The circumstellar disk of the Be star 28 (ω) CMa

by

Stanislav Štefl, Walter Nowotny-Schipper & Juha Reunanen

I. Scientific rationale

Be star (Jascheck et al., 1981): A non-supergiant B-type star, whose spectrum showed at some time one or more Balmer lines in emission.

General picture: The additional emission comes from a circumstellar disk around the rapidly rotating B-type star.

The present state of our knowledge: High-resolution (echelle) spectroscopy carried out during the nineties extended significantly our knowledge about the central stars of this systems and the correlation between the photospheric and circumstellar phenomena. Some of the central stars are proved to be non-radially pulsating. First interferometric measurements of diameters of Be star disks were obtained using GI2T and MkIII.

Our expectations from interferometry: Interferometry may bring the most important progress in this decade - direct measurements of geometrical and physical parameters of disks and their dynamics.

Why VLTI: The closest Be star disks have angular diameters of a few mas. A resolution of a few tens of mas is needed for detailed studies of disk structures.

II. Immediative objective

Determination of the outer (inner) disk radius and its flux ratio with respect to the central star of 28 CMa

Spectral type: B2IV-Ve
$\alpha(2000) = 07^h\ 14^m$ $\delta(2000)$ = -26^o 46'
→ date of observation Jan 15, 2002
Brightness: V = 3.^{m}6-4.^{m}11 K ≈ 4.^{m}3
seen pole-on (v.sin i ≈ 80 km/s)
→ simple modeling

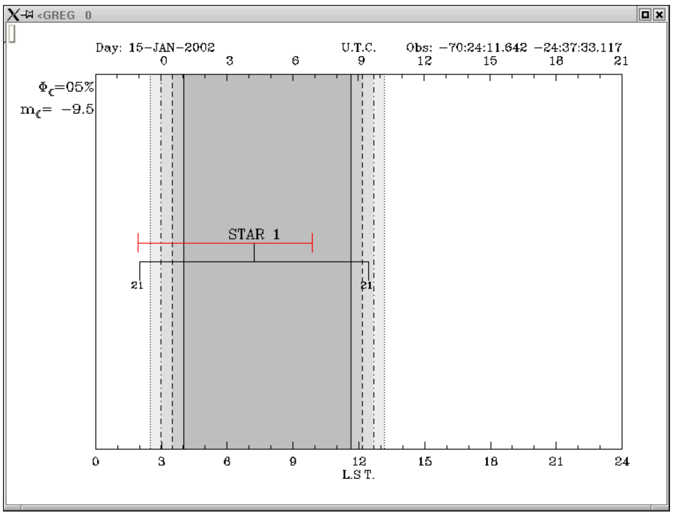

Fig. 1: Observability of 28 CMa on Jan 15, 2002

III. Choice of the instrument and configuration

Expected temperatures of the disk 6000 - 8000 K, maximum flux in the visible region, comparable flux from star and disk in near IR expected
$\rightarrow$ AMBER

Choice of the telescopes: bright source, low resolution is enough $\rightarrow$ ATs

Calculation of the model visibility curve: star (point source) + circumstellar uniform disk (5mas), flux ratio 0.9/0.1, see Fig. 2

