FORMATION OF COLD Cs_2 MOLECULES THROUGH PHOTOASSOCIATION

P. PILLET, A. FIORETTI, D. COMPARAT, C. DRAG, A. CRUBELLIER, O. DULIEU, and F. MASNOU-SEEUWS, *Laboratoire Aimé Cotton, CNRS II, Bat. 505, Campus d'Orsay, 91405 Orsay cedex, France*.

In contrast to atoms, laser cooling of molecules is very difficult because of the lack of a closed two-level scheme for recycling the population. The molecular photoassociation of cold atoms, where two free atoms resonantly absorb one photon and form an excited molecule in a ro-vibrational state, has opened the way to the observation of long range dimers and to the determination of long range potential curves. The formation of translationally cold ground state molecules after spontaneous de-excitation of photoassociated molecules is thought to be an easier way than the laser cooling method applied to molecules, but unfortunately this process is mostly quenched by spontaneous emission that leads back to the dissociation of the transient molecule into two free atoms. The cesium atom is however a good candidate for the observation of translationally cold ground state molecules [1].
The 0_g^- and 1_u potentials below the dissociation limit $6s^2S_{1/2}$ + $6p^2P_{3/2}$ present Condon points at intermediate distances, which are responsible for the existence of rather efficient channels for the creation of triplet and singlet ground state molecules, respectively, by spontaneous emission. We present the first evidence for translationally cold molecules created after photoassociation in a vapor-cell magneto-optical trap. We have observed the fall of the cold molecular sample and we have measured its temperature, 300μK, which is of the same order as that of the initial cold atomic sample.

[1] A. Fioretti, D. Comparat, A. Crubellier, O. Dulieu, F. Masnou-Seeuws, P. Pillet, submitted to Phys. Rev. Lett.