

COMMISSIONS 27 AND 42 OF THE IAU  
INFORMATION BULLETIN ON VARIABLE STARS

Number 4283

Konkoly Observatory  
Budapest  
2 January 1996

*HU ISSN 0374 - 0676*

**THREE NEW VARIABLE PLANETARY NEBULA CENTRAL STARS:  
M 2-54, M 4-18 AND NGC 2392**

We are presently engaged in a search for variable central stars of young planetary nebulae in order to shed more light on the cause of the variability of these stars. Previously, this has increased the number of known variables to 12 (Handler, 1995). In this note we report the discovery of three further related objects.

Our observations were carried out in August to December 1995 with the Texas two-channel photometer attached to the 0.9m and 2.1m telescopes at McDonald Observatory, respectively. We employed only channel 1 to acquire differential photometry. To prevent variable influence of the nebular background caused by variable seeing or poor guiding, we always included the whole nebula in the aperture.

We measured two comparison stars (C1 and C2) together with the the planetary nebula (PN) in the order: C1-PN-C2-C1-PN-C2-... The comparison stars, typically of 9–10 mag, were integrated for about 60 seconds, the planetary nebula about 120–240 seconds, depending on its magnitude. In order to minimize the nebular contribution to the data, Johnson *V* or Strömrgren *y* filters were used.

All data were corrected for sky background and for extinction. No dead-time correction was applied. The relative zeropoints of the measurements of the different stars were calculated for the first night and subtracted from the data except for a small offset for plotting purposes. These relative zeropoints were applied for all other nights of observation. The resulting light curves were analysed for variability. To allow the reader to judge the quality of the data, we did not compensate for variations in sky transparency or for possible tube drifts.

**M 2-54:** All the observations of this object were acquired with the 0.9m telescope through a Johnson *V* filter. We first measured the star on August 30, 1995. The light curve (Figure 1, left panel) was not of very good quality. However, a drift in the magnitudes of M 2-54 was visible, leading us to suspect that the central star could be variable. Consequently, we obtained a second run on October 23, 1995 under much better photometric conditions. Fortunately, the star also co-operated and became fainter by almost 0.2 magnitudes in 6 hours (Figure 1, right panel).

Needless to say, we conclude that M 2-54 is variable. However, from the present data we cannot infer the timescale of the light modulations. More extensive observations, preferably from at least two sites, are necessary.

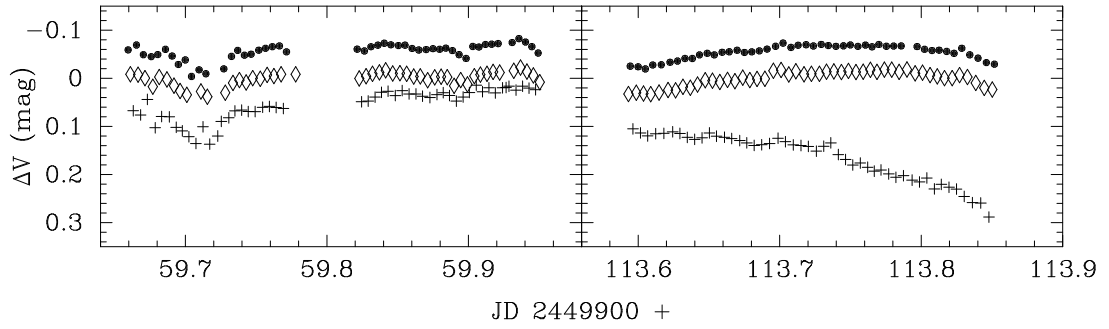


Figure 1: Light curves of M 2-54 (crosses) relative to the comparison stars SAO 34899 (dots) and SAO 34900 (diamonds)