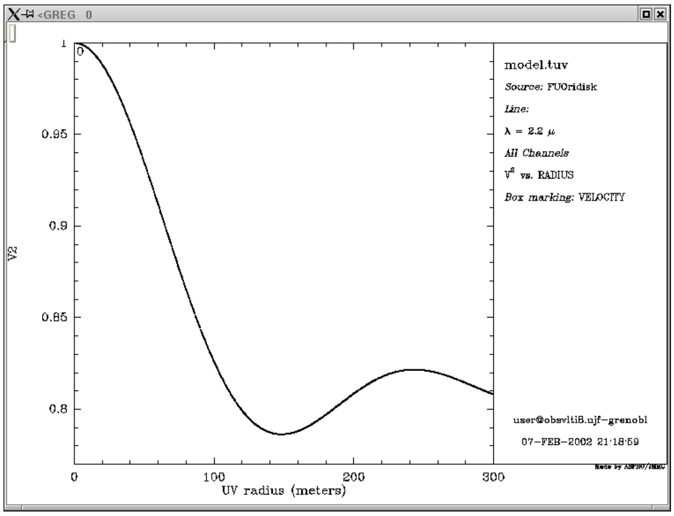

Fig. 2: Model visibility curve for 28 CMa

Choice of the baselines:
<u>outer radius:</u> determined from steep part of visibility curve, short baseline ≈ 40-60m
<u>flux ratio and inner radius:</u> determined from the sinusoidal part of visibility curve (at least 2 intervals corresponding to baselines of 180-200m and 140-150m)
$\rightarrow$ telescope configuration D0 + G1 + J6

IV. Simulated observations

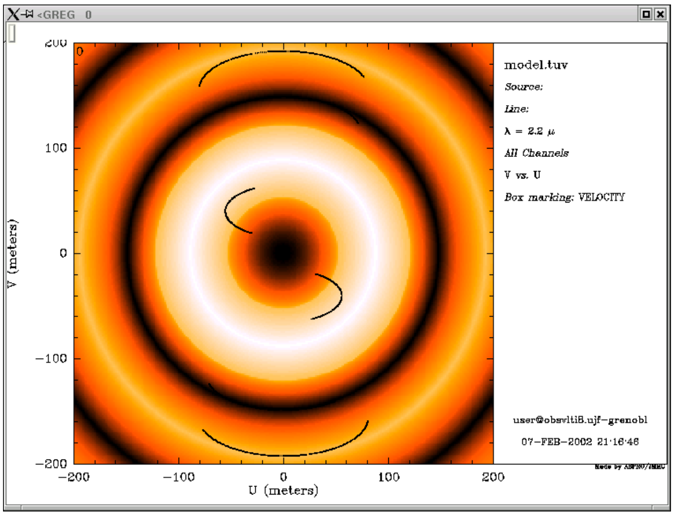

Fig. 3: Coverage of the UV plane

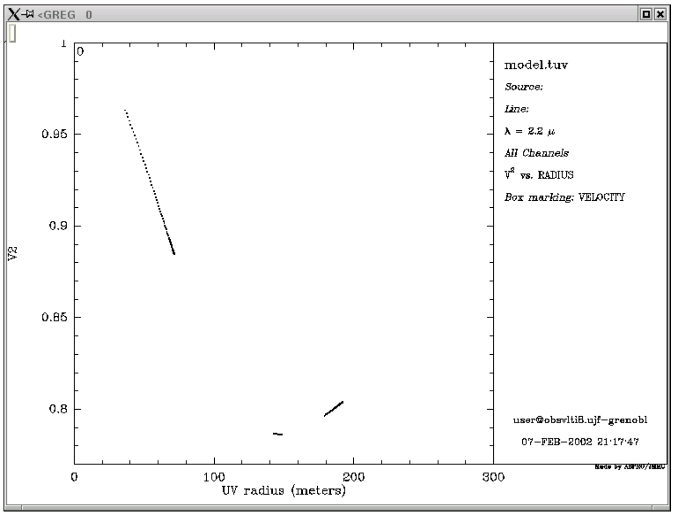

Fig. 4: Simulated visibility curve

The most important parts of the visibility curve can be observed during one night and fitted by models, compare Fig. 2 and 4.

V. Strategy and astrophysical analysis of the data

Interpretation of the observations taken in the quiet (non-active) phase:

- By fitting the visibility curve with model curves for different wavelengths, we can confirm the existence of a circumstellar disk or ring and distinguish between disk models with different density distributions.
- Determination of the disk outer (inner?) radius and flux ratio

Preparation of a dynamical study:

- Monitoring of the disk evolution after a big outbursts. Such outbursts may occur every 3-8 years in 28 CMa (Štefl et all, in preparation). A typical time scale of variability reflecting the outburst is about one to a few weeks. The aim of the dynamical study will be to map (using also simultaneous spectroscopy) the time dependent velocity field in the disk and answer the basic question - where the extra angular momentum necessary to form Keplerian disks comes from.