

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

Number 4048

Konkoly Observatory
Budapest
12 July 1994

HU ISSN 0324 - 0676

OPTICAL SPECTROSCOPY OF A FLARE ON PROXIMA CENTAURI

On 9 March 1994, a large flare event on Proxima Centauri (Gliese 551 = LHS 49 = V645 Cen) was serendipitously observed with the CTIO 1.0-m telescope Cassegrain Image Tube Spectrograph, the "2D-Frutti". Presented here is a spectrum taken during the flare event and, for comparison, spectra taken during quiescence on the two following nights.

Proxima Cen was observed as part of a spectral-typing program being carried out during non-photometric nights on the CTIO 1.0-m telescope. The 2D-Frutti spectrometer was configured with grating #26 (600 lines/mm, 5000Å blaze) in first order to provide coverage in the spectral range of 4200–7600Å with a resolution of 3–4Å around H α (6563Å). Because the observing conditions were non-photometric, these spectra are not flux calibrated. Instead, an instrumental spectral response function was derived by comparing observations of A-type field stars to the flux distribution of A-type spectrophotometric standard stars.

Table 1 contains details of the individual observations and lists equivalent widths (EW), measured with respect to the local continuum, for the hydrogen Balmer lines during the flare and on subsequent nights during quiescent periods. Figure 1 shows the spectrum of Proxima Cen while in flare and, for comparison, one of the quiescent period spectra.

Table 1
Spectroscopic Observations of Proxima Centauri

UT Date (at midpoint)	Exposure Time (sec)	EW(Å)			Notes
		H α	H β	H γ	
1994 March 09 7:33	480	27	92	173	1
1994 March 10 7:27	600	4	6	20	
1994 March 10 8:59	600	3	6	19	
1994 March 10 9:09	600	3	3	14	
1994 March 11 6:27	600	3	<2	10	2

Notes.- Equivalent widths are reported to the nearest Ångstrom; (1) Also seen in emission are He I(4471Å) EW = 10Å, He I(5876Å) EW = 7Å, Na I D lines (5890Å and 5896Å), and He I(6678Å) present but weak; (2) H β present in emission but weak.

Despite being the most nearby example of a dMe flare star, only a few optical spectra of Proxima Cen are found in the literature (e.g. Thackeray 1950; Mathioudakis & Doyle 1991). The flare spectrum in Figure 1 shows strong enhancement of Balmer line emission along with emission lines of He I (4471Å, 5876Å, and 6678Å) and the Na I D lines (5890Å

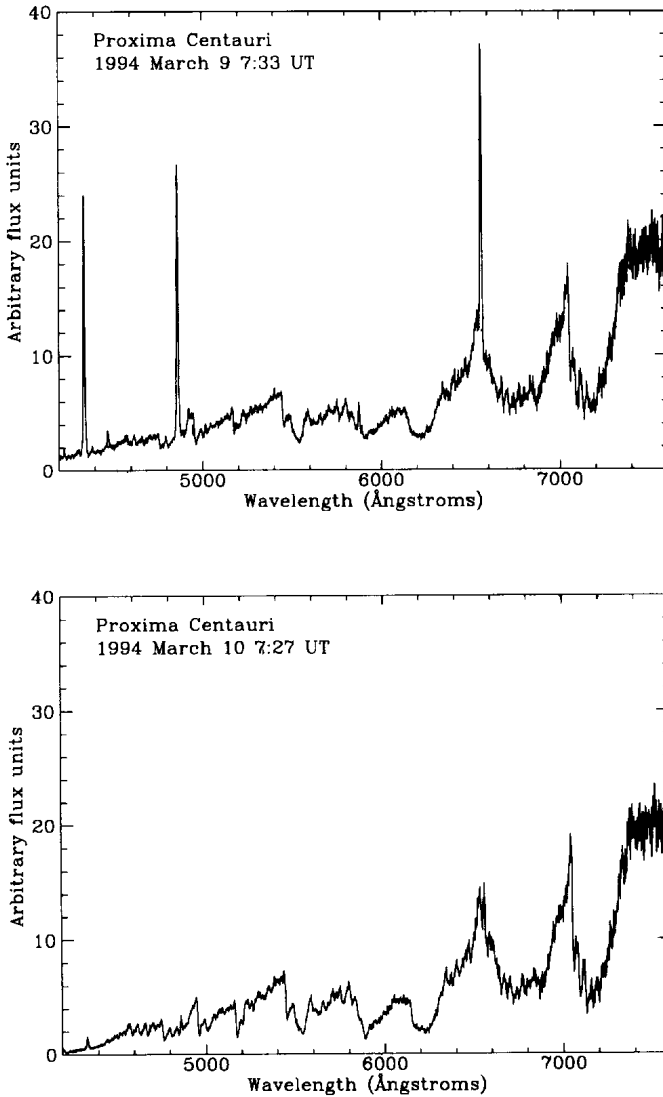


Figure 1: *Top*, Proxima Centauri in flare on 9 March 1994. The hydrogen Balmer lines are the most prominent emission lines in this spectrum. *Bottom*, Proxima Centauri during a quiescent period on 10 March 1994. These spectra are not flux calibrated.

and 5896Å). The H α equivalent width in flare is enhanced by factor of about 10 over that in the observed quiescent period observations and by a factor of 15 over the quiescent H α equivalent width reported by Mathioudakis & Doyle (1991). The H β and H γ lines show much larger enhancement factors during the flare. The continuum during the flare appears to be enhanced blueward of 4500Å.

Although Proxima has a lower rate of flare *production* than other flare stars (Walker 1981), it apparently does experience large flares from time to time. For comparison, a $\Delta U = 5.0$ magnitude flare event on UV Ceti, a classic prototypical flare star, produced $EW(H\alpha) = 67.5\text{\AA}$ and $EW(\text{He I } (5875\text{\AA})) = 15.5\text{\AA}$ (Eason *et al.* 1992). Because no earlier observations were made of Proxima Cen on 9 March, the serendipitous flare spectrum presented here may not represent flare maximum for this particular event.

The author made these observations as a visiting astronomer to Cerro Tololo Inter-American Observatory. The author would like to thank Dr. Chris Smith (CTIO) for deriving the instrumental spectral response curve for these data.

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