The Nearby Evolved Stars Survey

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Low-to intermediate-mass stars (0.8-8 $M_{\odot}$) evolve into asymptotic giant branch (AGB) stars, and they are major contributors to the chemical enrichment of the ISM in our Galaxy. Ongoing work in the AGB star community has made great progress in understanding these objects via modeling but comparative studies of the circumstellar environments of large samples of AGB stars have started only recently. These objects are known to have high mass-loss rates and studies of this mass loss provides an insight on the chemical evolution of the Galaxy, the evolution into planetary nebulae and further evolution into white dwarfs [1].

The CO molecule is a good tracer of AGB gas mass-loss [2, 3] since its abundance relative to molecular hydrogen (H_2), the main constituent of the stellar wind, is similar for oxygen- and carbon-rich AGB stars [4].

The Nearby Evolved Stars Survey (NESS) is a multi-telescope project targeting a volume limited sample of AGB stars (up to a distance of 3 kpc) in order to derive the dust and gas return rates from such objects in the Solar Neighbourhood, and to constrain the physics underlying these processes. We performed observations with the APEX telescope (~150 stars) and the JCMT (~500 stars) in higher *J*-transitions of CO and with IRAM 30m we observed the CO (1-0) and (2-1) lines simultaneously (with the EMIR receiver) towards a sample of ~32 stars. The CO (1-0) line traces the cold molecular envelope out to the distance where CO is destroyed by photodissociation in the interstellar radiation field and thus is useful to get information about the "oldest" mass-loss and determine anisotropic mass-loss morphologies.

With the IRAM 30m data, our detection rate for CO (1-0) line was 84%, and 100% detection for the CO (2-1) line. Mapping observations of some stars revealed extended structures and in various cases we detect lines from other molecules. Combining the data from all three telescopes will allow robust statistical analysis of the relationships between stellar and outflow properties on a population-wide scale, giving us constraints for AGB-star models.

References

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