

Millimeter-wave Absorption Studies of Molecules in Diffuse Clouds

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With IRAM instruments in the last few years, we have been using compact extragalactic millimeter wave radio sources as background objects to study the absorption spectrum of diffuse interstellar gas at millimeter wavelengths. The molecular content of interstellar gas has turned out to be unexpectedly rich. Simple polyatomic molecules such as HCO^+ , C_2H are quite ubiquitous near the Galactic plane ($b < 15^\circ$), and many species are detected in some directions (CO , HCO^+ , H_2CO , HCN , HNC , CN , C_2H , C_3H_2 , H_2S , CS , HCS^+ , SO , SiO). Remarkable proportionality relations are found between related species such as HCO^+ and OH , or CN , HCN and HNC . The high abundance of some species is still a challenge for current models of diffuse cloud chemistry.

A factor of 10 increase in the sensitivity will make such studies achievable in denser clouds, where the chemistry is still more active and where abundances are nowadays only available by emission measurements, and thus subject to uncertainties due to sometimes poorly understood line formation and excitation conditions.

Abstract submitted for Science with the Atacama Large Millimeter Array, 6 – 8 October 1999, Washington, D. C.