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VARIABLE STARS IN LYNDS 810

The large dark globule Lynds 810 located on the Vulpecula-Cygnus border is unusual in containing a centrally-located nebula as well as several bright superimposed stars (Herbst and Turner 1976). Most of the latter are foreground stars which lie along the $\sim$ 2.5 kpc line of sight to Lynds 810 (Turner 1986), but a few faint objects appear to be nebulous knots or stars that are possibly embedded in the globule (Herbst and Turner 1976). Neckel et al. (1985) have recently discussed the status of four of these, and have noted that one (number 7 in their identification system) is a variable star which coincides with an infrared source and with the end of a luminous jet running across the densest portions of the globule. The three others (numbers 8, 9 and 10) are nebulous condensations according to Neckel et al. This notes presents information pertaining to possible variability of all four objects as inferred from magnitude estimates from photographs of Lynds 810.

Figure 1 is a reproduction of a 60^m exposure of Lynds 810 using an O98-04 emulsion and OG610 filter obtained on the night of August 22, 1977 (JD 2443377.629) by Alan Dressler with the 2.5-m Dupont telescope on Cerro Las Campanas. The plate-filter combination for this exposure has a wavelength response similar to that of the POSS E-plate of the field obtained in July 1951 (JD 2433835.867), reproductions of which have been published by Herbst and Turner (1976) and Neckel et al. (1985). Star identifications in Figure 1 correspond to the numbering systems of these authors.

Stellar magnitudes were derived from the POSS E-plate of Lynds 810 using image diameters measured from a photographic enlargement of a glass copy of the plate in conjunction with a calibrated UBV sequence of nine stars from Turner (1986). The relation (B-R) = 1.6 (B-V) was adopted to obtain R magnitudes for the calibration stars (which span the interval R = 10.9 to 13.6), and the resulting image diameter-magnitude relation was determined to be linear over the interval R = 11.4 to 13.6. The results of Schaefer (1981) were used to justify linear extrapolation of this relation to R $\simeq$ 17.5, thereby making possible magnitude estimates (to $\pm$ $0^m.2$) for a number of stars in the field brighter than this. Many of these stars were then used to calibrate the relation between image diameter and magnitude for stars measured from Figure 1.

Table I summarizes the information from Figure 1 and the POSS E-plate pertaining to the four nebulous objects 7, 8, 9 and 10 of Neckel et al. (1985). They are indicated by crosses in Figure 1. Their positions were determined with reference to SAO stars in the field, and their magnitudes were estimated with some allowance made for their non-stellar appearance. For comparison purposes, the R magnitudes of stars 6, 11 and 12 are estimated to be 12.5, 16.9 and 15.4 respectively. Information on each object is discussed below:

Object 7. This object has clearly varied by $\sim 2^m$ from R = 15.7 in 1951 to R > 17.5 in 1977, and appears at an intermediate brightness level (R $\simeq$ 16.8) in the 0.66 μm CCD image published by Neckel et al. Although the star is absent from Figure 1, some of the surrounding nebulosity is clearly visible. Similarly, the star is faintly visible in a 0.9 μm CCD image and not visible in a 0.85 μm CCD image published by Neckel et al. Since no dates are provided for these CCD images, the time scale of variability is uncertain, although it might be on the order of days. The infrared spectrum of this object has been described by Neckel et al. (1985) and has been demonstrated to be equivalent to a total luminosity of about 350 $L_\odot$. It is clearly the dominant heating source of Lynds 810 (Neckel et al. 1985), but its spectral type is unknown. The amplitude of variability and the close connection with Lynds 810 indicate that it belongs to the In class of Orion variables. A more specific designation must await further study of the object.

Object 8. This nebulous knot appears to be at roughly the same brightness in the 1951 and 1977 photographs, as well as in the 0.66 μm CCD image published by Neckel et al. (1985). It is apparently not a light variable, although like object 7 it lies in the densest portions of Lynds 810. Since it is distinctly bluer than object 7 and also bluer than expected for an object this faint at the distance of Lynds 810 (Turner 1986), it is most likely a reflection nebula associated with object 7.