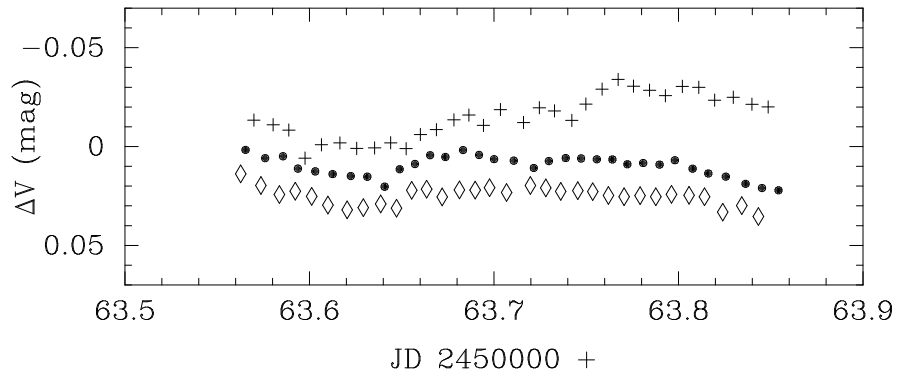


Figure 2: Time-series photometry of M 4-18 (crosses) relative to the comparison stars BD+60°806 (dots) and SAO 13101 (diamonds)

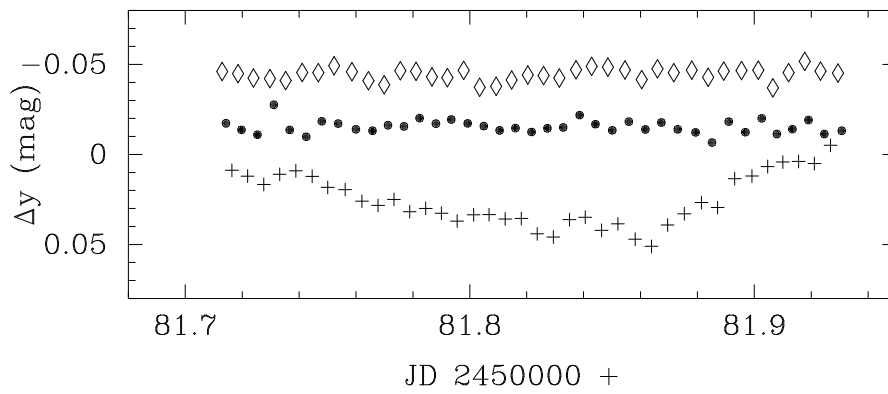


Figure 3: Light curve of NGC 2392 (crosses) relative to the comparison stars BD+21°1613 (dots) and SAO 79446 (diamonds)

We are careful to note that the gap in the August data was not caused by bad photometric conditions, but by a temporal failure of telescope tracking. The trend in the comparison star data taken in October is due to tube drift and is not caused by a wrong choice of the extinction coefficient.

**M 4-18:** We observed this object with the McDonald Observatory 2.1m telescope in the night of December 12, 1995 through a Johnson *V* filter (Figure 2). The central star brightened by about 0.03 mag during the 7 hours of observation. Thus, it is the lowest amplitude variable we discovered so far. Due to the good photometric conditions, under which the measurements were acquired, we consider the variability of M 4-18 to be well established.

Similarly to our conclusion for M 2-54, we recommend more observations of M 4-18 to unravel the timescale of its light modulations. However, due to the faintness of the star ( $V \approx 13.9$ ), CCD observations or a large telescope are required.

**NGC 2392:** We measured this planetary nebula on December 30, 1995 with the 0.9m telescope. Since the object consists of both a bright central star (HD 59088) and a large nebula (the famous Eskimo Nebula), we acquired our data through the Strömngren *y* filter. The resulting light curve is shown in Figure 3.

The timescale of the light modulations seems to be near 4–5 hours. However, since the variability of this kind of central stars is not strictly periodic (e.g. Handler et al., 1996), that value can be in error. NGC 2392 would be an object very well suited for both spectroscopic and photometric multisite observations.

*Acknowledgements:* This research was partially supported by the Austrian Fonds zur Förderung der wissenschaftlichen Forschung under grant S-7309 and by the Austrian Zentrum für Auslandsstudien.

G. HANDLER \*  
 Institut für Astronomie  
 Türkenschanzstraße 17  
 A-1180 Wien, Austria  
 E-mail: HANDLER@ASTRO.AST.UNIVIE.AC.AT

\* Guest observer  
 McDonald Observatory,  
 The University of Texas at Austin

#### References:

- Handler, G., 1995, *IBVS*, No. 4244  
 Handler, G., Méndez, R. H., Medupe, R., et al., 1996, *A&A*, in preparation