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A Variable Star Survey of the Open Cluster NGC 2126

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We present the first CCD photometric observations of the northern open cluster NGC 2126 in the constellation Auriga. Johnson-Cousins V(RI)$_C$ data (with a total time span of $\sim$57 hours) were taken on eight nights in 2002 February and December at the Piszkéstető Station of the Konkoly Observatory, using the 60/90/180-cm Schmidt telescope. We have discovered six new variable stars and have estimated the main characteristics of the cluster.

The results of the project can be summarized as follows. Cluster parameters were estimated by fitting isochrones (Bertelli et al. 1994) to the colour-magnitude diagrams. In order to decrease foreground contamination, we have examined the proper motion distribution of stars in the field using data taken from the USNO B-1.0 catalogue (the cluster itself has undetected proper motion). To minimize the effects of background stars, we used only the inner 8′ of the cluster. The resulting physical parameters are: $m - M = 11\overset{\mathrm{m}}{.}0 \pm 0\overset{\mathrm{m}}{.}5$, $E(B-V) = 0\overset{\mathrm{m}}{.}2 \pm 0\overset{\mathrm{m}}{.}15$, $d = 1.3 \pm 0.6$kpc.

Of the six variables, V1 and V2 showed clear variability, however, our dataset is too short to determine types or periods. V3 and V5 showed rapid oscillations with full amplitudes of a few tens of mmag. The periods and period ratios (V3: $f_1/f_2 = 0.81$, V5: $f_1/f_2 = 0.94$) suggest low-order radial overtone (V3) and non-radial (V5) δ Scuti-type pulsations for the two stars. We also discovered an Algol-type eclipse for V4.

The most interesting variable star is V6. We observed well-defined minima and steady oscillations outside eclipses with amplitude and cycle length characteristic of δ Sct pulsation. With these properties V6 seems to be an eclipsing binary with at least one pulsating component. The period analysis resulted in $P_{\rm orb} = 1.17320(3)$ d. The oscillations outside eclipses seemed to be stable, with a period of $P_{\rm pul} = 0.12936(24)$ d. An interesting result is that $P_{\rm orb}/P_{\rm pul} = 9.07 \pm 0.02$, suggesting that there might be a 1:9 resonance between the orbital motion and pulsation. A low-resolution optical spectrum is consistent with an F-type star, so that the oscillations may be attributed to δ Sct pulsation. From the astrometric study its cluster membership can be excluded; it is a foreground object.

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References

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