

**The Galaxy and its Companions:  
Poster Papers**

## Interesting Variables near the Quintuplet Cluster

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**Abstract.** Two of the five cocoon stars in the “Quintuplet” cluster of young, luminous objects, located about 30 pc in projection from the Galactic Centre, are variables. The nearby “Pistol Star”, also called the “Serendipitous Star”, and a similar object, both suspected on spectroscopic grounds of being Luminous Blue Variables, have indeed been found to vary, confirming their tentative classification. A further variable apparent member of the cluster is probably a Mira in the same line of sight.

### 1. Observations

We have been conducting a *K*-band ( $2.2\ \mu\text{m}$ ) survey of the inner Bulge of the Milky Way with the intention of finding luminous long-period variables. This region is obscured by interstellar dust at visible wavelengths. Typically, four observations of each of 25 fields were made during the Galactic Centre seasons of the years 1994 through 1997. In addition, a few observations were made at *J* and *H*, but these are not reported on here. The PANIC camera that was used incorporates a large-format PtSi detector (effectively  $1040 \times 520$  pixels; see Glass, Sekiguchi & Nakada, 1995). With the 0.75-m telescope at Sutherland, a single exposure covered  $5' \times 5'$ . Taken together, all 25 fields make up an area of  $24' \times 24'$ , centred on the Galactic Centre. The particular field discussed here is no. 13 of the 25. It is centred at 17h 45m 25.5s,  $-28^\circ 50' 50''$  (2000). It includes the interesting cluster known as the “Quintuplet” which, like the Galactic Centre cluster, contains many young ( $10^6$ – $10^7$  yr) luminous early-type stars, Wolf-Rayets, dust-enshrouded or cocoon stars and a late-type supergiant.

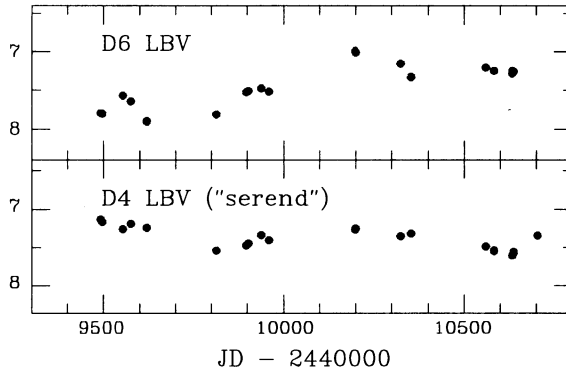


Figure 1.  $K$  light curves of the putative LBVs in the neighbourhood of the Quintuplet. Star D4 is the Serendipitous/Pistol star and star D6 is the LBV. Photometric errors run from  $\sim 0.04$  mag at  $K = 8$  to  $\sim 0.13$  mag at  $K = 11$ , though other sources of error occasionally contribute.

Figure 1 shows light curves of the two putative LBVs identified in the neighbourhood of the Quintuplet.

The light curves of bright, close-in, apparent members of the Quintuplet are given in Fig. 2. Many stars do not vary at our level of detectability. However, stars Q2, Q3 and Q5 do show significant variation.

## 2. Discussion

### 2.1. Luminous Blue Variables

The Luminous Blue Variables (LBVs), also known as Hubble-Sandage Variables, form a small group of stars which have been noted in the Galaxy, the LMC, M31 and M33. Their properties have been summarized by Humphreys & Davidson (1994). Variations of several types may occur: giant eruptions ( $\geq 2$  mag), eruptions (1–2 mag) on time scales of 10–40 years, oscillations of  $\sim 0.5$  mag on time scales of months to a few years and microvariations of  $\leq 0.1$  mag. Their bolometric luminosities lie in the range  $-8.8$  to  $> -11$ .

Several of the members of the cluster at the Galactic Centre are thought to be LBVs (e.g. Libonate et al. 1995). In the Quintuplet, the “Serendipitous Source”, an  $H\alpha$  and HeI emission-line star found by Moneti, Glass and Moorwood (1994), has been classified by Figer, McLean & Morris (1995) as an LBV on spectroscopic grounds. It appears to be the source of Ly continuum radiation responsible for the ionization of the “Pistol” radio continuum feature. It is D4 in the present work. More recently, a second star (D6 in the present list) has been classified tentatively as an LBV (Figer, McLean & Morris, 1998).

