



AVVISO DI SEMINARIO

Martedì 15 aprile 2014 alle ore 10,00

nell'Area della Ricerca CNR di Pisa, Aula 44, primo piano, Edificio "A"

il Dr. Hans LIGNIER

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terrà un seminario sul tema:

Ro-vibrational optical cooling of molecules

Abstract

Laser techniques applied to precision spectroscopy or to the control of chemical reactions have improved considerably our knowledge of molecular physics. One of the greatest challenges of modern physical chemistry is to push forward the limits of electromagnetic or laser techniques to probe or manipulate molecules at low temperatures where molecular interactions are dominated by pure quantum phenomena.

In this context, we have developed an original technique that enables us to manipulate the internal degrees of freedom of diatomic molecules. Basically, the principle consists in using a broadband laser pumping all the internal levels towards a target level. We performed various experiments demonstrating the feasibility of the process: vibrational cooling [1] and rotational cooling [2] were successful on the cesium dimer formed by photoassociation of cold atoms.

In our recent project, we project to apply this method to rovibrationally cool a molecule (barium monofluoride) produced in a supersonic beam. Barium monofluoride is somehow particular as it has the property to stand about twenty optical cycles without escaping to another vibrational level. Once this species is prepared in a single rovibrational state, it will be possible to implement a Sisyphus cooling scheme, a well-known effect/method in the realm of cold atoms that potentially removes a huge quantity of kinetic energy per photon. In other words, Sisyphus cooling applied to molecules might be a solution to slow down and thoroughly cool a supersonic molecular beam.

[1] Optical pumping and vibrational cooling of molecules, M. Viteau et al., **Science**, 321 232 (2008).

[2] Rovibrational cooling of molecules by optical pumping, I. Manai, et al., **Phys. Rev. Lett.**, 109, 183001 (2012).