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

Number 5477

Konkoly Observatory
Budapest
14 November 2003

HU ISSN 0374 – 0676

OPTICAL CCD OBSERVATIONS OF ETA CARINAE AT LA PLATA OBSERVATORY

FERNÁNDEZ LAJÚS, E.[1,2]; GAMEN, R.[1,3]; SCHWARTZ, M.[1]; SALERNO, N.[1]; LLINARES, C.[1]; FARIÑA, C.[1]; AMORíN, R.[1]; NIEMELA, V.[1,4]

[1] Facultad de Ciencias Astronómicas y Geofísicas, Universidad Nacional de La Plata, Paseo del Bosque S/N. B1900FWA La Plata.

[2] Fellow of UNLP, La Plata, Argentina; e-mail: eflajus@fcaglp.unlp.edu.ar

[3] Fellow of CONICET, Argentina.

[4] Member of the Carrera del Investigador Científico, CIC, Buenos Aires, Argentina.

In 2003.5 Eta Carinae, suspected to be a binary system with a period of 5.53 years (cf. Damineli et al., 2000), was expected to undergo an X-ray eclipse (cf. Corcoran et al., 2001). In the framework of an international campaign to obtain multi-wavelength observations of this event, we have obtained optical CCD images of Eta Carinae. About 3000 images were acquired in 2003 between January and August. Here we present our data of Eta Car obtained before and during the X-ray eclipse.

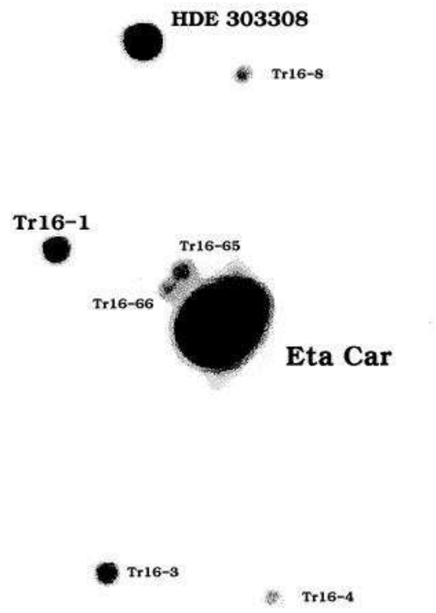

Figure 1. *V* image of the Eta Carinae region. North is up and East is to the left. Labels follow the nomenclature of Feinstein et al. (1973).

