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A SEARCH FOR EARTH-CROSSING ASTEROIDS

(NAGW-232)

SEMIANNUAL STATUS REPORT

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COVERING JULY 1, 1983 TO DECEMBER 31, 1983

This fifth brief Semiannual Status Report is submitted under the provisions of NASA regulations for Research Grants. One reason that it can be brief is the extensive Supplement prepared to our last Semiannual Status Report. A revised copy of that document is appended. It is not only a historical review of all of Lincoln Laboratory's (M.I.T.) work on Earth-approaching minor planets, it also presents the observational and theoretical basis for asteroid detection and discrimination by semi-automatic or automatic means.

As is usual, our observing work is presented both in tabular form (Table 1) and graphical form (Fig. 1). I've also included a figure (No. 2) which shows the vast improvements made in both resolution element size and sensitivity in our EBSICON cameras. This is principally due to the efforts of Dr. R. Weber and has occurred in parallel with our CCD work (see below). (Figure 3 shows the completed CCD camera). Finally, Figure 4 is an up-to-date illustration of what an asteroid detection now looks like. Shown are four phases during the realignment of the live (white) and reference (black) frames. As one passes through the sequence you can see that the stars' images overlap and become grey, while the displaced images of the asteroid (#899 on day 342 of 1983 at B = 14^m25) do not cancel. The dots in the lower lefthand corner are blemishes - they appear in all images with the same displacement.

Table 1. Asteroid Searches

Time Period	No. of Objects	No. of Observations	No. of Nights	No. of Square Degrees	Discoveries
1979-80 inclusive	45	96	5	200	2
1981	209	580	53	2785	33
Jan.	22	58	3	200	0
Feb.	9	48	6	345	0
March	8	24	6	300	0
Apr.	10	39	3	160	0
May	11	71	4	220	0
June	4	11	2	80	0
Aug.	37	133	8	550	8
Sept.	28	42	4	190	2
Oct.	46	86	5	275	14
Nov.	0	0	2	55	0
Dec.	34	68	10	410	9
1982	226	370	42	4612	27
Jan.	4	4	1	27	0
Feb.	38	58	5	275	8
March	39	66	6	345	5
Apr.	20	57	6	330	2
May	43	50	6	275	2
Sept.	36	67	8	1390	1
Oct.	19	36	3	580	1
Nov.	76	10	3	580	3
Dec.	20	22	4	810	5

Table 1. Asteroid Searches (Cont.)

Time Period	No. of Objects	No. of Observations	No. of Nights	No. of Square Degrees	Discoveries
1983	108	233	49	13010	5
Jan.	25	48	4	930	3
Feb.	13	43	7	1860	1
March	12	30	8	1740	0
Apr.	11	22	6	1680	0
May	10	20	8	2090	0
Sept.	14	24	3	765	0
Oct.	0	0	1	115	0
Nov.	12	24	6	1975	0
Dec.	11	22	6	1855	1

The pictures are Polaroid pictures of the television monitor screen, cut, mounted, and rephotographed. The actual image is even better than the one portrayed here.

The meeting at NASA Headquarters in September has inspired me to firm up the statistical basis for searching for Earth-approaching asteroids. A summary of this work, in the form of an Astronomical Journal preprint, is enclosed too.

The CCD camera (Fig. 3) has been completed, tested, taken apart, revamped, and will be tested again during the March 2 New Moon. The sensitivity tests requested by NASA Headquarters were performed on our EBSICON cameras as well as the old version of the CCD camera. They are summarized in Table 2. The reference fields were a field in Aquila, SA 71, or SA 94. The results, in Table 2, are reduced to top of the atmosphere and are in the B system.

Table 2.