Figure 1 shows that both these stars are clearly variable. The Serendipitous star has a  $K$ -amplitude of  $0.47 \pm 0.06$  mag and D6 has an amplitude of  $0.92 \pm 0.06$  mag. Neither object appears to have a regular period on the time-scales

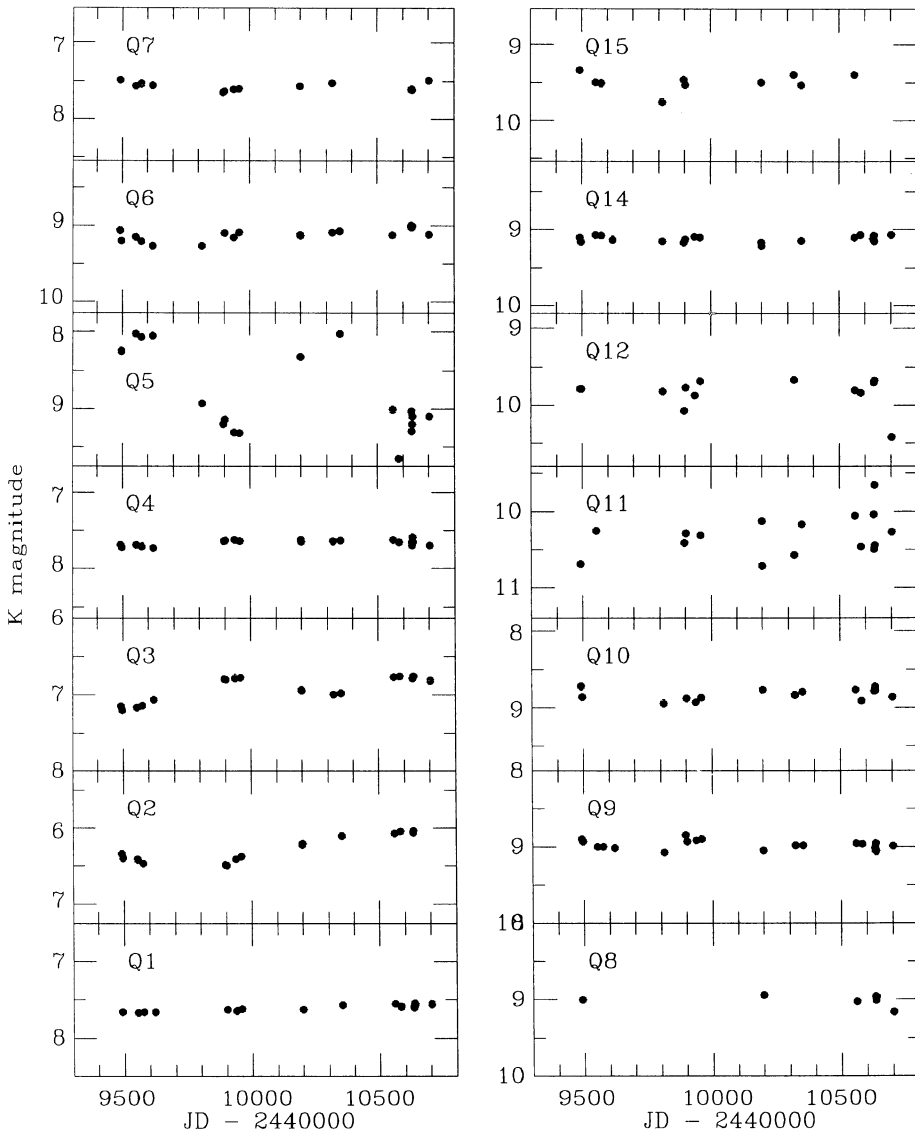


Figure 2. *K* light curves of 14 bright members of the Quintuplet. The identifications (Q numbers) are taken from Glass, Moneti & Moorwood (1990). The scatter in Q11 and Q12 may be due to crowding or faintness; this figure should only be used to establish upper limits to the variability of the sources. Only stars Q2, Q3 and Q5 are likely to be real variables.

covered. The present result is further evidence that the LBV classifications of these stars are correct.

## 2.2. Quintuplet Variables

Stars Q2 and Q3 show variations at  $K$  of  $0.46 \pm 0.06$  and  $0.44 \pm 0.06$  mag respectively (Fig. 2). These objects are members of the original “Quintuplet” of cocoon-like stars for which the cluster is named. Although early workers (Okuda et al. 1990; Glass, Moneti & Moorwood, 1990) favoured the idea that they are protostars, others believe that they are dusty WC (Wolf-Rayet) types. They show no spectral features except the silicate absorption bands.

## 2.3. Long-Period Variables

One close-in apparent member of the Quintuplet cluster, Q5, appears to be a large-amplitude red variable (Mira) of period 680 days. If it is really a Mira, it cannot be a true cluster member on grounds of age.

Long-period variables are common in the inner Bulge. Several hundred have been identified so far. Preliminary results of the overall  $24' \times 24'$  survey were published by Glass et al. (1996) and a second report will be found in Glass et al. (1999).

A detailed paper on the Quintuplet results has been submitted to MNRAS.

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