COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 6031

Konkoly Observatory
Budapest
16 July 2012

HU ISSN 0374 – 0676

SPECTRAL DETECTION OF A VERY STRONG FLARE ON WX UMa

MELIKIAN, N. D.[1]; NATSVLISHVILI, R. Sh.[2]; TAMAZIAN, V. S.[3]; KARAPETIAN, A. A.[1]

[1] Byurakan Astrophysical Observatory, Armenia

[2] Abastumani Astrophysical Observatory, Georgia

[3] Astronomical Observatory R. M. Aller, University of Santiago de Compostela, Spain

WX UMa (= Gliese 412B) is a relatively faint ($m_V = 14\overset{\mathrm{m}}{.}41$) M6V flare star located at a distance of 4.8 pc (Gould & Chaname, 2004; Pettersen, 1991). Being the secondary component B in the double system WDS 11055+4332, it exhibits a well studied large scale magnetic field (Morin et al. 2010) and has been identified as an X-ray source, while no significant X-ray emission was detected from the primary component A (Schmitt et al. 1995). The first flare with an amplitude of $1\overset{\mathrm{m}}{.}5$ on this star was probably detected by A. van Maanen on photographic plates obtained with the Mount Wilson 100″ telescope in 1939 (Joy, 1967).

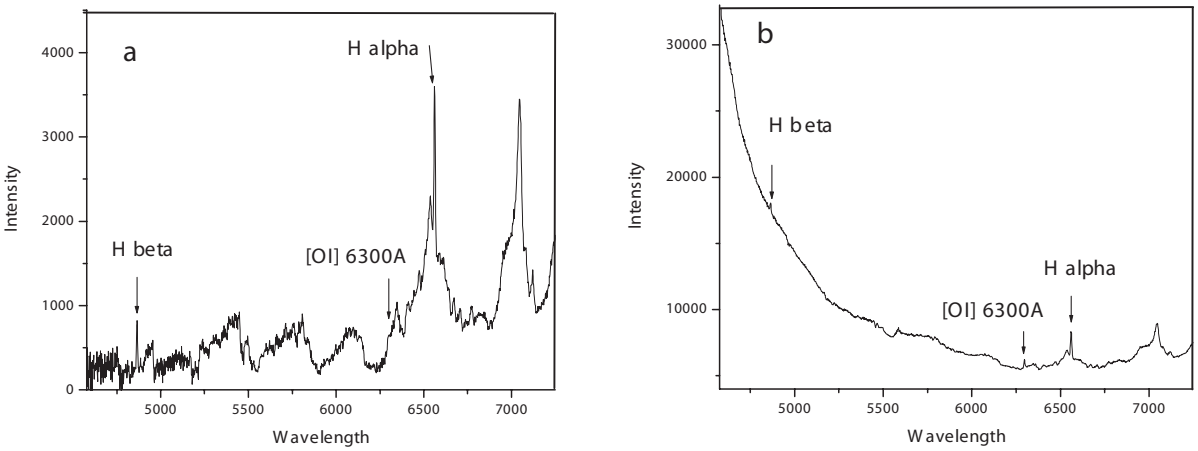

Figure 1. Spectra of WX UMa before (a) and during (b) the flare event.

In the framework of our study of binary flare stars in the solar vicinity, spectral monitoring of HU Del, CM Dra, WX UMa and VW Com is being carried out with the 2.6m telescope of Byurakan Astrophysical Observatory. The observations were performed with

the SCORPIO spectral camera providing the spectral resolution of 1.7Å/pix. (Afanasiev et al. 2005). For data reduction, we have made use of the SCORPIO dedicated software packages (Moiseev, 2002; Moiseev & Afanasiev 2005) for background sky subtraction, extraction, wavelength calibration (using a Neon lamp in our observations), and flux calibration.

During four nights within a period from May 18 to June 1, 2012, 70 spectra were obtained for these stars. Their preliminary processing allowed us to detect a very strong flare on the secondary component of WX UMa on May 18. In this report, some observational characteristics of this event are reported, while more detailed results of the monitoring will be presented later.

Spectra were obtained with equal exposures of 300 s and time interval between them about 80 s. As a standard, BD+28 4211 (m_V =10.$^{\rm m}$56) was used. In 33 minutes five spectra were obtained, and a very strong flare was detected on the last spectrum. In Fig. 1, the spectra before (a) and during (b) the flare are presented. An unusually strong brightening in the blue part is clearly seen in Fig. 1b, which in terms of energy distribution transforms the M6 spectrum to an early B type. Apart from this, the appearance of the [OI] 6300Å emission line during the flare event (see Fig. 2a,b) should be noticed. The equivalent widths of emission lines Hα and Hβ measured on all spectra are presented in Table 1.

