# pc-scale CO depletion in an Infrared Dark Cloud

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Molecules are used as tracers of interstellar gas, but their high sensitivity to both chemical reactions and freeze out onto the dust grains can alter their abundance by orders of magnitude. This renders molecules good diagnostics of selective processes (e.g., shocks), but poor tracers of the bulk of the cloud material. The study of molecular depletion is therefore key for understanding the limits of molecules as gas tracers.

To understand these limits, we observed G11 with the IRAM 30 m telescope in $N_2H^+$ and $C^{18}O$. G11 is one of the first-detected and best-studied IRDCs. It is located at a distance of 3.6 kpc, and it is ∼30pc in size. Henning et al. (2010) characterized several of its pre- and protostellar cores, and Kainulainen et al. (2013) has studied the dust extinction in the infrared, deriving a high-fidelity, high-resolution (2") column density map of the cloud. In fact, Kainulainen et al. (2013) results made G11 the perfect target to compare these two typical molecular tracers directly with dust extinction, and therefore, molecular depletion, at pc scales.

Our observations show that $C^{18}O$ and $N_2H^+$ behave very differently inside the G11 cloud. While $C^{18}O$ disappears from the gas phase at densities larger than few $10^4$ $cm^{-3}$, $N_2H^+$ remains detectable at all observed densities. This pc-scale behavior seen in G11 is reminiscent to that found in dense cores at scales of less than 0.1 pc, and illustrates the critical need of using depletion-resistance tracers when studying IRDCs as a whole.

## References

Henning, T., Linz, H., Krause, O., et al. 2010, A&A, 518, L95
Kainulainen, J., Ragan, S. E., Henning, T., & Stutz, A. 2013, A&A, 557, A120