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**OPTICAL PROPERTIES OF HD 154791 DURING X-RAY OUTBURSTS**

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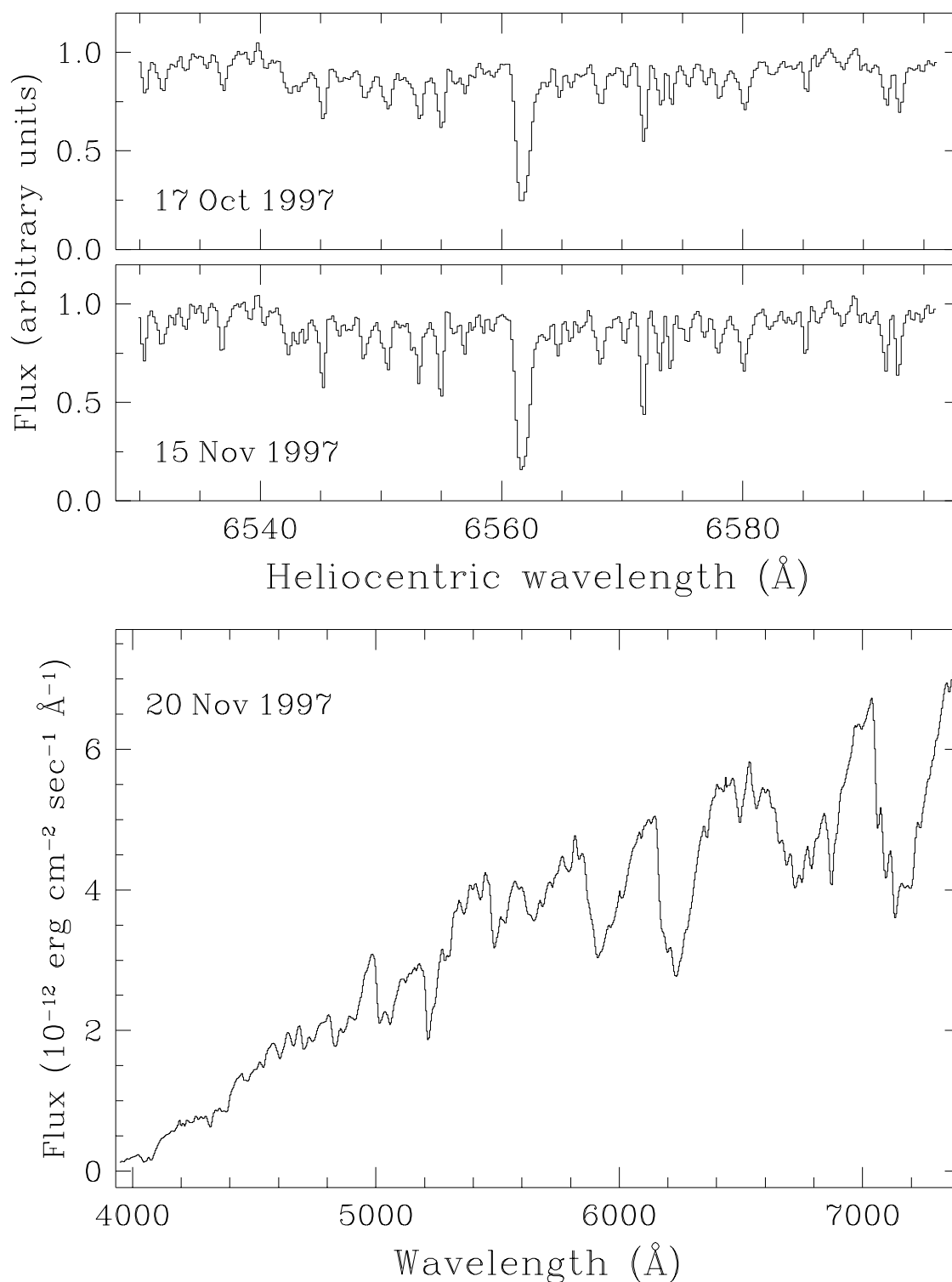
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Garcia et al. (1983) identified the *Ariel V* X-ray source 2A 1704+241 ( $\equiv$  4U 1700+24  $\equiv$  3A 1703+24) with the bright star HD 154791. They argued for the object to be a binary in which the M giant is orbited by a neutron star. According to Garcia et al. the main characteristics of HD 154791 are: i) significant variations in the X-rays on time scales from minutes to years; ii) lack of detectable continuum in the IUE SWP spectra and presence of C IV 1550 Å and N v 1238 Å in emission; iii) absence of significant variations in optical and infrared photometry; iv) the M giant optical spectrum is not contaminated by emission lines tracing the presence of the hot companion.

