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NARROW BAND PHOTOMETRY OF SELECTED ASTEROIDS

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Abstract

The CCD Photometrty of selected asteroids was carried out to check for possible cometary activity in them. To distinguish the asteroids with possible cometary activity from those of the main belt ones, each object of interest was observed in two filters; one centered on the C_2 emission band at 5140A (90A bandpass) and the other centered on the nearby continuum at 4845A (65A bandpass). None of the observed asteroids appear to have any C_2 emission.

Summary

The possiblility that some asteroids could be cometary in origin has been extensively reviewed recently by Weissman et al (1989). What fraction of the known asteroids have their origin in the distant cold regions of the solar system cannot easily be estimated. It appears that this fraction may be larger among the population of near earth asteroids (NEA) than among the main belt ones. Luu and Jeweitt (1990) have discussed this possibility among the NEA's and the Trojans as special analogs of cometary nuclei from their CCD reflectance spectra.

A detailed scrutiny to find the possible extinct comets among asteroids is difficult since the number of objects of interest is large and they are in general faint. Our endeavour is to short list such candidates for detailed future analysis from narrow band CCD photometry of all possible asteroids that are likely to show cometary activity. Our observational program also included a few faint comets for CCD photometry. Each object of interest was observed in two filters one centered on C_2 emission band at 5140A (90A bandpass) and the other one centered on nearby continuum at 4845A (65A bandpass) in order to easily distinguish the objects with cometary like activity from their intensity ratio in the two filters. During the four observing nights, (21st, 22nd February 1991 and 10th,11th March 1991) at f/13 cassegrain focus of the one meter telescope of the Vainu Bappu Observatory (VBO), Kavalur, we could observe twelve asteroids, one comet and a few G type standard stars. Asteroids were chosen such that they were near stationary during the observing run. The EPHEM program by Dr.Dave Tholen was used to generate the ephmerides. The exposure time through the two interference filters ranged from 5 to 30 minutes. Each object was observed in two filters. The motion of each object from one frame to the other was checked for consistency with the expected change in pixel position. Basic CCD calibration viz. corrections for bias, dark and flat field were done using the Starlink EDRS package available at the VAX–VMS, at the VBO. The mean bias value is subtracted from all the image frames. To cörrect for the pixel-to-pixel sensitivity a master flat is obtained (in each filter) which is the average of a few normalizeed flat fields taken from the morning/evening sky. The magnitudes were determined for each object by aperture photometry programs adapted from the Starlink software package and modified to suit the Comtal environment. The sky contribution was subtracted from measurements of a region nearby. The corrections for atmospheric extinction was done using the average extinction coefficient 0.25 in V valid for Kavalur. The observed magnitude difference through the two filters (m_c,m_l) was found to be peaking at a value of 0.5 for most of the asteroids while it is 1.18 for Comet Aarseth Brewingt. These results are given in Table 1. In Table 1, the column 3 gives the V magnitude at the time of observation and column 5 gives the magnitude difference through the two filters. All the results reported here are from a single act of measurements for each object. Results for the G–type stars observed are also included in Table 1 and Figure 1. As the exposure times for the stars are short, the results for them would be least affected by variation in the sky condition and hence would represent the lower limit to the expected ratio of intensities through the two filters.The slightly larger value found for 63 Ausonia, 665 Sabine and 754Malabar could be due to small variations in sky conditions between the two exposures and therefore needs to be confirmed.

As the CCD field at the f/13 focus of the one meter telescope is only 2'x 2'.5 we do not sometimes get a field star in each frame to monitor the variation in the sky between the two exposures. We hope to get over this problem by using prime focus of the 2.34-m Vainu Bappu Telescope where the CCD field is 4'x6'. This would also considerably reduce the exposure times and allow us to observe fainter objects. The histogram (Fig.1) shows that probably none of the asteroids observed have faint C_2 emission.

