

Search for Variable Stars in the Open Cluster NGC 2539

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Abstract. We report on the results of CCD photometric observations of the open cluster NGC 2539. Eight new variable stars have been found in the observed field of this cluster. However, no γ Doradus-type variability was found among the member stars.

Since 1998 we have been performing a long term project for CCD photometric survey of open clusters, as well as time-series photometry, to search for variable stars in the clusters at the Bohyunsan Optical Astronomy Observatory (BOAO). As a part of this project we have carried out *UBVI* CCD photometry and *V* filter time-series photometry of the open cluster NGC 2539. The observations were done for ten nights between February and March of 2000, with the 1.8m reflector and an SITe 2K CCD camera at BOAO. Figure 1 shows the observed field of the cluster.

From the *UBVI* photometry of NGC 2539, we have derived a reddening value $E(B - V) = 0.06 \pm 0.03$, a true distance modulus $(V - M_V)_0 = 10.2 \pm 0.1$, and an age of $\log t$ [*yr*] = 8.8, using the empirical ZAMS (Sung & Bessell 1999) and the theoretical isochrone with $Z = 0.019$ (Girardi et al. 2000).

We have examined the light curves of 583 stars from *V* filter time-series images and have discovered eight new variable stars among them. Five of them are classified to be eclipsing binary stars, and the others are: one δ Sct star, one field γ Doradus star, and one field SPB star. Basic parameters of the eight variable stars are summarized in Table 1. We could not find any γ Doradus-type pulsating stars among the member stars in this cluster. This result is consistent with Krisciunas & Patten (1999)'s suggestion that the γ Doradus-type phenomenon occurs only in an open cluster younger than about 250 Myr.

References

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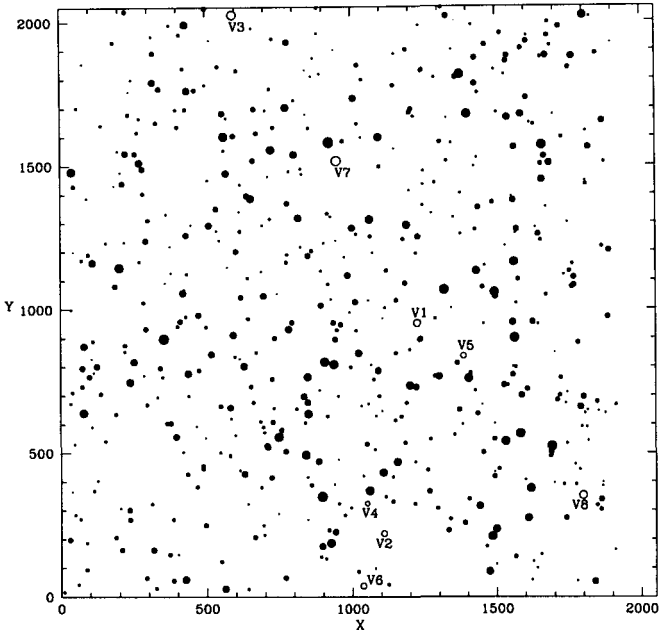


Figure 1. Observed CCD field ($11'6 \times 11'6$) of the open cluster NGC 2539. Eight new variable stars are represented by open circles with their IDs.

Table 1. Basic parameters of eight new variable stars in NGC 2539

ID	V^1	$B - V^1$	Period	ΔV_{max}	Epoch ²	Type
V1	13 ^m 213	0 ^m 255	0 ^d 055	$\sim 0^m02$	2451597 ^d 1575	δ Sct
V2	14 ^m 290	0 ^m 577	0 ^d 352	$\sim 0^m04$	2451585 ^d 13	field(?) γ Dor
V3	11 ^m 847	0 ^m 086	1 ^d 092	$\sim 0^m06$	2451618 ^d 05	field(?) SPB
V4	15 ^m 652	0 ^m 739	0 ^d 292	$\sim 0^m25$	2451591 ^d 025	eclipsing binary
V5	14 ^m 584	0 ^m 749	0 ^d 340	$\sim 0^m13$	2451596 ^d 06	eclipsing binary
V6	14 ^m 301	0 ^m 581	0 ^d 945	$\sim 0^m13$	2451617 ^d 99	eclipsing binary
V7	11 ^m 050	1 ^m 603	1 ^d 964	$\sim 0^m07$	2451630 ^d 07	field eclipsing binary
V8	12 ^m 527	0 ^m 250	0 ^d 700	$\sim 0^m04$	2451629 ^d 15	eclipsing binary

¹average visual magnitude and color

²at the maximum brightness for pulsating stars and the minimum for eclipsing binary stars