Title : will be set by the publisher
Editors : will be set by the publisher
EAS Publications Series, Vol. ?, 2002

BINARY STARS WITH COMPONENT DISKS: THE CASE OF Z CMA

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Abstract. We present here a proposal for the mid-infrared study of the circumstellar material around Z CMa. The suggested configuration of the interferometer and the observational strategy are based on model simulations performed using the software ASPRO. We find that the UT1-UT3 telescope pair (the first mode to be offered) is able to constrain the flux ratio of the binary but not the extension of possible circumbinary disks. We suggest to use an AT unit to increase the baseline and thus resolve the material orbiting one or two components.

1 Introduction

The peculiar B-star Z CMa, located at the distance of 1 kpc, is one of the few known FU Orionis-type object (Covino *et al.* 1984). Its spectral energy distribution (SED) shows significant mid-infrared excess, reaching 120 Jy at the 12 micron measurements of IRAS. Speckle interferometric observations (Haas *et al.* 1993, Thiebaut *et al.* 1995) revealed the presence of an infrared companion with a separation of only 0.1” (PA 120 deg). Optical studies show a jet stretching perpendicular to the axis of the binary (Miroschnichenko & Yudin 1993, Poetzel *et al.* 1989).

Z CMa is naturally in the focus of interest but tradiational observing techniques are insufficient to answer the following exciting questions:

- Are there disks around both stars?
- Are the disks coplanar (i.e. perpendicular to the jet)?
- Does the jet come from the mid-infrared companion?
- Is there a circumbinary disk?

This single object promises important clues on star and binary formation. Since the expected disk extension in the MIR is about 10 mas, Z CMa is among the best targets for MIDI.

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DOI: (will be inserted later)

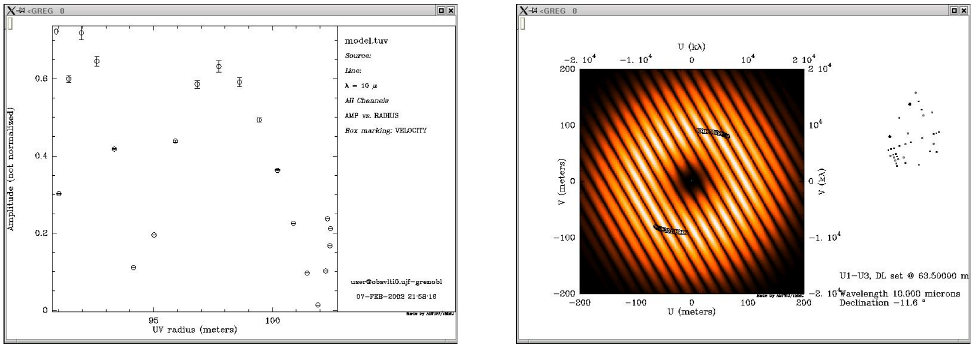

Fig. 1. *Left panel*: Simulated visibility for the UT1-UT3 configuration. *Right panel*: Derivative of the amplitude on the (u, v) plane.

2 Observational Strategy

The MIDI instrument will first be offered on baselines UT1 + UT3 of 104 m. This is equivalent to a spatial resolution of around 20 mas. Due to the position of the source the observations have to be scheduled in January. To enhance the visibility contrast, a prism (R=30) will be applied. Using the ASPRO simulator we estimated the total observing time to be of 5 hrs with 15 minutes for each point and 5% typical on-source time. A fixed delay line of 63.5 m is needed to compensate the declination of the object.

3 Simple Model

To test the selected parameters we used a model consisting of two Gaussian disks of equal fluxes and extensions. Their diameter were 12 milliarcsecs and the separation – corresponding to the separation of the binary components – was 0.1".

4 Results

Applying the ASPRO simulator on our simple model together with the instrumental setup described above, we optimized our observational strategy. The simulated visibility is shown on Fig. 1 left panel. The quasi-sinusoidal pattern is introduced by the separation of the two disks, while the amplitude modulation (i.e. the change in the peaks of the sinusoids) is determined by the extension of the disks. Fig. 1 right panel shows the projected baselines at which we conducted our observations on the (u, v) diagram vs. the derivative of the amplitude. The information acquired by each point is proportional to the derivative. Our optimized strategy probes the (u, v) plane where the derivative is the highest.

5 Conclusion

We performed error analyses on the simulated visibilities to constrain the accuracy of the data acquired. We find that:

• MIDI can easily constrain the flux ratio of the two stars to a few percents

• Due to the orientation and the length of the UT1 + UT3 baseline, MIDI observations can not put constrains on the size of the dust disks.

• Since the object is bright enough to be observed with the auxiliary telescope units, we suggest a follow-up observation using different baselines to constrain the disk parameters. The longest possible baseline is recommended.

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