Outflow feedback on star formation: wind-driven or jet-driven?

M. Rabenanahary\textsuperscript{1}, S. Cabrit\textsuperscript{1}, Z. Meliani\textsuperscript{2}, G. Pineau des Forêts\textsuperscript{1,3}

\textsuperscript{1}LERMA, Observatoire de Paris, PSL, Sorbonne Université
\textsuperscript{2}LUTH, Observatoire de Paris, PSL, Sorbonne Université
\textsuperscript{3}IAS, Université Paris-Saclay

A long-standing open question in star formation is the process responsible for its low efficiency on parsec scales (a few %), and for shifting down the IMF to only \(\sim 30\%\) of the prestellar core mass distribution. The most recent numerical simulations show that neither turbulence nor magnetic fields can, alone, reproduce these low efficiencies, and that feedback by protostellar outflows must play a crucial role by disrupting accretion streams, expelling material from cores, and/or sustaining turbulence (see eg. [1] for a review).

Unfortunately, the magnitude of outflow feedback (affected cloud volume, injected momentum, entrained mass, impact on the disk and infalling envelope) depends strongly on the underlying protostellar wind geometry, which remains uncertain and heavily debated [2]: a fast wide-angle "X-wind", a slower MHD disk wind, a narrow jet? Clearly, if we want to reliably assess the role of outflow feedback in star formation, it is of utmost importance to determine which wind geometry is the most realistic (and/or which one can be excluded).

As a new contribution towards this goal, we present numerical predictions for outflows "shells" driven by a narrow jet in a prestellar core, that we compare against recent ALMA observations and analogous predictions for a wide-angle X-wind [3]. Our simulations are the first to combine jet variability, ambient density-stratification, and long timescales up to 10,000 yr (typical of young outflows) on scales up to 0.1 pc. We find that the predicted widths, position-velocity diagrams, and mass-velocity distribution, show striking resemblance with ALMA observations of CO outflows such as HH46-47 and CARMA-7, and often in closer agreement than models based on a wide-angle "X-wind". Implications and future tests will be briefly discussed.

Références