Static Limiting Magnitudes (B)

Telescope Configuration	Cassegrain		Prime	
	Zoom	Full	Zoom	Full
Camera				
EBSICON	16^{m}.5	16^{m}.25	16^{m}.25	16^{m}.5
CCD				16.5

BIBLIOGRAPHY

Observations made at the Lincoln Laboratory ETS under the direction of L. G. Taff:

M. P. C. 8050, July 1983

Preprint to on Astronomical Journal. The Discovery Circumstances of Earth-Approaching Asteroids

Supplement to the Semiannual Status Report

Figure Captions

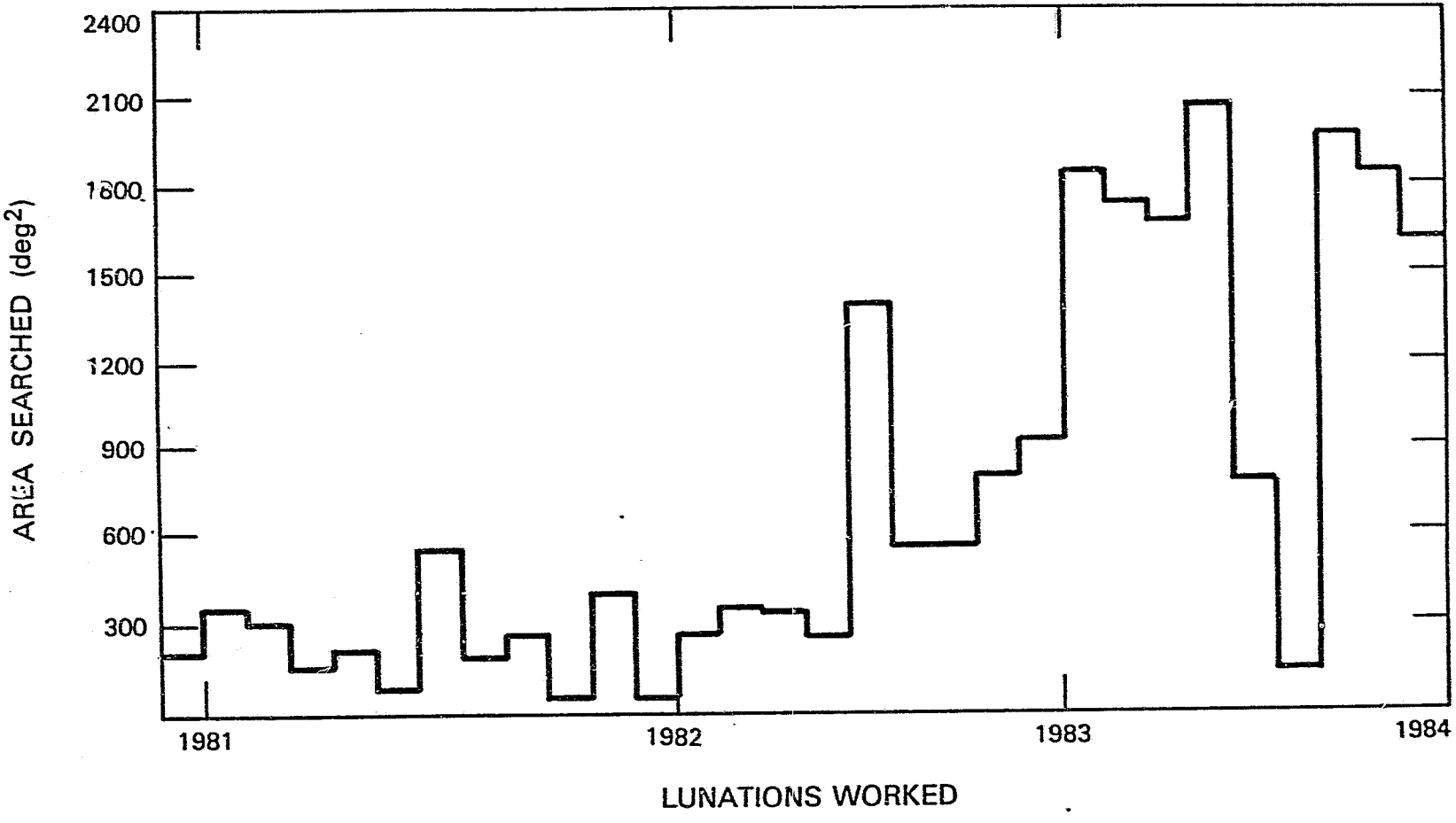
Figure 1. Graph of celestial sphere coverage (in square degrees) as a function of lunation.