References

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Sl.No.	Object	V	EXP(SEC)	(mc-m1)
1.	667 DENISE	12.84	300	0.60
2.	665 SABINE	13.30	900	0.72
3.	63 AUSONIA	11.20	300	0.70
4.	31 EUPHROSYNE	11.74	300	0.55
5.	109 HERA	12.42	600	0.54
6.	754 MALABAR	14.0	1800	0.68
7.	925 ALPHONSINA	12.56	1200	0.52
8.	449 HUMBURGA	13.5	1800	0.47
9.	68 LETO	12.16	1500	0.57
10.	11 PARTHENOPE	11.15	1200	0.55
11.	784 PICKERINGIA	13.41	1800	0.55
12.	912 MARITIMA	14.42	1800	0.51
13.	COMET AARSETH BREWINGT	7.69	300	1.18
14.	M67 REGION 3 STAR(12)	12.27	1200	0.48
15.	M67 REGION 3 STAR(17)	12.67	1200	0.49
16.	HR5235 (GO IV)	2.68	1	0.49
17.	HR5384 (G 1 V)	6.27	30	0.47
18.	HR140931 (GO V)	8.21	60	0.47
19.	HR5868 (GO V)	4.43	60	0.49

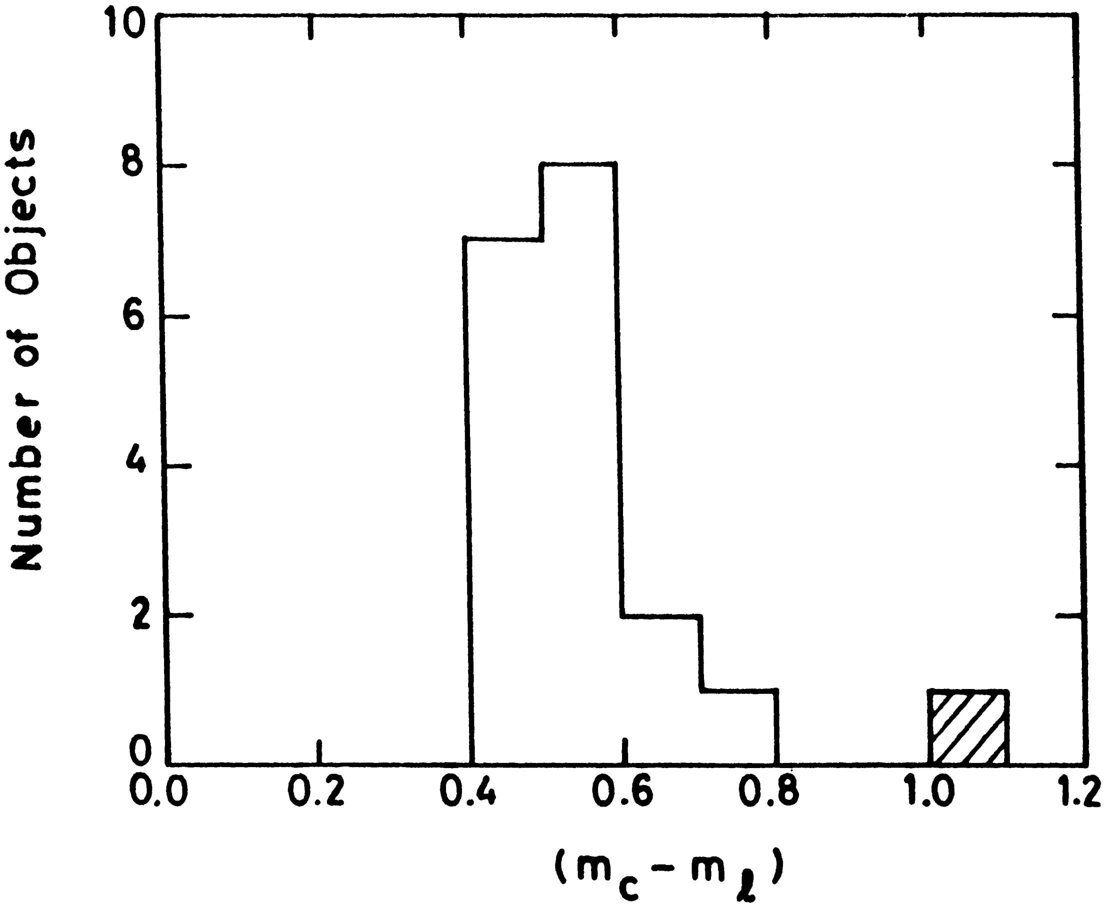

Fig. 1 Histogram of the observed magnitude difference in the continuum filter (4845 - 65A band pass) and the C_2 emission band (5140 - 90A band pass) in 12 asteroids, 6 G-type stars and the Comet Aarseth Brewingt. The Comet value is shown shaded.