APSA 先端光量子科学アライアンス談話会

UT-PSC 光量子科学研究センターセミナー

IPST フォトンサイエンス研究機構セミナー

Toward a Magneto-Optical Trap for CaF Molecules

Dr. Eunmi Chae

Doyle lab, the Department of Physics,
Harvard University

蔡恩美氏
ハーバード大学理学部 John Doyle 研究室

日　時　:　平成 26 年 9 月 11 日(木) 16:30-18:00
場　所　:　東京大学理学部1号館2階 201A 号室

Abstract

Ultracold atoms have been an excellent quantum system to control and manipulate for studying various physics from simulation of condensed matter to precision measurements. Polar molecules with large electric dipole moments, large internal electric field, and rich internal states can overcome the limitation of atoms and expand the boundary of physics we can explore. For a certain experiment, one needs to choose an appropriate molecule according to its properties. However, there is no general method to produce ultracold molecules yet. For example, laser slowing which is a common starting point to slow atoms before capturing in a trap is hard to implement to molecules due to the limited number of photons that molecules can scatter before falling into dark internal states.

A slow buffer-gas beam source [1] with peak forward velocity ~ 50 m/s is an ideal source to start with due to the small number of photons required to stop molecules. We plan to use this versatile source to load a magneto-optical trap (MOT) for CaF molecules. Similar to the steps taken for a MOT for SrF [2], we are using "white-light" to slow the molecules below the MOT capture velocity. We plan to employ time-varying magnetic fields and MOT laser polarization (at an oscillation frequency of ~ 6 MHz, AC MOT) with the aim of depopulating magnetic dark states of molecules in the trap [3]. I will discuss first about our experiments of atomic MOTs for Yb, Tm, Er, and Ho directly loaded from buffer-gas beam source proving the feasibility of our beam source to load a MOT. The demonstration of white-light slowing and AC MOT for Li atoms will be followed. The talk will come to an end with the recent experiment of white-light slowing of CaF molecules and the progress toward an AC MOT for CaF.

References

[1] N. R. Hutzler, et al., Chem. Rev. 112, 4803 (2012).
[2] J. F. Barry, et al. arXiv:1404.5680 (2014).
[3] M. T. Hummon, et al., Phys. Rev. Lett. 110, 143001 (2013).

紹介教員：五神真教授　(物理学専攻)