भारतीय खगोलभौतिकी संस्थान
Indian Institute of Astrophysics

IIA Colloquium

3:30 p.m., Tuesday, 23rd June 2026
IIA Auditorium

Prof. James M. Jackson

National Radio Astronomy Observatory
USA

The Most Rapidly Collapsing Molecular Clumps

An analysis of the Millimetre Astronomy Legacy Team 90 GHz (MALT90) survey has produced a sample of 27 candidate dense molecular clumps with large collapse motions, as revealed by large “blue” asymmetrical line profiles of the optically thick HCO+ (1–0) line. New, more sensitive molecular line observations of this sample, conducted with the Mopra 22-m telescope, confirm the blue asymmetries in the HCO+(1–0) line profiles, with large, positive values of the asymmetry parameter A (HCO+) = 0.69±0.01, and decreasing values of A for lines with smaller optical depths, as expected for collapsing clumps. The hyperfine ratios for N2H+(1–0) are in their optically thin, LTE, values, but for HCN (1–0) they are not; the F = 1 → 1 hyperfine line shows abnormally weak intensities. A simple two-component model shows that self-absorption of the background F = 1 → 1 hyperfine line by the main F = 2 → 1 hyperfine line of a cold, foreground, redshifted cloud can reproduce the observed HCN (1–0) hyperfine intensities and match both the HCN (1–0) and HCO+(1–0) line profiles. All of these results are consistent with self-absorption of the optically thick lines on the red side of the profile, as expected for collapsing clumps. A simple two-cloud model suggests that this sample represents dense clumps with extreme collapse velocities, V_inf ~ 2.4 km s−1, the highest known.

High Tea at auditorium lounge at 3:00 p.m.