ISMO
L'INSTITUT DES SCIENCES MOLÉCULAIRES D'ORSAY

SEMINAIRE ISMO

Klaus Müller-Dethlefs
The Photon Science Institute School of Chemistry
The University of Manchester Alan Turing Building U K

ZEKE Rydbergs in a crowd: An ultra-cold, long lifetime, strongly-coupled molecular Rydberg plasma

For ZEKE spectroscopy the experimental conditions are usually set to produce an ensemble of only weakly interacting, very high-*n* Rydberg states at low density (typically < 10^5/cm^3), very far away from plasma conditions. In contrast, the formation of a Rydberg plasma by ZEKE excitation can be expected when increasing the ion/electron density. We have produced such an ultra-cold *molecular* Rydberg plasma with ion densities around 10^{15}/cm^3 for two molecules, para-difluorobenzene (pDFB) and nitric oxide.
For NO (in Ne as carrier gas) we produce such an ultra-cold, very long lifetime Rydberg plasma by two photon excitation into the threshold region, resonant via the A-state (N=0), in the expansion region of a supersonic jet, close to the nozzle. Collisions in the jet expansion cool the ions in the plasma to ca. 0.1*K* thus avoiding disorder heating as in MOT Rydberg plasma experiments.

After 320μs, when the plasma hits a 4mm diam. aperture, a dramatic increase in density is experimentally observed just behind this aperture. These observations can be explained by a compression of the plasma, which exhibits the properties of a sponge like material, i.e. a plasma crystal. These observations substantiate the evidence that this experimental route creates a strongly-coupled plasma with condensed phase properties.

The experimental observations are consistent with the formation of a strongly-coupled, ultra-cold plasma, crystallising into a "jellium" metal-like solid, possibly a new state of matter.

* * * * * *

ATTENTION DATE INHABITUELLE

Jeudi 10 juin 2010 à 11 h 00

Bât 351 - 2ème étage
Université Paris-Sud 91405 ORSAY Cedex