OBSERVING TECHNIQUES

Broadening perspectives

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The high spatial resolution provided by long-baseline interferometric arrays such as ALMA is extremely valuable scientifically, yet interferometers observing at such small scales (smaller than the wavelength divided by the closest separation of the antennas) are insensitive to large-scale regions of emission. This drawback makes it challenging to observe comets, for instance, where the molecular comae of nearby comets can cover several hundred arcseconds on the sky (compared to ALMA's maximum recoverable angular scale of ~5" at submillimetre wavelengths) and molecular emission lines can be weak. To circumvent this, Martin Cordiner and colleagues have pioneered a data-reduction technique that includes observations from the four 12-m 'total power' (autocorrelation) antennas of the ALMA interferometer in order to study the extended coma of comet C/2012 S1 (ISON).

Combining data from 28 active dishes (out of the 66 antennas in the array), and adding in the autocorrelation data that is normally discarded, this new technique brought about a fourteen-fold increase in the detected brightness of the HCN ($J = 4$–3) emission line from the comet (compared to the interferometer), and resulted in the first detection of the rotational emission from $H^{13}CN$ in this particular comet. Indeed, the initial reduction of the ALMA data using conventional (cross-correlation) techniques (reported in M. A. Cordiner et al. *Astrophys. J. Lett.* **792**, L2; 2014) failed to detect $H^{13}CN$ emission at all, demonstrating the improvement provided by this data-reduction method.

Further advances in sensitivity could be made by creating a dedicated position-switching mode for this kind of observation, enabling better background cancellation, which is currently affected by standing waves in the telescope optics and strong sky emission lines.

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