SPECTRO-IMAGING OBSERVATIONS OF TTS MICROJETS.

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The physical mechanism by which mass is ejected from accreting systems and collimated into jets is a fundamental open problem in star formation. Magnetohydrodynamic (MHD) accretion-driven wind models best explain the efficient collimation and the large mass ejection efficiencies observed. However, the exact origin of the outflow is not yet determined: origin in the disk or in the star. Distinguishing between the different scenarii is crucial not only for understanding the accretion/ejection processes but also for planetary formation models as they have distinct implications on inner disc physics. We present here spectro-imaging studies of the forbidden line emission regions in selected TTS microjets. The aim of this study is to find observational constrains to the models using high resolution observations that allow us to probe the outflow on scales $\leq$ 100 AU.

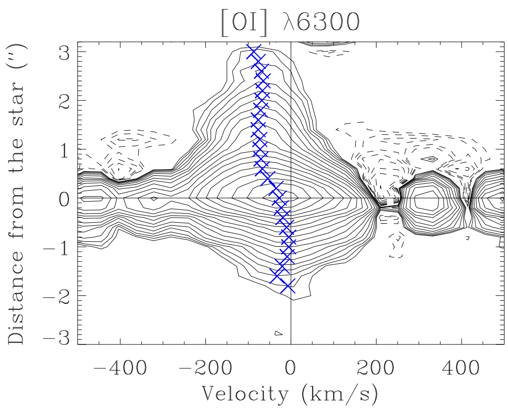

Figure 1: Position-Velocity map along the RY Tau jet in [OI] λ6300Å, integrated over a 1$''$ wide "slit" and sampled every 0.$''$2. Centroid velocities (blue crosses) derived from gaussian fits are also plotted.

We first present the optical spectro-imaging observations of RYTau in the [OI]λ6300Å line, using the integral field spectrograph OASIS, combined with adpative optics (AO), at CFHT. RY Tau is hotter and more massive [1], and it has an acretion rate [1] typically an order of magnitude lower than previously studied sources. It is also a suspected close binary star from Hipparcos observations [2]. We clearly detect the blueshifted jet with an average centroid velocity of $\sim$-70 km/s (HVC) that suggests a weak inclination to the plane of the sky. We also detect a blue low velocity component (LVC) of $\sim$-10 km/s that dominates the PV map, Fig. 1, close to the star. We have found a jet PA of 294$^\circ\pm$ 1° perpendicular to the orientations of the disc (21°) inferred from mm CO observations [3]. This PA is in good agreement with the PA of the centroid shifts observed by Hipparcos (304$^\circ\pm$ 34°) [2] calling into question the interpretation in terms of binarity of RY Tau. We derive an opening angle of $\sim$5° and a mass loss rate of 0.2-1.3 10^{-8} $M_\odot$/yr giving a $\dot{M}_{ej}/\dot{M}_{acc}$ ratio between 0.02 and 0.2, similar to the values found in other jet sources. We investigate the transverse morphology of the jet and compare it with predictions from MHD disc wind models and, as we expected, the radial velocity is smaller in the external parts of the jet than in the internal parts. At 1.$''$2 to the star we detect a velocity shift of -20.8 $\pm$ 6.5 km/s likely caused by the wings of a bow-shock placed at the position of the maximum in velocity and intensity, at 1.$''$35 from the star.

We also analyze near IR spectro-imaging observations of the DG Tau microjet using the integral field spectrograph SINFONI, combined with adaptive optics, at VLT. Observations were made in H and K at a spectral resolution of 3000-4000 and spatial resolution of 0.15".

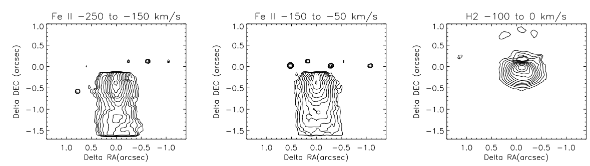

Figure 2: [Fe II] 1.644 μm and H_2 2.128 μm reconstructed channel maps of the DG Tau blueshifted jet. The achieved spatial resolution is FWHM=0.15".

The important atomic and H_2 emission detected in the DG Tau microjet, Fig. 2, allow us to carry out a detailed study of the flow structure in a broad range of excitation conditions and check the disk wind scenario. In particular, the H_2 emission detected in this star shows a collimation similar to the atomic flow, a strong indication that H_2 traces intrinsic jet material with launching radii of a few AUs in the disc. We will present the first results of this study on the conference poster.

References

[1] Calvet, et al., 2004, AJ,128, 1294

[2] Bertout, C., Robichon N., & Arenou F., 1999, A&A, 352, 574

[3] Koerner, D. W., & Sargent, A. I., 1995, AJ, 109, 2138