Outflow dynamics, accretion disks and chemical abundances

A. Fuente
Observatorio Astronómico Nacional (OAN), Apdo. 1143,
E-28800 Alcalá de Henares (Madrid), Spain
fuente@oan.es

FIRST is ideally suited for studying the earliest stages of star formation. Wide-field SPIRE and PACS imaging surveys will allow us to complete the census of protostars in the nearby molecular clouds. Spectroscopic studies of these protostars will provide important information to constrain the physical processes that are taking place in these protostars.

The excitation near young stellar objects is dominated by a mixture of photodissociation regions (PDRs) and shocks. While shocks are expected to be the dominant excitation mechanism in bipolar outflows, PDRs are expected to be important in the inner envelope and the accretion disks. To distinguish between regions dominated by shocks and PDRs is essential for the correct interpretation of the data. We can distinguish between PDRs and shocks by (i) determining the excitation conditions of the dominant coolants; (ii) chemical arguments, a different chemistry is expected in shocks and PDRs; (iii) the kinematical structure of the region, since the molecular emission occurs in the post-shock accelerated gas, the lines may be shifted appreciably from the velocity of the ambient gas; and (iv) energetic arguments, the IR line emission /IR continuum emission ratio is expected to be very different from PDRs to shock. However, very few times these diagnostics have been applied successfully to previous observations. This was mainly because previous observations (mainly ISO) were hampered by the limited sensitivity, the poor angular and spectral resolution (beam = $80''$, Δv = 10 kms^{-1}), and the observation of the high excitation lines (with critical densities larger than 10^6 cm^{-3}). The detailed study of prototypical regions using the high spatial and spectral resolution provided by HIFI will allow to fully characterise the physical and chemical conditions in PDRs and shocks.

Applying these results to other YSOs, we hope to be able to construct a physical and chemical evolutionary sequence in YSOs. Large surveys of young stellar objects of different luminosities and ages, will allow to determine the dependence of the physical conditions and chemistry of the circumstellar material with the spectral type of the newly formed star.