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An Optical Outburst of the Cataclysmic Variable in M22

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Abstract. Cataclysmic variables (CVs) formed through close encounters may be the most abundant class of compact binaries in globular clusters. As part of a systematic search for CVs undergoing dwarf nova eruptions (DN) in globular clusters, our 2004 monitoring program of M22 detected an outburst of a CV candidate during May. We present a light curve for the May 2004 period, obtained using the *ISIS* image subtraction routine. Our ground based results are in good agreement with previous *HST* measurements, and confirm the DN nature of the outburst and the object's CV status. Further application of the *ISIS* software will enable us to identify other DN candidates in the core of M22 with the aim of characterizing the properties of these systems, as opposed to similar ones in the field.

1. Introduction

Compact binary systems in globular clusters are an important target for observations. The process of their formation, unlike primordial field binaries, is thought to be three-body collisions and tidal capture (e.g. Hut & Verbunt, 1983), leading in general to very close binaries, with perhaps different properties relative to their counterparts in the field. So far relatively few DN outbursts of globular cluster CVs have been observed (e.g. Shara, Bergeron, Gilliland, *et al.*, 1996; Ó Tuairisg, Butler, Shearer, *et al.*, 2003) compared to the predicted populations of such systems and it is of significant interest to determine if this is due to an underlying difference in the nature of the cluster CVs compared with field CVs. Furthermore, the presence of HeII emission lines in the *HST* spectra of these systems suggests a possible magnetic nature (Grindlay, Cool, Callanan, *et al.*, 1995).

To characterise these systems we present results from a long-term monitoring program of the globular cluster M22 during which a DN outburst of a cluster CV was observed.

A ∼3 magnitude brightening of the same source was originally interpreted by Sahu, Casertano, Livio, *et al.* (2001) as a gravitational microlensing of a background bulge star by a low mass foreground cluster object. Subsequent analysis of *HST* data by Anderson, Cool & King (2003) prompted reclassification of the object as a cluster CV, *CV1*.

2. Observations and Data Analysis

Observations obtained from the 1.3m telescope at the *Cerro Tololo Inter-American Observatory* (*CTIO*) in Chile cover the period of March - November 2004. The dataset consists of 6x6 arcminute optical V-band images centred on the core of M22.

Photometry was performed on the crowded-core CV using the *ISIS* image subtraction software (Alard & Lupton, 1998; Alard, 2000). The light curve shows the ∼15 day

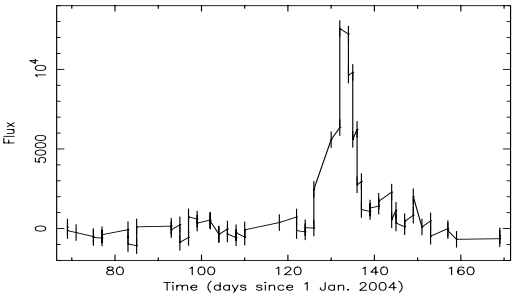

Figure 1. The *ISIS* differential flux light curve for the DN eruption of the M22 CV.

May outburst (Figure 1), the only large outburst seen in nine months of monitoring. Subsequent data showed several spikes above noise-level which may be shorter-timescale outbursts, but better sampling is necessary to confirm this.

3. Discussion

The outburst characteristics are consistent with the approximate 3.5 magnitude, 18 day 1999 outburst reported by Sahu *et al.* (2001). It also fits easily into the DN category, and the repeated outbursts together with the proper motion studies of Anderson *et al.* (2003) effectively confirm the CV nature of the source.

The next step is to search for lower-amplitude, shorter-timescale outbursts from *CV1* and other globular cluster CVs. Such outbursts would suggest an Intermediate Polar (IP) type. IPs are weak-field magnetic CVs harbouring truncated accretion disks which have been shown to lead to shorter outburst durations, especially in the V-band, compared to non-truncated disks. Even though outbursts starting at the inner disk edge are predicted to be rare in IPs, those starting at the outer edge are as frequent as in non-magnetic systems, hence small DN eruptions may not be uncommon in this class. Magnetic systems are also predicted to show a shorter outburst decline time (Angelini & Verbunt, 1989), so careful monitoring of the outburst lightcurve morphology during the decay from maximum brightness could help discriminate between a magnetic and non-magnetic system.

Although our data do not provide conclusive evidence as to the IP nature of *CV1*, we believe that ground-based studies of DN outburst morphologies have a role to play in constraining the nature of globular cluster CVs. Further monitoring is necessary to confirm a possible magnetic nature for the CV and for CVs in other globular clusters.

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