Object 9. This nebulous object is the brightest of the four on the POSS E-plate, but is not visible on any later photographs. Its absence from the POSS O-plate implies (B-V) > 4, indicating heavy reddening. The possibility arises that it is simply a plate flaw, although two larger images northwest of Lynds 810 on the POSS E-plate are obvious emulsion flaws of different character from object 9. Alternatively, it may be a large amplitude variable, possibly a nova, which lies

Table I

Object	α_{1950}	δ_{1950}	R(1951)	R(1977)
7	$19^h\ 43^m\ 22^s.2$	+27° 43' 39"	15.7	>17.5
8	$19^h\ 43^m\ 21^s.9$	+27° 43' 52"	17.5	17.5
9	$19^h\ 43^m\ 21^s.1$	+27° 41' 11"	15.2	>17.5
10	$19^h\ 43^m\ 20^s.0$	+27° 41' 32"	16.9	>17.5

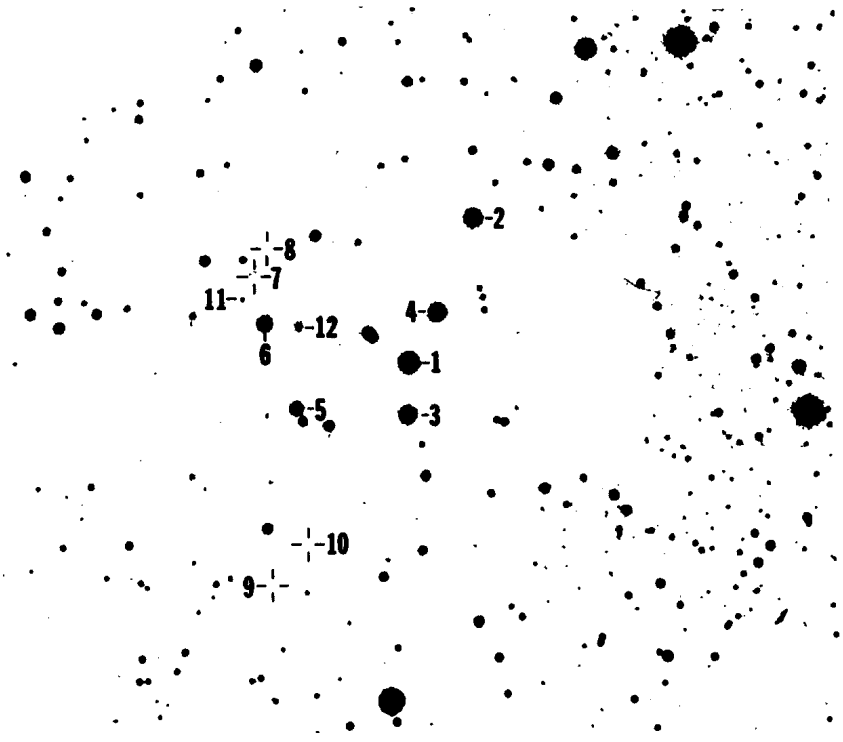

Figure 1

beyond Lynds 810. Objects 9 and 10 lie on the optical boundaries of the cloud and seem unlikely to be directly associated with it. However, the extremely red colour and nebulous appearance of object 9 on the POSS both argue that it lies on the far side of Lynds 810. Additional observations of this object are needed to properly classify it.

Object 10. This nebulous knot is clearly visible on the POSS E-plate but is not visible in Figure 1 or in the POSS O-plate. The latter result implies that (B-V) > 3. A faint object appears at its location in the 0.9 μm CCD image published by Neckel et al. (1985), so it is presumably not a plate flaw. Like object 9 its extremely red colour and nebulous appearance argue that it lies beyond Lynds 810. It also requires additional observations for proper classification.

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