	(18.5-5,52)		8.107	3605		PU-FM	12.196
		(30-5,6.6)	,	8·107	7 905		9B-FM	50.0%
	.3243g added	. (35-5)		5.107	145		PB-FM	48.1%
w(.005)	New 6mcoln 6e. . 32045	(25-5,6.1)	1	2.10-6	92s		PU-FM	45.4%
2.	?	?		Ś	?		PB-FM	45.6%
at	IBM Ge	1525 °C	15 cm.	VEEC6 <1.105	5 10 min			
20		1050-1110 °C	12 cm	VECC0 -110	10 min			
t		?			4 min		THIS FILM W	DAS ALVMINIZ
.†		1300 °C		NRC < 1.105	5 min			
at			13.5 em		5 mm			
at t		1040°C VAR45, 138, VI.7	7"	Little NRC LIS	5 min			
				Little alRC <1.105				
1				I	1 1	I I		1