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**THE FEBRUARY 1999 OUTBURST OF THE  
DWARF NOVA CI Gem**

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CI Gem (S3428) is a poorly known cataclysmic variable. It was discovered by Hoffmeister on Sonneberg plates as a dwarf nova or novalike star; it reached a maximum of  $m_{pg} = 14.7$  on 1940 Jan 3, declined by about  $1^m$  in the subsequent 10 days, and dropped below the plate limit after 16 days. The light curve is shown in Ahnert et al. (1947) and Wenzel (1990). A hand-drawn finding chart was published by Hoffmeister (1957). On this basis, Duerbeck (1987) tentatively identified CI Gem at its minimum stage with a fairly blue star of  $18-19^m$ . This star is listed as 1050-03707552 in the USNO-A2.0 catalog (CDS VizieR service).

Wenzel (1990) reported three additional outbursts on 1963 October 15 ( $m_{pg} = 16.5$ ), 1966 February 23 ( $m_{pg} = 16.5$ ), and 1986 December 3 ( $m_{pg} = 14.5$ ).

A new outburst was found by one of us (P.S.) on an unfiltered CCD frame taken 1999 February 18.185 (UT) by Mark Parker with the UC Santa Barbara Celestron-14 telescope. On a unfiltered frame taken February 16.172 (UT) with the University of Iowa 0.5-m IRO robotic telescope, the object was still below (or at?)  $R \approx 18.6$ . Aperture photometry of the discovery image yields  $R \approx 15.8$ , using a local sequence by Duerbeck (in preparation). On 1999 February 18.98 (UT), Pepe Vilchez and Peter Sorensen used the wide field camera at the prime focus of the 2.5 m Isaac Newton telescope (INT). They obtained one  $B$  and two  $R$  frames which show the object at  $B = 15.85$ ,  $R = 15.76$  (Fig. 1). Additional images from IRO yield  $R \approx 16.4$  and  $16.8$  on February 20.178 and 21.160 (UT), respectively. According to Kato and Schmeer (1999; see also

<http://www.kusastro.kyoto-u.ac.jp/vsnet/LCs/index/gemci.html>),

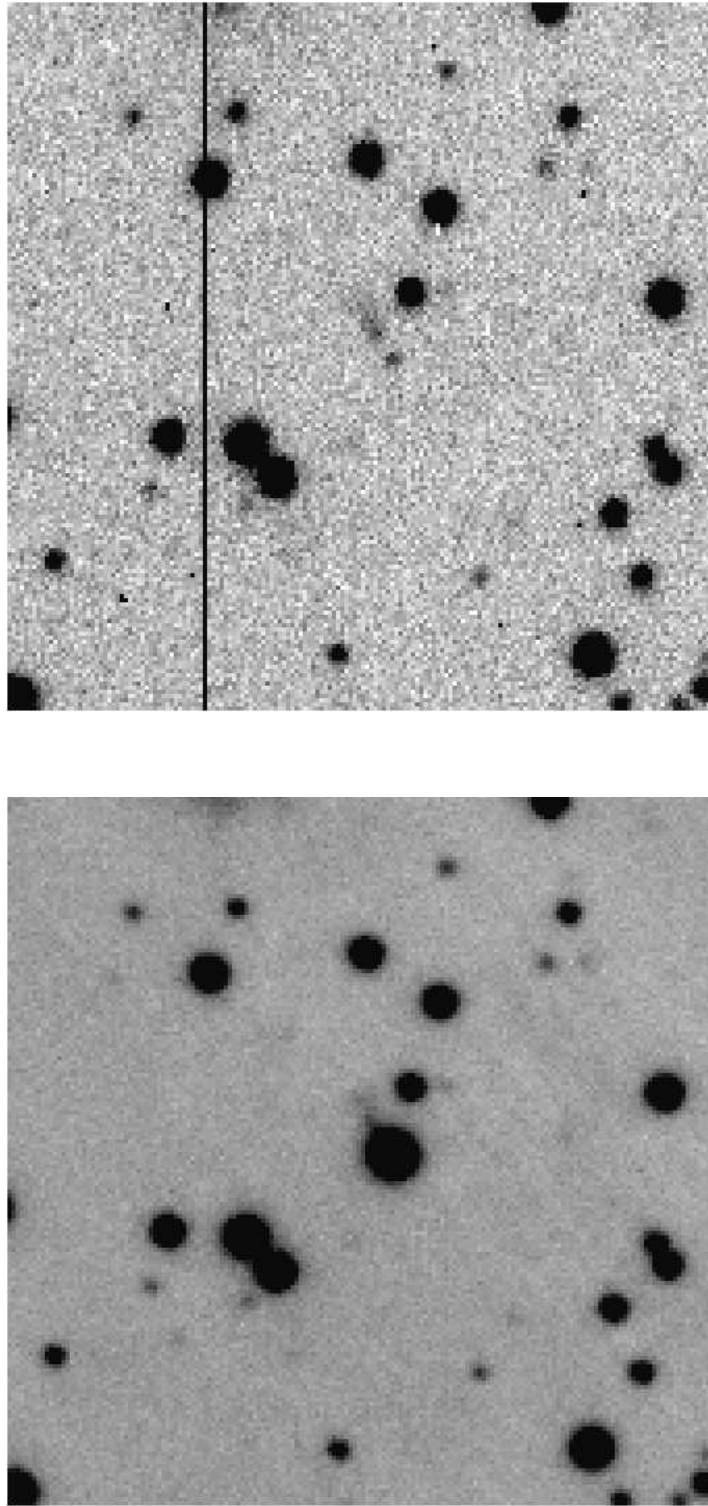
CI Gem was at  $V = 15.9$  on 1999 February 19.5 (UT), and dropped by  $2^m$  in three days.