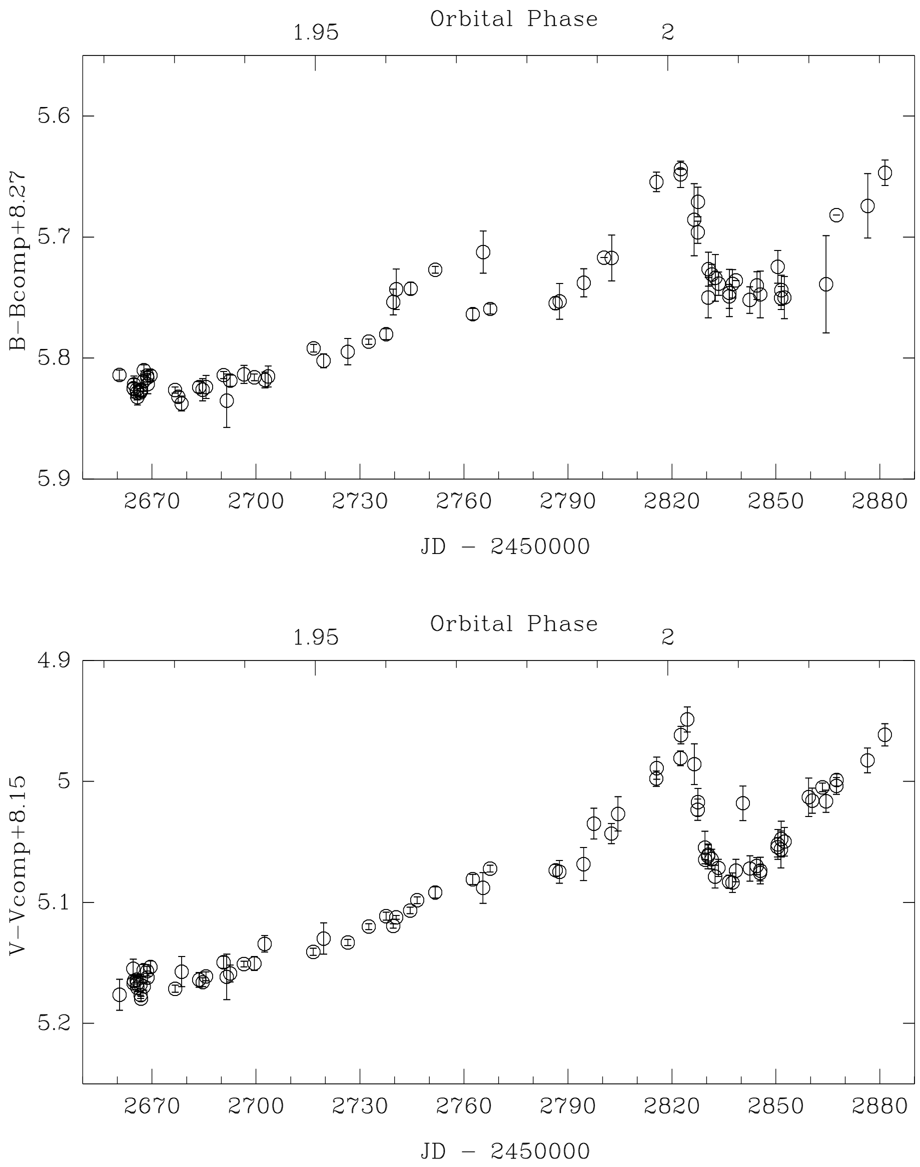

Figure 2. Relative B and V magnitudes of Eta Car observed between 20th January and 29th August, 2003. Bars represent the sample standard deviations. Along the top axis, orbital phases are indicated, calculated according to the ephemeris: heliocentric X-ray minimum = 1997.95 + 5.53609E (Corcoran 2003).

The images were acquired through Johnson-Cousins $BVRI$ filters with a Photometrics STAR I CCD camera attached to the 0.8-m reflector (f/20.06 Cassegrain) at La Plata Observatory, Argentina. The detector used is a Thomson-CSF TH7883 scientific-grade front-illuminated chip, Peltier cooled, of 384 × 576 pixels (23 μm square pixel). Our instrumental configuration results in $1\farcm9 \times 2\farcm8$ field images with an oversampled scale of $0\farcs3$ per pixel. $BVRI$ passbands used are those recommended by Bessell (1990) for coated CCDs. One of our images is reproduced in Figure 1, with identifications of the objects.

Differential photometry of Eta Car was determined using HDE 303308 as comparison star. This star was found to have constant light by Sterken et al (2001) and Freyhammer et al (2001). In order to give values approximate to the standard magnitudes of Eta Car, we have added to our relative magnitudes the $UBVRI$ Johnson-Kron-Cousins photometry of HDE 303308 by Feinstein (1982), i.e. $B = 8.27$, $V = 8.15$, $R = 8.01$ and $I = 7.85$.

Instrumental magnitudes of each star were determined by means of aperture photometry. In order to minimize small fluctuations, due to noise, the instrumental magnitudes, were calculated as an average of individual values determined in 6 apertures for Eta Car and 4 apertures for HDE 303308, selected constructing CCD growth curves (Howell et al., 1989) for the first observed frames. The radii of the apertures for Eta Car were between 80 and 105 pixels, and those for HDE 303308 between 40 and 60 pixels, with increments of 5 pixels. The values of the apertures were kept the same for all of the frames observed during the campaign.