Simultaneous X-ray, IUE and optical observations in March 1985 were reported by Dal Fiume et al. (1990). They confirmed the identification of 2A 1704+241 with HD 154791 and noted some changes in comparison to the observations of Garcia et al. (1983). Dal Fiume et al.'s X-ray observations are characterized by a much softer spectrum and by an overall decrease of the source intensity by a factor of  $\sim 6$ . The high excitation UV emission lines of C IV and N v had disappeared.

Recently Remillard (1997, announcement circulated through the VSNET-Alert electronic service) reported about an X-ray outburst of HD 154791. During the first two weeks of November 1997 the flux at 2-10 keV reached a historical maximum of about 35 mCrab.

Being one of the very few binaries supposed to harbor an M giant and a neutron star, HD 154791 is in on our long-term observing program. A few days before and a few ones after Remillard's announcement of the X-ray outburst we secured high-resolution CCD spectra of HD 154791 with the Coudé-spectrograph of the 2 m telescope of the National Astronomical Observatory Rozhen (resolution  $R \sim 0.35$  Å) and with the Echelle ( $R \sim 0.3$  Å) spectrograph of Padova & Asiago Astronomical Observatory 1.82 m telescope. With the Boller & Chivens ( $R \sim 18$  Å) spectrograph at the same telescope we secured also low resolution spectrophotometry. Photometric observations have been obtained with the UBVRi photoelectric photometer at the 60 cm Cassegrain telescope of Torun Observatory (Poland). SAO 84893 and  $\delta$  Her have been used as comparison and check star respectively. The intrinsic errors in the BVRi bands do not exceed 0<sup>m</sup>01 and for the U data they are typically between 0<sup>m</sup>02 and 0<sup>m</sup>04. The photometric data and spectra closest in time to the X-ray outburst are presented in Table 1 and Figure 1 respectively. A few additional spectroscopic data are given in Table 2.



**Figure 1.** The H $\alpha$  region in the high-resolution spectra of HD 154791, obtained on 17 October 1997 (Rozhen) and 15 November 1997 (Asiago), i.e. soon before and near maximum of the X-ray outburst.

The spectra are normalized to the local continuum level (*two upper panels*). Flux calibrated low-resolution spectrum of HD 154791 obtained on 20 November 1997 (Asiago) (*bottom panel*)

The main result of the present investigation is that the X ray outburst, still ongoing at the time of our November observations, had no detectable effect on the optical properties of HD 154791.

No changes in the high resolution spectra are visible, and no emission line appeared in the H $\delta$ -H $\alpha$  region. The numerous absorption lines visible in the spectra of Figure 1 are normal in M giants and are produced by neutral metals. The radial velocities in Table 2 confirm the Garcia et al. (1983) report of undetectable orbital motion, either caused by low orbital inclination or by large orbital separation. The H $\alpha$  equivalent width values presented in Table 2 are constant within the measurement errors. The overall aspect of the low resolution spectrum in Figure 1 is still and always that of an M giant.

The photometric data show that there are no variations in the BVRI bands, even if variability in the U band is present. Our data seem to ascribe the latter to a sort of flickering activity. Our pre-X-ray-outburst photometry shows the star about 0<sup>m</sup>26 fainter in B and  $\sim$ 0<sup>m</sup>14 brighter in V in comparison to Garcia et al. (1983).

Table 1. UBVR photometric observations of HD 154791

Date	JD 2400000+	V	U-B	B-V	V-R	V-I
16 Aug 1997	50677.474	7.64	2.13	1.73	1.35	2.68
17 Aug 1997	50678.377	7.67	1.66	1.74	1.36	2.71
19 Aug 1997	50680.391	7.66	1.82	1.76	1.36	2.63
20 Aug 1997	50681.425	7.67	1.29	1.72	1.37	2.65
25 Aug 1997	50686.355	7.64	1.76	1.74	1.37	2.62
21 Oct 1997	50743.264	7.65	1.68	1.76	1.33	2.64

Table 2. The radial velocity of the absorption lines and the equivalent width of H $\alpha$  measured in our high-resolution spectra

Date	JD 2400000+	RV $_{\odot}$ km s $^{-1}$	W $_{\lambda}$ Å
1 Apr 1996	50175.493	$-43.3 \pm 0.4$	0.97
3 May 1996	50207.402	$-51.8 \pm 0.5$	1.00
3 Jun 1996	50238.395	$-43.5 \pm 0.4$	1.01
17 Oct 1997	50739.178	$-46.7 \pm 0.5$	0.98
15 Nov 1997	50768.216	$-49.9 \pm 0.5$	1.04
18 Nov 1997	50771.193	$-52.8 \pm 0.4$	1.08

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