The interaction between giant Herbig-Haro flows and their surroundings

Abstract

Using the on-the-fly (OTF) mapping technique with the NRAO 12m telescope, we observed a great extent of the molecular gas surrounding two giant Herbig-Haro (HH) flows. Most conventional molecular outflows studies are constrained to the immediate vicinity of the molecular outflow lobe and do not study the overall cloud gas around it. We used the advantages of the OTF technique in order to observe two molecular outflows and a large extent of their surroundings, using the CO(2-1) line, with high resolution and signal to noise, in a relatively small amount of time.

The map of the giant HH flow HH315, driven by the star PV Cephei (at a distance of 500pc) is 2 x 3.6 pc. The OTF map of the HH300 outflow, driven by IRAS 04239+2436 in B18w cloud, in Taurus, (at a distance of 140 pc) only includes the redshifted lobe, and it is 0.4 x 1.5 pc. By observing with high sensitivity, a bigger area than what it is usually observed of the molecular gas surrounding HH flows, we are able to study the overall effects the HH flows have on the surrounding gas in a more complete way.

Preliminary Results

1) This is the first time that HH300 has been mapped in CO, and the first time that HH315 has been fully mapped in CO(2-1). We find the HH315 outflow to be bigger than was originally thought.
2) Both molecular outflows have density-velocity structure suggestive of their being formed by (bow-shock) prompt entrainment.
3) Both molecular flows have a mass which is 10 to 20% that of the mass of the ambient gas in the same area where the flow lies.
4) We find unresolved high-velocity components in CO(2-1) at the same position as several of the optical HH knots. In particular, the IRAM 30m data shows very interesting position and velocity structure in both HH315B and HH315C.
5) From the position-velocity diagram of HH315 it is evident that the outflow has modified the velocity structure of the cloud.
6) We find that HH300’s redshifted lobe is aligned to its parent dark cloud’s major axis. Is this coincidence, or the outflow’s doing?


* CCD image from Reipurth et al. 1997, AJ, 114, 278

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