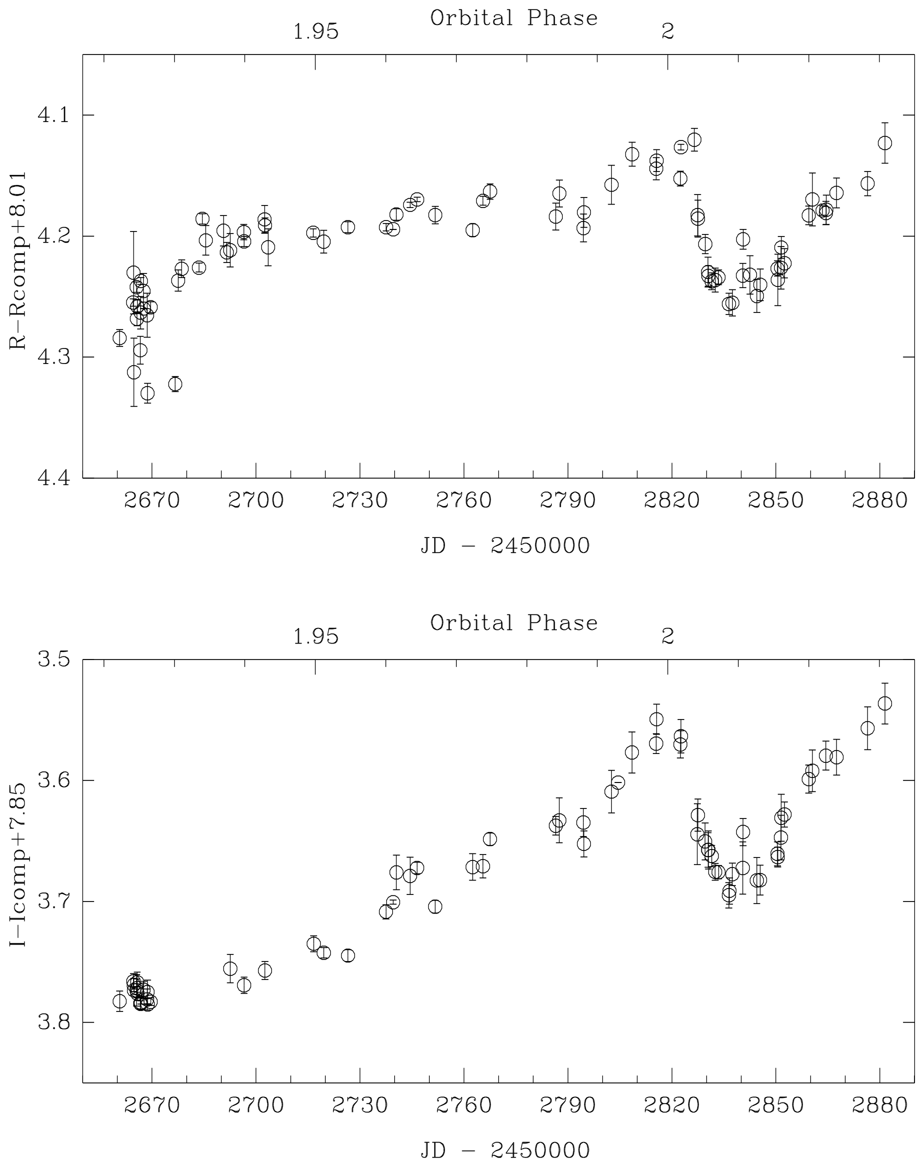

Figure 3. The same as Fig. 2 for relative R and I magnitudes.

Typical individual errors of B, V, R, I instrumental magnitudes are 0.008, 0.004, 0.006, and 0.01 mag respectively. Mean differential magnitudes of Eta Car were calculated from the instrumental magnitudes of a series of images obtained within intervals of 100-minutes (~ 0.000035 of orbital phase). Standard deviations were also calculated for each mean magnitude. These data are available through the IBVS-website as a table (`5477-t1.txt`) where, in successive columns we quote for each filter, the Julian Date of each observation, the mean differential magnitude, the standard deviation of the mean, and the number of images included in the mean values.

Variations of the observed *B, V, R, I* magnitudes of Eta Car from January to August, 2003, are shown in Figures 2 and 3. The optical variations seem to follow the behaviour of Eta Car observed in X-rays by RXTE, available on the web page of Dr. M. Corcoran (2003). We notice a fading of optical light about 10 days after the eclipse in X-ray was observed (phase 2.0 in the Figures 2 and 3). This fading is similar in shape to the infrared minimum observed during the previous X-ray eclipse of Eta Car (Feast et al., 2001).

An interpretation of this light fading as an optical eclipse of the Eta Car system is pending an analysis incorporating all the data collected during the multi-wavelength campaign of observations of this 2003.5 event.

The participation of the following students in obtaining the observations: Anabella Araudo, Gisela Romero, Ariel Sánchez Camus, Silvia Sicilia, Lautaro Simontacchi, Andrea Torres and Javier Vásquez is gratefully acknowledged. We thank the referee, Dr. C. Sterken, for valuable suggestions which improved the presentation of this paper.

References:

Bessell, M., 1990, *PASP*, **102**, 1181

Corcoran, M. F., Ishibashi, K., Swank, J. H., & Petre, R., 2001, *ApJ*, **547**, 1034

Corcoran, M. F., 2003, private communication, see http://lheawww.gsfc.nasa.gov/users/corcoran/eta_car/etacar_rxte_lightcurve/

Damineli, A., Kaufer, A., Wolf, B., Stahl, O., Lopes, D., & de Araújo, F., 2000, *ApJ*, **528**, L101

Feast, M., Whitelock, P., Marang, F., 2001, *MNRAS*, **322**, 741

Feinstein, A., 1982, *AJ*, **87**, 1012

Feinstein, A., Marraco, H., Muzzio, J.C., 1973, *A&AS*, **12**, 331

Freyhammer, L., Clausen, J., Arentoft, T., & Sterken, C., 2001, *A&A*, **369**, 561

Howell, S. B., 1989, *PASP*, **101**, 616

Sterken, C., Freyhammer, L., Arentoft, T., van Genderen, A. M., 2001, *ASP Conf Ser*, **233**, 39