**EXPLORING THE MECHANISMS OF VARIABILITY IN CLASS I AND II YSOS WITH TWO-EPOCH HST/NICMOS OBSERVATIONS.** A. S. Cotera[1], G. Schneider[2], D. C. Hines[3], B. A. Whitney[3], K. R. Stapelfeldt[4], and D. L. Padgett[5], *(1) SETI Institute, 515 N. Whisman, Mountain View, CA 93035; (2) Steward Observatory, University of Arizona, 933 N. Cherry Ave., Tucson, AZ 85721; (3) Space Science Institute, 4750 Walnut St., Suite 205, Boulder, CO 80301; (4) NASA Jet Propulsion Laboratory, 4800 Oak Grove Dr., MS 183-900, Pasadena, CA 91109; (5) Spitzer Science Center, Mail Code 220-6, Pasadena, CA 91125.*

Fifty years ago, photometric and spectroscopic variability first distinguished T Tauri stars as a distinct class of objects [1]. Traditionally, the inherent variability of YSOs has been observed as changes in both the magnitude and the equivalent width of emission and absorption lines. This spectroscopic "veiling" has been attributed to variable accretion processes onto the stellar photosphere [e.g. 2]. The timescales of the variability are not uniform however, and range from days to years. The observed photometric timescales and the spectroscopic veiling suggests that the physical cause of the variability arises from one or both of two different fundamental phenomena: (1) temperature variations on the stellar photosphere, and (2) uneven illumination caused by a clumpy circumstellar environment.

Most of the prototypical YSOs reside in the Taurus-Auriga Cloud. At a distance of $\sim$140 pc, they are observable with HST down to scales of $\lesssim$100 AU, approximately the size of our Solar System. Early serendipitous HST observations of the Class II object HH 30 [e.g. 3] provided an almost textbook example of theoretical models [e.g. 5] of light scattered from an edge-on ($i\sim82^o$), flared, optically thick, accretion disk. Wood & Whitney [6] modeled a small lateral asymmetry in the scattered light pattern seen at different epochs in Burrows et al. [3], and suggested that it could be explained as a hot spot created via magnetic stellar accretion mediated by a dipole field not aligned with the stellar rotation axis. Based on additional epochs of HST observations, Stapelfeldt et al. [4] found that timescale arguments precluded changes in the outer disk as an explanation. They found that the limited data was consistent with both the hot-spot model [6] and shadowing by vertical disturbances in the inner disk, perhaps bars, warps, or spiral arms.

As part of HST program GO 10178 (PI: Hines), to obtain multi-wavelength polarimetry to investigate the evolution of dust grains in the disk around YSOs, we obtained NICMOS F160W observations in 2004 of seven objects which had previously been observed with NICMOS in 1997. Two of the objects, L1551 IRS 5 and HH 30 were observed as part of GTO 7228 (PI: Young), while the other five, CoKu Tau/1, DG Tau B, Haro 6-5B, IRAS 04010+2610 and IRAS 04302+2247 were observed as part of GO 7418 (PI: Padgett). We have reprocessed the 1997 data using the best available reference files.

All of the objects show significant changes in their scattered light patterns between the two epochs. The observed variations, however, are not all consistent with the simple lateral asymmetry seen HH 30, and no single pattern of variations is seen through all of the observed objects. For example, in DG Tau B (Figure 1), we find that between from 1997 to 2004 the flux from the brighter ("upper") region of the nebula has decreased significantly, while the dimmer ("lower") region has increased. In addition, although the one side of the upper region has dimmed, there has been no corresponding brightening of the laterally symmetric region. In addition to the traditional variability in the magnitude and the equivalent width of emission and absorption lines, changes in the scattered light pattern observable in high resolution imaging must be considered when addressing the underlying mechanism responsible for the variability of these objects. We will explore which of the mechanisms is most consistent with our observations.

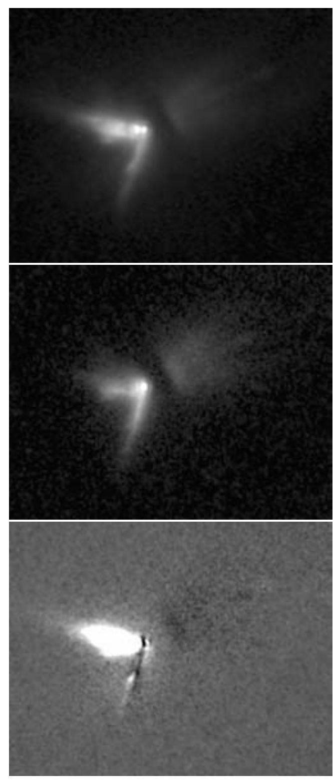

Figure 1: DG Tau B: *Upper:* F160W image from 1997, taken as part of GO 7418 (PI: Padgett). *Middle:* F160W from 2004, taken as part of GO 10178 (PI: Hines). *Lower:* 1997-2004 differenced image.

**References**

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