



Matrix Isolation Sublimation (MISu): Cryogenic Atoms and Molecules

We present the Matrix Isolation Sublimation (MISu) technique for generating cryogenic beams of atoms and molecules for high precision spectroscopy. We have produced beams of Cr, Li, H and Li₂. We have measured temperatures from 16 K all the way down to 1 K, depending on the sublimation regime. The cold beams will be used for high-precision laser spectroscopy and for loading magnetic traps. Main applications are: comparison of hydrogen and antihydrogen spectra, production of cold samples of dipolar molecules for Quantum Information studies and other fundamental physics studies besides ultra-cold chemistry and astrochemistry. The MISu process is as follows: (1) A matrix of rare or inert gas (Ne, H₂) is first produced by directing a flux of rare gas towards a cold sapphire substrate at ~4 K. (2) The atomic/molecular species of interest are implanted into the matrix by laser ablation of a solid precursor containing the species. (3) The matrix gas along with the atomic/molecular species of interest is released by a sublimating heat pulse applied to the sapphire substrate. (4) The atoms/molecules fly out into vacuum, entrained or not into the inert gas cloud, depending on the sublimation regime.

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