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# Sounding diffuse molecular gas with ALMA as a mean to prove that the CO-dark gas is molecular

*Friday, 18 October 2019 10:10 (15 minutes)*

Contributed talk

Abstract:

Studies of the dust continuum emission and extinction, and of the gamma ray emission show that a fraction of the interstellar gas is not traced by the combination of HI 21 cm and CO J=1-0 emission lines. The nature and physical conditions of this so called CO-dark gas are debated. We have used ALMA to search for molecular absorption towards distant quasars in the field of view of molecular clouds (Chamaelon, Taurus-Auriga, Galactic Bulge). We show that HCO<sup>+</sup> absorption, tracing the presence of diffuse molecular hydrogen, is detected down to reddening values approaching the threshold for H<sub>2</sub> formation ( $E(B-V) \sim 0.1$  mag), and that the detected amount of molecular gas explains the presence of CO-dark gas. CO is detected toward a subset of sources with column densities at the same level as those derived from FUV spectra, that are too low to produce a detectable J=1-0 emission. The CO-dark gas is dynamically active with complex HCO<sup>+</sup>, HCN, CCH and CO line profiles. The CO line profiles are narrower than those from HCO<sup>+</sup>, providing further support for a tight coupling of the gas dynamics and chemistry. This work also confirms that HCO<sup>+</sup> is the most sensitive tracer of diffuse molecular gas at millimeter wavelengths, with a mean abundance relative to H<sub>2</sub> of  $3 \times 10^{-9}$ , firmly established by several comparisons with other, independent column density determinations.

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