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Spectroscopic monitoring of classical and recurrent novae at Asiago Observatory

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Abstract. In the course of the monitoring of spectral evolutions of classical and recurrent novae on outbursts, 11 classical novae and 2 recurrent novae (U Sco, CI Aql) were observed at Padova-Asiago Observatory in the years from 1990 to 2001. The used instruments were a Reosc Echelle spectrograph and a Boller and Chivens grating spectrograph mounted on the 182-cm reflector at Mt. Ekar station and a prismatic spectrograph Camera VI and the Boller and Chivens spectrograph mounted on the 122-cm reflector at Asiago Observatory.

Key words. stars: evolution – stars: individual: V1494 Aql – stars: novae

1. Observations at Asiago

The monitoring of spectral evolution of novae is a traditional work of Padova-Asiago Observatory. The observations have been carried out using three spectrographs and two telescopes in the recent years. The high dispersion spectra, $\lambda/\Delta\lambda \cong 8000$, were taken with a Reosc Echelle spectrograph mounted on the 182-cm telescope at the Mount Ekar station of the Astronomical Observatory of Padova. The spectral range of most echelle spectra is from 435 nm to 690 nm. The medium dispersion spectra, $\lambda/\Delta\lambda \cong 800$ with a grating of 600 lines/mm, were taken with a Boller & Chivens spectrograph. This spectrograph was mounted on the 182-cm telescope until the end of 1997, then was translated to the 122-cm telescope of the Asiago Observatory of the University of Padova. The observation with the Boller & Chivens spectrograph on the 122-cm telescope started in August 1998. Until this time, a prismatic spectrograph Camera VI, whose resolutions were 10 nm/mm at Hβ and 30 nm/mm at Hα, was mounted on the 122-cm telescope.

Table 1 gives names of novae, dates of discovery, dates of first and last observations in our observatory, and numbers of spectra taken with respective spectrographs. The term 'continue' in the column of last observation means the object is still monitored. The recurrent novae T CrB and RS Oph are also frequently monitored in our observatory, but they are not included in this list, because no explosion was observed in the last decade.

Among these objects, detailed reports of V1974 Cyg were made by Rafanelli et al. (1995) and by Rosino et al. (1996). The spectral evolution of V723 Cas in the ex-

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Name	year	discovery	first obs.	last obs.	B&C	Echelle	C. VI
V838 Her	1991	March 24	March 31	1991, July 2	6		
V1974 Cyg	1992	Feb. 19	Feb. 24	1996, August 9	15	2	
V1425 Aql	1995	Feb. 7	Feb. 10	1995, Oct. 23			22
V723 Cas	1995	August 24	August 26	continue	49	36	93
V2487 Oph	1998	June 15	July 9	1998, July 9		1	
V1493 Aql	1999	July 13	July 25	1999, July 25	1		
V1494 Aql	1999	Dec. 1	Dec. 3	2000, Sept. 16	32	17	
V445 Pup	2000	Dec. 30	Jan. 14	2001, April 2	8	2	
V1548 Aql	2001	May 11	May 19	2001, May 19	1		
V2274 Cyg	2001	July 13	July 17	2001, August 28	20		
V2275 Cyg	2001	August 18	August 24	continue	14	1	
U Sco	1999	Feb. 25	Feb. 26	1999, March 15	2	5	
CI Aql	2000	April 28	May 13	2000, July 26	4	9	

Table 1. Spectroscopic observations of classical and recurrent novae at Asiago

tremely long pre-maximum stage was reported by Iijima et al. (1998). Recently, Iijima (2002) analyzed the spectra of U Sco on the outbursts in 1999 and estimated the helium abundance of the ejecta to be N(He)/N(H)= 0.16 ± 0.02, which means this object may not be helium rich.

2. V1494 Aql 1999-2

At the present time we are working on the spectral evolution of Nova (V1494) Aql 1999-2 which was discovered on December 1, 1999 (Pereira 1999). Kiss & Thomson (2000) estimated the date of light maximum to be December 3.4 UT (JD 2451515.9 ± 0.1). The first spectra in our observatory were taken on December 5, then 32 medium dispersion spectra and 17 high dispersion spectra were obtained until September 16, 2000.

The early spectroscopic and photometric evolutions of this nova were reported by Kiss & Thomson (2000). They estimated the absolute magnitude at light maximum to be $M_{\rm V}=-8.8 \pm 0.2$ and the distance to be 3.6 ± 0.3 kpc, but the effect of the interstellar extinction was not taken into account in their work. Our high dispersion spectra, however, show that the equivalent widths of the interstellar absorption components of Na I D1 and D2 are 0.46 ± 0.01 and 0.55 ± 0.01 Å, respectively. Using this result, we estimated the interstellar extinction as $E(B-V) = 0.66$ and $A_V = 2.0$. The distance to the nova may have to be reduced to 1.4 ± 0.2 kpc.

The early spectra in December 1999 showed prominent emission lines of H I and Fe II, but the emission lines of Fe II faded rapidly. The spectrum taken in February 2000, 65 days after maximum, showed emission lines of H I, He I, He II, N II, N III, [N II], [O I], [O III], [Fe VI], [Ca V], etc., but none of Fe II. This nova may have translated from type Fe II to type He/N of the classification of Williams (1992). The last spectra taken in September 2000 showed emission lines of [Fe VII] and the coronal line of [Fe X] 6374.5 Å.

The detailed results of the analyses will be published elsewhere (Iijima & Esenoglu, in preparation).

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