POSTER CONTRIBUTIONS (ABSTRACTS)

HYDRODYNAMIC EJECTION OF BIPOLAR FLOWS FROM T TAURI STARS

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If T Tauri stars form, at least in part by way of an accretion disk, then intrinsically bipolar flows arise as natural consequences of this mode of star formation. Taking the vertical structure into account, the orbital energy released as disk matter impacts the protostar is shown to be sufficient to straightforwardly generate pressure-driven winds perpendicular to the plane of the disk. These flows originate from a region much smaller than the entire stellar surface and thus large recombination rates make the flows neutral. This mechanism produces intrinsically collimated motions in contrast with the normal assumption of originally spherical winds constrained by a disk. Disk accretion naturally leads to bipolar flows and may actually *constitute* the T Tauri phase. Symmetrically located Herbig-Haro objects would also be a consequence of this mode of stellar formation.

JETS FROM PRE-MAIN-SEQUENCE STARS: AS 353 A AND ITS ASSOCIATED HERBIG-HARO OBJECTS

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A new Herbig-Haro object, designated HH 32C, has been discovered near the T Tauri star AS 353A. HH 32C is aligned on the opposite side of AS 353A from two previously known HH objects 32A and B. The emission line spectrum of HH 32C shows high velocity blue-shifted material moving at speeds (350-400 km s^{-1}) comparable to the high velocity redshifted material in HH 32A, B. A faint bridge of emission line gas is seen connecting AS 353A with HH 32A, B. Thus, this represents the second case in which HH-objects clearly trace a high-velocity, well-collimated bipolar outflow from the immediate vicinity of a *visible* pre-main sequence object.

Spectra of all three HH objects at 0.5 Å resolution obtained with the MMT echelle spectrograph reveal Hα, [N II] and [S II] line profiles with complex velocity structure ranging from 20 to 400 km s^{-1} but with a different dominant velocity in each knot. Excitation temperature differences between the slow moving knot HH 32A (peak intensity at 60 km s^{-1}) and the fast moving knot HH32B (peak intensity at $\sim$ 260 km s^{-1}) strongly support a model by which these HH objects are interstellar cloudlets accelerated and shock-heated by a jet emanating from AS 353A. This model is supported also by the lower brightness of HH 32B and the two times higher proper motion of HH 32B compared to HH 32A (Herbig and Jones 1983). This means that the shock-heated matter visible in HH 32B is closer to the velocity of the jet than in HH 32A. The obtained high resolution P Cygni profiles of the Hα, NaD and Ca II lines of AS 353A indicate the presence of a strong and cool stellar wind. The Hα absorption extends to a higher negative velocity than does the Na D_2 absorption (also Ca II K with V_{max} = 270 km s^{-1}). The smaller maximum velocity in the lower ionization species suggests that we are observing a wind which is being gravitationally decelerated as it moves away from the star and is cooling by radiation and adiabatic expansion. A decelerating wind is further suggested by a relatively sharp (FWHM ≃ 40 km s^{-1}) blueshifted absorption at -114 km s^{-1} in the Ca II K line, which has not varied appreciably over two months. This suggests a formation distance (> 4 AU) considerably further from the star than for the broader "P Cygni" absorption. This all means that the present terminal wind velocity in AS 353A seems to be considerably lower than the maximum P Cygni velocities, or $V_t \sim$ 100-200 km s^{-1}; a value typical of other high mass loss T-Tauri stars (Mundt 1983, *Ap. J.*, submitted). Thus, the high velocity components in the HH-objects are moving much faster than the inferred terminal velocity of the wind. This either means that the wind speed is variable or a mechanism is required which both accelerates and collimates the flow far from the star.

A more detailed discussion of these observations is published in *Ap. J.* (*Letters*), 265, L71, 1983).

JETS FROM YOUNG STARS

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Deep CCD images in the red and in Hα of various young stellar objects (mainly T-Tauri stars) and Herbig-Haro objects have been obtained. These observations were made in January 1983 with 2.2-m telescope on Calar Alto, Spain.

Here we report on the discovery of three new objects which are associated with jet-like emission nebulosities. These three new jets go out from a star at the position of HH 30, from DG Tau B (a faint red star near DG Tau) and from the vicinity of HL Tau. The faint star found at the position of HH 30 (by imaging with emission-line free filters) is probably a T-Tauri star as indicated by the spectrum obtained by Cohen and Schmidt (1982, *A.J.*, 86, 1228). Furthermore we confirm that a jet is emanating from the position of IRS in L1551, and report the discovery of a bright HH-knot 8 arc sec south-west to the T-Tauri star DG Tau. All these 4 jets have typical dimensions of 2×15 arc sec on the sky which corresponds to about 0.001×0.01 pc (at a distance of 150 pc). On the basis of the morphological structure of these jets and from the presence of similar cases (with known velocities of the emitting matter) it can be argued that they are probably the result of highly collimated outflows from young stars. In all 4 cases discussed here the opening angle of the jet is in the order of 5-10 degrees which requires a very efficient collimation process. However, the high collimation seems to get lost within relatively small distances (∿ 0.01 pc). Similar high degress of collimation are known so far only in the case of the jet emanating from the dust globule ESO 210-6A which is connecting HH 46 and HH 47 (see e.g., Graham, 1982 in *Leiden Workshop on Southern Galactic Surveys*). These high degress of collimation and the fact that some of these flows are already highly collimated on scales of 0.001 pc puts important constraints on any collimation process.

The region around HL Tau, HH 30 and IRS 5 is known to be associated with high velocity CO gas (see e.g., Snell and Edwards 1983, preprint). "Optical indicators" for relatively well collimated flows from sources with high velocity molecular gas are known for a few other cases (AS 353 A, HH 1, 2, HH 7-11). It may be that a large percentage of the high velocity molecular flows are driven by sources with small (∿ 0.01 pc) but well collimated jets.