Figure 2. Curves of resolution element density (left) and responsitivity (right) for new and old EBSICON cameras used in search work.

Figure 3. Open view of completed two-chip CCD camera.

Figure 4. Four (left to right, top to bottom) successive views of electronic asteroid detection.

Fig 1



EBSICON POINT-SOURCE PERFORMANCE

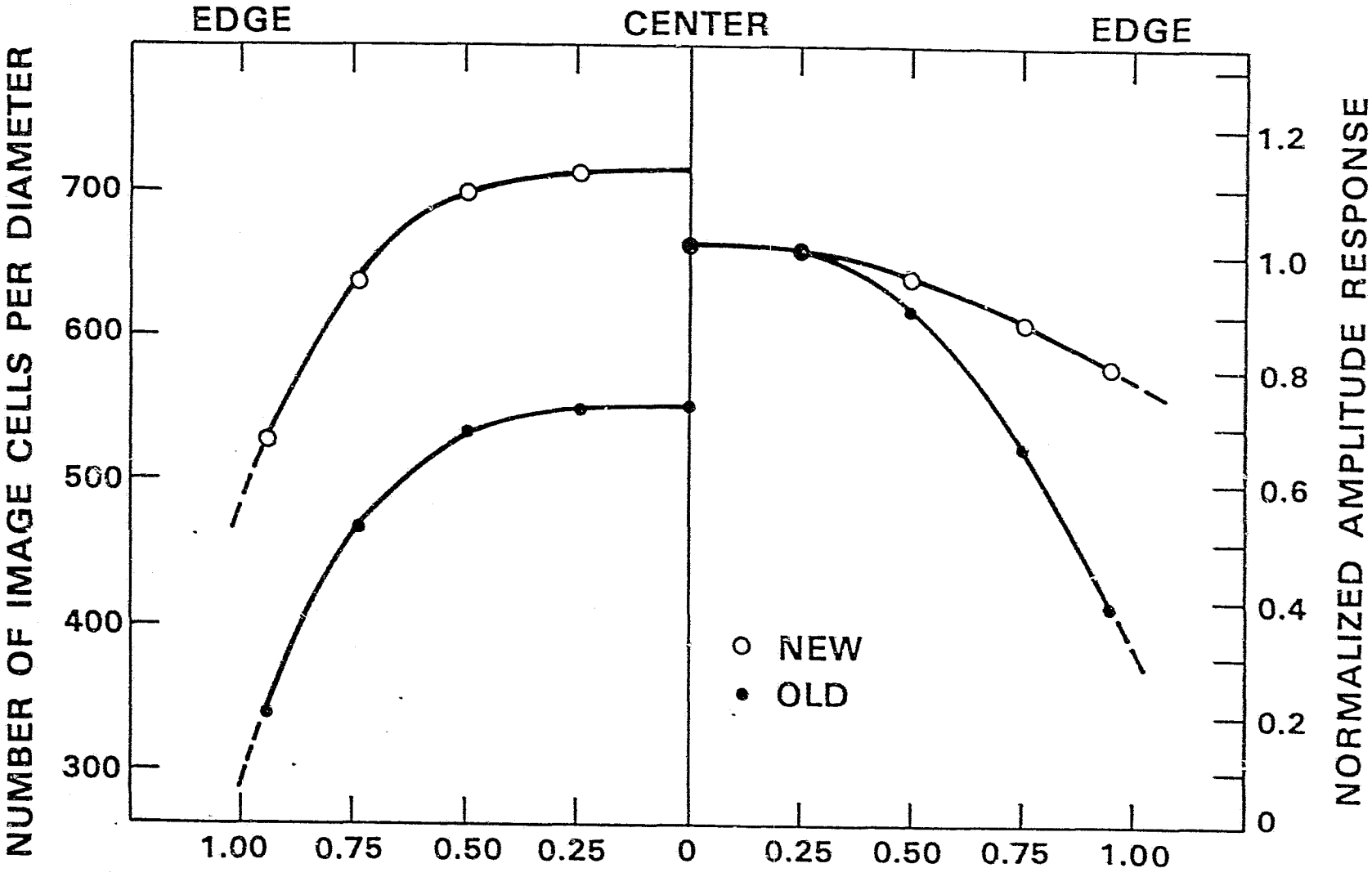


FIG. 2

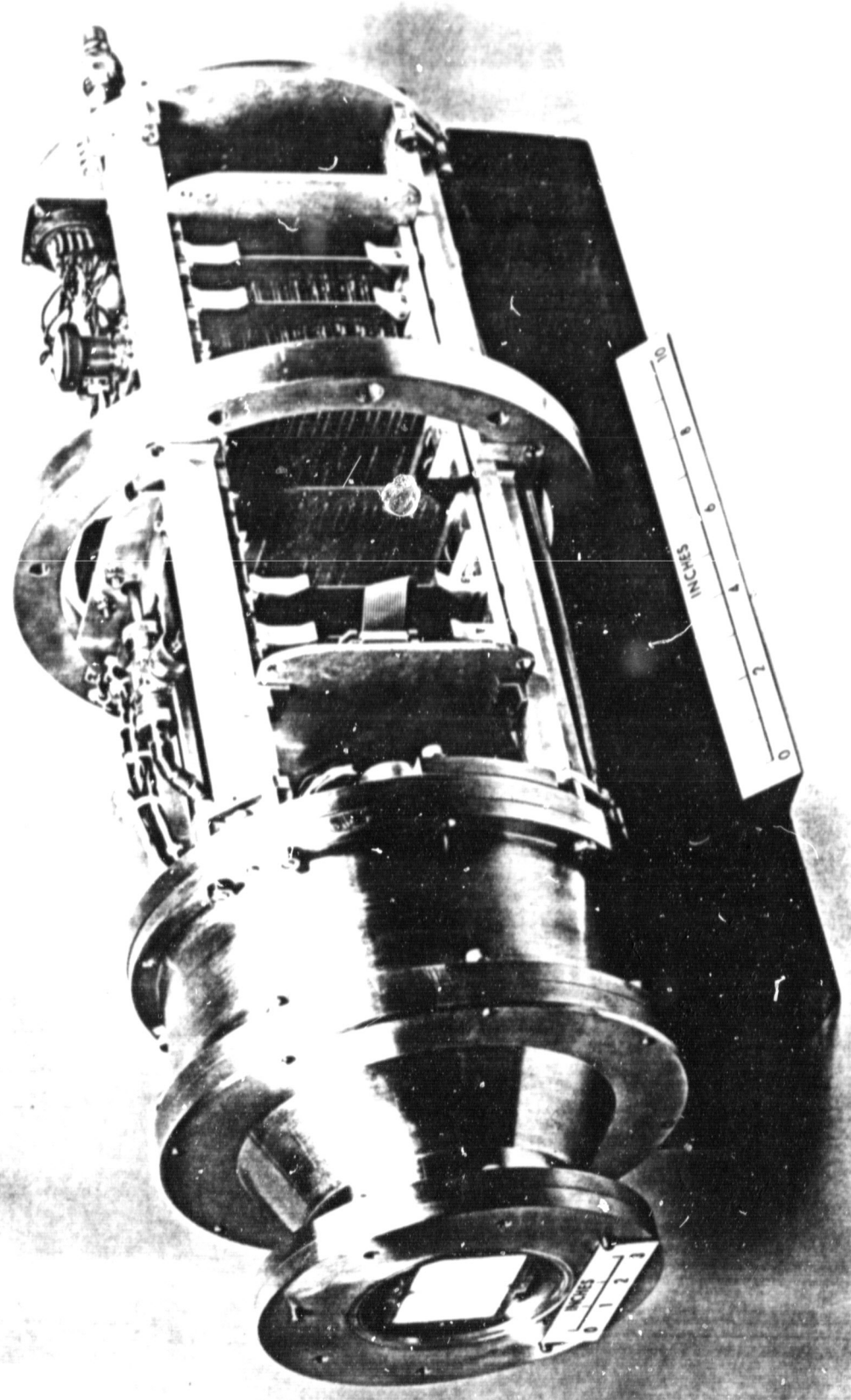


Fig. 3

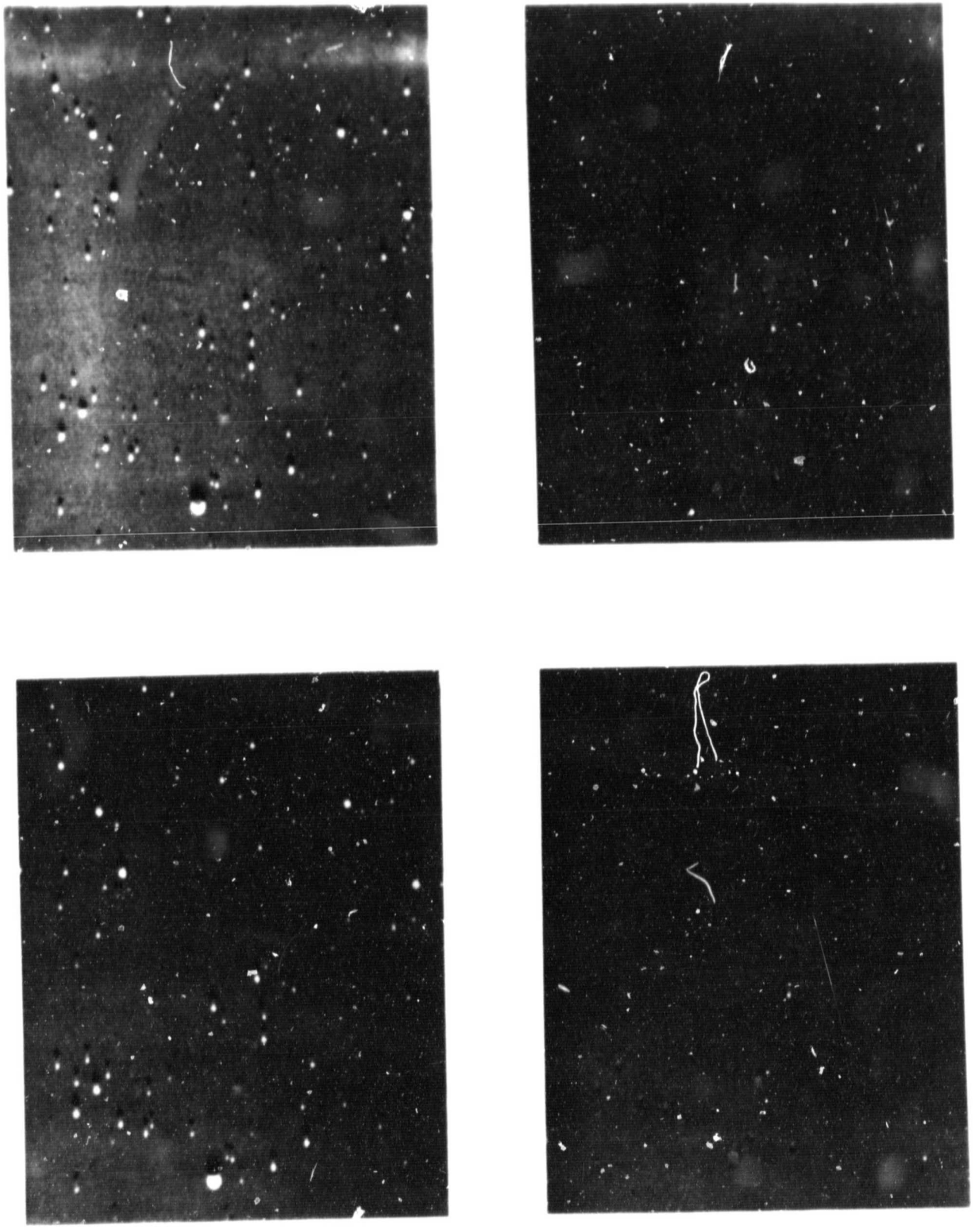


Fig. 4