

## **Manipulation of the vibration of cold molecules**

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The photoassociation of cold atoms is a promising approach for preparing a cold molecular assembly at temperature in the range of the microkelvin [1]. The molecules can be accumulated in a magnetic quadrupolar trap [3] or in an optical dipolar trap [3]. Cold and dense molecular samples can so be obtained. Unfortunately, the molecules are prepared in a bunch of ro-vibrational levels. To control the vibration is still a challenge. Raman schemes can offer a possibility to prepare molecules in a well defined ro-vibrational level [4], but the accumulation of molecules is limited by further laser excitation of these molecules.

The possibilities to manipulate the vibration of the molecules by using femtosecond laser or shaped laser will be discussed. A key of the experiment is the use of a REMPI (Resonance Enhanced MultiPhoton Ionization) process to characterize the populated levels in the sample [5].

### References:

- [1] Formation of cold Cs<sub>2</sub> molecules through photoassociation, A. Fioretti, D. Comparat, A. Crubellier, O. Dulieu, F. Masnou-Seeuws et P. Pillet, Phys. Rev. Lett., 80, 4402-4405 (1998).
- [2] Accumulation of cold cesium molecules via photoassociation in a mixed atomic and molecular trap, N. Vanhaecke, W. de Souza Melo, B. Laburthe Tolra, D. Comparat, P. Pillet, Phys. Rev. Lett. 89, 063001 (2002).
- [3] Atom-molecule collisions in an optically trapped gas, N. Zahzam, T. Vogt, M. Mudrich, D. Comparat et P. Pillet, PRL 96, 023202 (2006).
- [4] Accurate asymptotic ground state potential curves of Cs<sub>2</sub> from two-colour photoassociation, N. Vanhaecke, C. Lisdat, B. T'Jampens, D. Comparat, A. Crubellier et P. Pillet, EPJD 28, 351-360 (2004).
- [5] Photoionization and detection of the ultracold Cs<sub>2</sub> molecules through diffuse bands, C. Dion, O. Dulieu, D. Comparat, W. de Souza Melo, N. Vanhaecke, P. Pillet, R. Beuc, S. Milosevic, G. Pichler, Eur. Phys. J. D 18, 365-370 (2002).