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MODELING THE DISK OF ζ TAU USING THE CHARA ARRAY

G. H. Schaefer,[1] D. R. Gies,[2] J. D. Monnier,[3] M. Zhao,[3] N. Richardson,[2] Y. Touhami,[2] E. Pedretti,[4] N. Thureau,[4] H. A. McAlister,[2] S. T. Ridgway,[5] J. Sturmann,[1] L. Sturmann,[1] T. ten Brummelaar,[1] and N. H. Turner[1]

We present our initial observations of the Be star ζ Tau obtained using the Michigan Infrared Combiner at the CHARA Array. We computed simple geometric models that account for the asymmetry we detect in the disk. Our long term goal is to continue a multi-year monitoring campaign to follow the outward motions of disk enhancements. This work will be complemented by spectroscopy of the emission lines to investigate the development of asymmetric structures, such as spiral arms, in the disk.

The CHARA Array is an optical/IR interferometer located on Mount Wilson (ten Brummelaar et al. 2005). The array has six 1 meter telescopes arranged in a Y-configuration with baselines ranging from 34–331 meters. We used the Michigan Infrared Combiner (MIRC; Monnier et al. 2004, 2006a) in the H-band to observe the disk of ζ Tau. MIRC combines the light from four telescopes simultaneously, providing visibility amplitudes and closure phases.

ζ Tau is one of the brightest Be stars and therefore an ideal target for optical/IR interferometry (Quirrenbach et al. 1994, 1997; Vakili et al. 1998; Tycner et al. 2004; Gies et al. 2007; Carciofi et al. 2009). We observed ζ Tau with MIRC in the H-band at CHARA on 2007 Nov 11–19 and 2008 Sep 26–28. The visibilities provide information on the size, orientation, and inclination of the disk. We also measure non-zero closure phases that indicate an asymmetry in the disk.

We fit a two-component geometric model to the MIRC data. The model is composed of a uniform disk with an angular diameter of 0.38 mas to fit the central star and an elliptical Gaussian to model the circumstellar disk. To account for the asymmetry we detect in the closure phases, we modulated the elliptical Gaussian disk by a sinusoid as a function of azimuth (e.g. Monnier et al. 2006b).

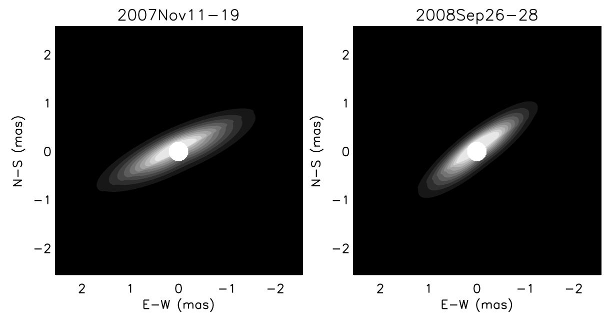

Fig. 1. Geometric models of ζ Tau based on our MIRC observations.

Figure 1 shows the best fit models for our two epochs of observations. We measure a FWHM for the major axis of $\sim$ 1.8 mas, with an axis ratio of 0.26. During the first epoch, the asymmetry lies along the minor axis of the disk. We find a 10° change in the position angle of the disk between 2007 Nov and 2008 Sep. We are combining these results with follow-up MIRC observations, published interferometric observations, and contemporaneous spectroscopy of Hα profile variations to investigate whether we are detecting precession within the disk of ζ Tau.

We also plan to compare the interferometric and spectroscopic data of ζ Tau with predictions from theoretical models of Be stars disks (e.g. Berio et al. 1999; Meilland et al. 2007; Jones et al. 2008; Carciofi et al. 2009).

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[1]The CHARA Array of Georgia State University, Mount Wilson Observatory, Mount Wilson, CA 91023, USA (schaefer @chara-array.org).
[2]CHARA, Georgia State University, P.O. Box 4106, Atlanta, GA 30303, USA.
[3]University of Michigan, Ann Arbor, MI, USA.
[4]University of St. Andrews, Scotland, UK.
[5]National Optical Astron. Observatory, Tucson, AZ, USA.