Slow ground state molecules from matrix isolation sublimation

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Synopsis We describe a cryogenic beam of $^7$Li$_2$ dimers from sublimation of a neon matrix where Li atoms have been implanted via laser ablation of solid precursors of LiH. Laser absorption spectroscopy measured: T~7 K, Trot ~ 6K, drift velocity of 130 m s$^{-1}$ with molecular density of 10$^7$ cm$^{-3}$. The formation of molecules in a matrix offers new possibilities.

The production of cold samples or beams of molecules is an ongoing research field with many applications [1], from quantum information to basic physics tests, such as the search for a permanent electric dipole moment tests, quantum information studies, cold collisions, chemistry, and trapping.

A typical spectrum for the $A^1\Sigma^+_u (v' = 4, J' = 2) \leftarrow X^1\Sigma^+_g (v'' = 0, J'' = 1)$ transition, at 665.927 nm, are shown in Fig. 1.

![ Typical spectrum of Li$_2$ transition at 665.927 nm, black line; (b) best fit to the measured data, red line. The measured parameters $\Delta\nu_e$ and $\delta\nu_{DS}$ are related to temperature and forward velocity. ](image)

Details of the experimental setup for Matrix Isolation Sublimation (MISu): a neon matrix is grown onto a cryogenic sapphire substrate, and atoms of Li and H are implanted via laser ablation of a solid LiH precursor; atoms and molecules are liberated from the matrix into vacuum with a sublimation heat pulse on the NiCr film resistor on the sapphire, will be presented. Also, details how to generate and characterize the molecular beam will be given.

References

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