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SpS1-Measuring magnetic fields on young stars

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T Tauri stars (TTSs) are young (∼few Myr) late type stars that have only recently emerged from their natal molecular cloud material to become visible at optical wavelengths. It is now generally accepted that accretion of circumstellar disk material onto the surface of a TTS is controlled by a strong stellar magnetic field (e.g. see review by Bouvier *et al.* 2007). The stellar field appears critical for explaining the rotational properties of TTSs (Bouvier *et al.* 2007, Herbst *et al.* 2007) and may also play a critical role in driving the outflows seen from many of these sources (e.g. Shang *et al.* 2007, Mohanty & Shu 2008). As a result, there is a great deal of interest in measuring the magnetic field properties of TTSs (e.g. Johns–Krull 2007, Donati *et al.* 2008). In particular, disk locking theories predict that an equilibrium is established where the disk is trunctated at or close to corotation and the stellar rotation rate depends only on the (assumed) dipolar magnetic field strength, the stellar mass, radius, and the mass accretion rate in the disk (see Bouvier *et al.* 2007).

Recent efforts to measure magnetic field properties on TTSs have focused on detecting Zeeman broadening of lines in Stokes I spectra or on the detection of circular polarization in Stokes V spectra. Zeeman broadening measurements are sensitive to total magnetic flux, while polarization measurements give information on field geometry, though they often miss most of the flux (e.g. Reiners & Basri 2009). The majority of results published to date are based on Zeeman broadening measurements. Rapid rotation of young stars complicates the observations; however, the λ^2 dependence of Zeeman broadening compared to the λ^1 dependence of Doppler broadening allows this to be overcome by using lines (e.g. Ti I) in the near-IR (e.g. ~ 2 μm). Recent measurements (e.g. Johns–Krull 2007, Yang *et al.* 2008) find field strengths of the correct magnitude, but the predicted star to star variations are not observed.

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