IX - POSTER CONTRIBUTIONS
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HIGH-VELOCITY MOLECULAR BULLETS IN BIPOLAR OUTFLOWS : L1448 AND HH7-11

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On the main axis of two bipolar outflows (L1448 and HH7-11), we have discovered molecular clumps ("bullets") moving at extremely high-velocities. The observations were made in CO lines (mainly $J = 2 - 1$) with the IRAM 30-m telescope at Pico Veleta, near Granada (Spain). We present in Figure 1 some profiles observed toward the axis of the two outflows. In addition to the ambient line and to the extremely high-velocity wings, we observe several very well defined peaks at high velocities. Our maps show that these features are well delimited in the space, indicating that they arise in small high-velocity clumps or "bullets".

In L1448, the bullets have typical sizes of about 0.03 pc and masses of a few $10^{-4} M_O$. They appear in pairs (one red-shifted for each blue-shifted) at symmetrical positions with respect to the position predicted for the driving source (the "U-star"). Such a high symmetry indicates that the bullets have been ejected from the immediate vicinity of the U-star. In the HH7-11 outflow, we have detected high-velocity molecular bullets traveling at velocities > 100 km/s, however the CO emission from the HH7-11 bullets is significantly weaker than that from the L1448 bullets. This difference in intensity could be related to the different degree of evolution of both sources, since the kinematical timescale of the L1448 outflow is shorter than that of HH7-11 (both sources are at about 350 pc of distance).

Our observations suggest that the CO bipolar outflows are driven by jet-like neutral winds at extremely high-velocities. The existence of high-velocity CO bullets in those winds could be a common phenomenon, at least in the youngest outflows. It remains unclear whether those neutral winds are of stellar origin or if they arise in the surface of circumstellar disks. However, the models in which the wind originates from the two sides of an accretion disk seem to be favored by the L1448 observations, because the coupling between the two sides of the disk leads naturally to simultaneous fluctuations of the mass ejection rate in the two opposite directions. In the frame of the MHD disk-driven wind models, the instabilities in the mass ejection rate of the accretion disk (and associated MHD wind) can generate periodical

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ejections of matter which are bipolar in origin, similar to the ejections observed toward L1448. More detailed reports on our observations can be found in Bachiller et al. (1990, Astron. Astrophys., 231, 174) and in Bachiller and Cernicharo (1990, Astron. Astrophys., in press).

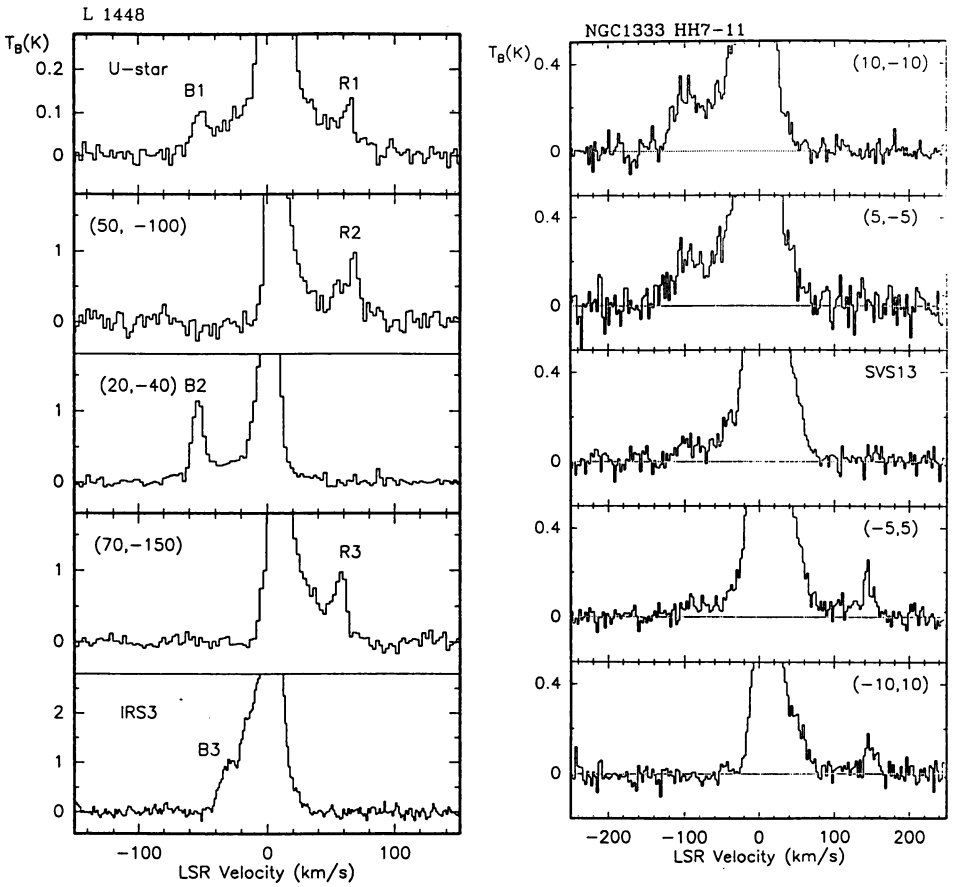

Fig. 1. Left : Some CO ($J = 2-1$) profiles observed toward the main axis of the L1448 outflow. Position offsets are measured with respect to the IRS3 position (in arcsec). Right : CO profiles observed toward the HH7-11 outflow. Position offsets are with respect to SVS13.

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