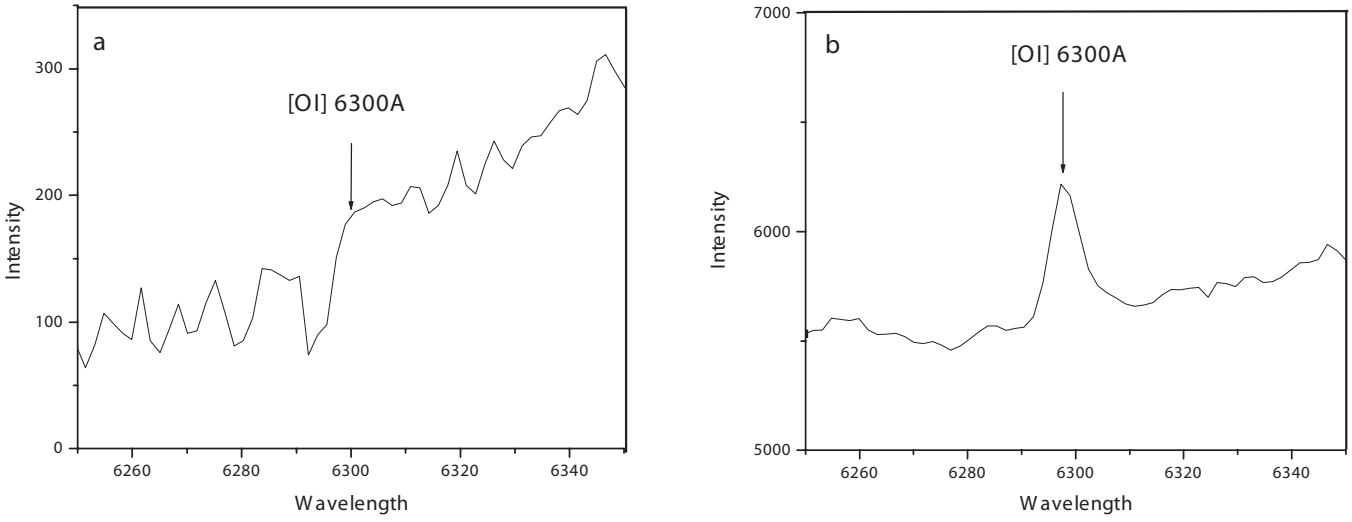

Figure 2. The emission line [OI] 6300Å before (a) and during (b) the flare event.

The data overview shows that the equivalent widths of Hα and Hβ on the first four spectra increase while on the last spectrum they clearly decrease. This fact along with the disappearance of some absorption lines on the last spectrum is probably a result of veiling by the strong continuous emission formed during the flare. Brightness in the quiescent state (spectral region 4500−7250Å) varies in the range $\Delta m = 0.^{\rm m}0 - 0.^{\rm m}5$, while a simultaneous increase of Hα and Hβ EWs is clearly detected. The very strong lowering of the EWs during the flare is probably caused by the brightening of continuum. It is worth noting that the existence of two phases during a flare event has been suggested on the basis of high time-resolution observations of UV Ceti type stars (Moffett & Bopp, 1976). These are the spike phase dominated by continuum emission, and the slow phase showing strong emission-line radiation along with decreasing continuum.

Table 1. Equivalent widths of the Hα and Hβ emission lines

Sp. No.	Start exp. (UT) [h m s]	EW Hβ (Å)	EW Hα (Å)
1	21 22 15	11.9	11.9
2	21 28 14	14.7	12.1
3	21 36 33	16.9	12.4
4	21 43 29	19.2	13.6
5	21 50 58	0.9	3.1

The estimated amplitudes of brightening (Δm) in the spectral ranges 4600−7250Å and 4600−5000Å are $2\overset{\mathrm{m}}{.}8$ and $4\overset{\mathrm{m}}{.}5$ respectively. In reality, the amplitude of this flare is much higher since detected relatively "low" amplitude is a result of the low time-resolution of our observations. Notice that the decrease of the flare amplitude from the blue to the red part of the spectrum is typical of UV Ceti stars.

References:

Afanasiev, V.L., Gazhur, E.B., Zhelenkov, S.R., Moiseev, A.V., 2005, *Bull. Special Astrophys. Obs.*, **58**, 90 http://unipaq.sao.ru/hq/lsfvo/devices/scorpio/BSAO_eng.pdf

Afanasiev, V.L., Moiseev, A. V., 2005, *Astron. Lett.*, **31**, 194

Joy, A.H., 1967, *ASPL*, **10**, 41

Gould, A., Chaname, J., 2004, *ApJS*, **150**, 455

Moffett, T.J., Bopp, B. W., 1976, *ApJS*, **31**, 61

Moiseev, A.V., 2002, *Bull. Special Astrophys. Obs.*, **54**, 74

Morin, J., Donati, J.-F., Petit, P., Delfosse, X., Forveille, T., Jardine, M.M. 2010, *MNRAS*, **407**, 2269

Pettersen, B. R. 1991, *MmSAI*, **62**, 217

Schmitt, J.H.M.M., Fleming, T.A., Giampapa, M.S., 1995, *ApJ*, **450**, 392