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OPTICAL SPECTRUM OF CI Aql IN THE PLATEAU PHASE

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CI Aql is a recurrent nova with two records of outbursts in 1917 and 2000. Recurrent novae are one of subclasses of cataclysmic variables (CVs; e.g., see Warner, 1995 for a review) known as very fast novae and characterized by considerably shorter intervals of outbursts compared with those of classical novae. In the 2000 outburst of CI Aql, however, the initial decline was noticeably slow, which was comparable to that of a moderately fast nova (Matsumoto et al., 2001), and the later plateau phase lasting 1.4–1.7 yr was exceptionally long (Lederle & Kimeswenger, 2003; Matsumoto et al., 2003). Kato et al. (2002) pointed out that a recurrent nova IM Nor, whose outbursts were recorded in 1920 and 2002, showed a similar timescale in the light-curve evolution in the 2002 outburst. These recent findings suggest the existence of a new class of recurrent novae with slower evolutions and longer intervals of outbursts, i.e., intermediates between classical novae and recurrent novae.

We obtained optical spectra of CI Aql on 2001 May 11, 375 days after the recorded maximum, by using a liquid-nitrogen cooled CCD (EEV CCD15-11/UV) attached to a classical Cassegrain telescope with a 101-cm aperture at Bisei Astronomical Observatory. Our low-dispersion mode derived a 162 Å mm^{-1} (corresponding to 4.5 Å pixel^{-1}) image scale and wavelength coverage of 4400 Å with center-wavelength of 5700 Å. The exposure time for the object was set to 1200 s, and four object frames were obtained in total (Table). The phase range of the exposures was between 0.82–0.90, using the ephemeris given in Mennickent & Honeycutt (1995). A marginal part of each frame (< 4500 Å), in which sensitivity of the CCD is extremely low, was trimmed prior to procedures of data reductions performed by using the IRAF[1]. Wavelength calibrations were made with an Fe-Ne lamp, and we used HR 7596 (= 58 Aql) as a standard for flux calibrations. Finally, all four spectra were averaged (Figure 1). The signal-to-noise ratio of the continuum determined over 5000 Å to 7000 Å was about 10.

The optical spectrum showed a mildly reddened continuum that was brighter than in the previous quiescence, which confirmed that the object was still over the quiescent level though close to it, as compared with the quiescent spectrum given in Greiner et al. (1996).

[1] IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation. See `http://iraf.noao.edu/` for more information.

Table 1: Log of the spectroscopic observation on 2001 May 11.

HJD at mid exposure	exp. time	orbital phase
2452041.1804	1200 s	0.82
2452041.1956	1200 s	0.85
2452041.2130	1200 s	0.88
2452041.2283	1200 s	0.90

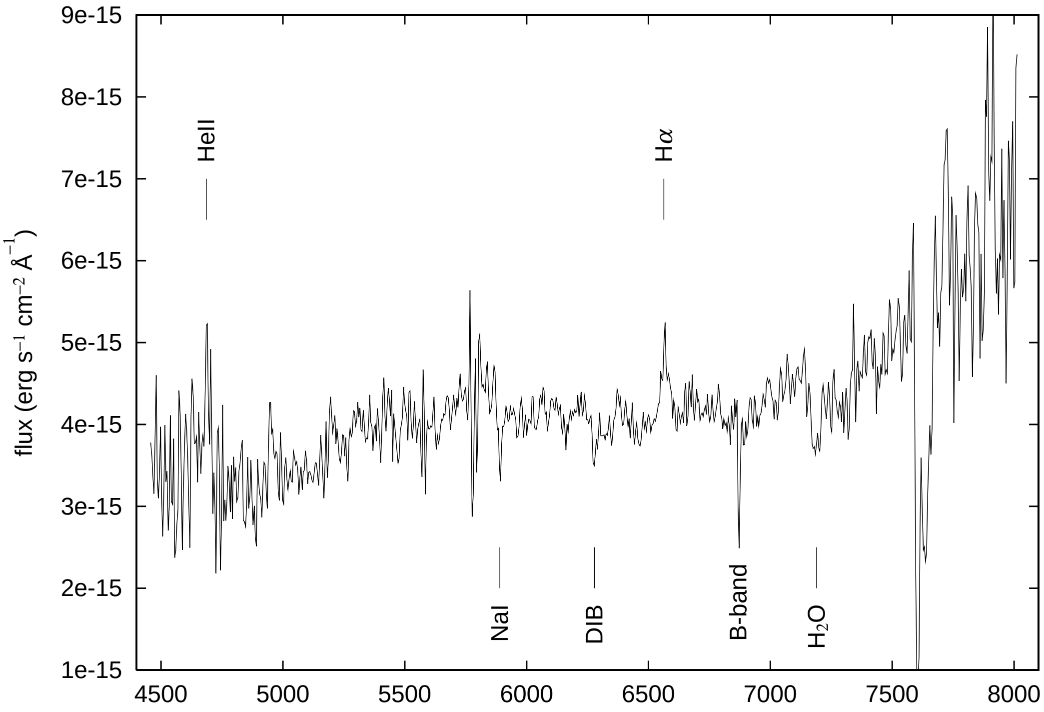

Figure 1. Averaged spectrum of CI Aql on 2001 May 11.

It is known that the optical spectrum of CI Aql in quiescence is characterized by absorption lines of the Balmer series which usually indicates non-CV nature, while HeII at 4686 Å and CIII–NIII complex at $\sim$ 4600 Å are observed as emission features, on a reddened continuum (Mennickent & Honeycutt, 1995; Greiner et al., 1996).

In our spectrum, Hα emission line was clearly identified. We found that the FWZI was about 4800 km s^{-1} and the equivalent width was -10 Å. The doubly-peaked emission feature which had been observed in an earlier phase of the 2000 outburst (Kiss et al., 2001; Matsumoto et al., 2001) became a single-peaked one in this later phase. Such evolution of the line profile is similar to those observed in outbursts of a recurrent nova U Sco (Anupama & Dewangan, 2000) suspected to have a similar configuration of the binary system to CI Aql (Hachisu et al., 2000; Hachisu et al., 2003 and references therein). The wing of the Hα was accompanied by a symmetric broad component, which likely reflects high-speed outflowing such as an expanding shell by the outburst, but contributions of [NII] emission lines at both sides of Hα (e.g., O'Brien & Cohen, 1998) are also possible. HeII λ4686 emission line was weakly present. CIII–NIII complex at $\sim$ 4600 Å was marginal. A probable emission line at $\sim$ 4946 Å met no firm identification. Hβ was not detected, which suggest this line was in transition from emission to absorption. Scatter at $\sim$ 5800 Å was likely caused by relatively noisy frames (the first and second ones) in the process of averaging.

Finally, the NaI λ5893 line was seen in absorption. The presence of DIB absorption features (e.g., at 6278 Å) suggests that the NaD line, originating from the secondary star, may have been significantly contaminated by interstellar or circumstellar matter causing the reddened continuum.

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