

Millimeter-Wave Interferometry of Proto-Planetary Nebulae

A. Dayal¹, J.H. Bieging¹ and P. Bergman^{2,3}

Steward Observatory, Tucson, USA Caltech, Pasadena, USA 1; Onsala Space Obs., Sweden 2; 3

We have observed 2 compact PPNe, AFGL 2343 and IRAS 22272+5435, in the CO J=1-0 transition using the Owens Valley interferometer (OVRO), and the NRAO 12-meter telescope. Our observations were made in the low and intermediate resolution configurations of the interferometer and we obtain a synthesized beam (HPBW) of $\approx 4''$. We are now modelling both sources using statistical equilibrium/radiative transfer codes. Our objectives are to a) map the distribution and kinematics of the molecular gas at high angular resolution and b) estimate the physical conditions (mass loss rate, temperature, density) in the molecular envelopes, through our models.

(i) **AFGL 2343:** The CO emission is centrally concentrated but extends out to about $8''$ from the center. The emission line is about $\approx 90 \text{ km s}^{-1}$ wide, centered at a systemic velocity of 100 km s^{-1} (V_{lsr}). The line profile suggests that the CO emission is optically thin and resolved; the asymmetry (sharp peak at 125 km s^{-1}) points to a strong excitation gradient which results in absorption of the blue-shifted emission by cooler, foreground gas.

(ii) **IRAS 22272+5435:** The CO emission region is somewhat elliptical (PA $\approx 125^\circ$) and there is evidence of a protrusion that extends about $11''$ from the center (Fig 1). The direction of this protrusion appears to follow the distribution of the cooler dust and the $11 \mu\text{m}$ emission feature, in our mid-IR images. The CO emission line is parabolic in shape (optically thick) and has a width of $\approx 20 \text{ km s}^{-1}$.

Fig. 1: IRAS 22272+5435: CO J=1-0 emission. The contours range from 0.8 K-T_b ($3-\sigma$) to 15 K , with an average spacing of 2.5 K .