Its position was determined on the INT-frames, using seven nearby stars selected from the USNO-A2.0 catalog, with the aid of the MIDAS/ASTROMET package:

RA =  $06^h30^m05^s.86$ , Decl. =  $+22^\circ18'50''.7$  (equinox J2000.0).

It lies about  $7''.5$  south of 1050-03707552.

Archival CCD frames of the field, taken 1989 January 11 with the ESO/Danish 1.54-m telescope at La Silla, clearly show a fairly red object at the exact place of CI Gem, with  $V = 21.66$ ,  $B - V = 0.8$ ,  $V - R = 0.91$  (Fig. 1). In  $B$ , the object is at the limit of visibility, and the error in the colour index may amount to several  $0^m.1$ .



**Figure 1.** The field of CI Gem in 1989 and in 1999, taken in the  $R$  band with the ESO/Danish 1.54-m telescope and the Isaac Newton 2.5-m telescope, respectively. North is up and west to the right. The field is about  $80'' \times 80''$ . The outburst image of 1999 coincides with a faint starlike object in the centre of the image. Some nonstellar objects are found in its vicinity

The galactic extinction was estimated using the routine EXTINCT by Hakkila et al. (1997). It reaches a maximum value of  $A_V = 0.39 \pm 0.20$  at 2 kpc. Thus, the red colour of CI Gem cannot be due to interstellar reddening. Several neighbouring objects are clearly galaxies – also an indication of low reddening in this direction. The starlike appearance of the object at minimum makes the identification quite certain.

The 1940 eruption was a bright outburst, which lasted more than 18 days. The 1986 outburst listed by Wenzel was also bright, but of unknown duration, while the 1999 outburst was definitively fainter and shorter (5...7 days). The 1963 and 1966 outbursts were also faint, but too fragmentarily observed to permit any conclusions on their character.

We are reluctant to classify this object as an SU UMa-type dwarf nova, as was done by Wenzel (1990). Kato and Schmeer (1999) analyzed photometry carried out during the recent outburst and found no periodicities below 3.6 hours. A more important criterion is the colour: At minimum, SU UMa-type systems tend to have  $B - V$ -values around 0.10, while SS Cyg-type systems usually appear redder, with  $B - V$ -values around 0.45 (Bruch and Engel 1994). SS Cyg-type systems may also show long and short outbursts (e.g. SS Cyg itself has preferred outburst lengths of 8 and 14.5 days), amplitudes of 5 – 6<sup>m</sup>, as well as outburst intervals of several 100 days (Warner 1995). Vogt (1981) established a statistical relation between orbital period and  $B - V$  colour at minimum; the colour of CI Gem indicates a period of 8...10 hours.

The outburst characteristics of CI Gem, in combination with its red colour at minimum, favour its classification as SS Cyg-type dwarf nova. Only time-resolved photometry during a long outburst can establish the subtype beyond doubt.

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