Minicolloque n° PMQ31 **x Oral** **□ Poster**

Anderson localization of light by Ytterbium cold atoms

Álvaro de Melo[a*], Hector Letellier[a], Anaïs Dorne[a], and Robin Kaiser[a]

a. Université Côte d'Azur, CNRS, Institut de Physique de Nice, 1361 Route des Lucioles, 06560 Valbonne, France.

* email : alvaro.mitchell@inphyni.cnrs.fr

The experimental realization of 3D Anderson localization of light, or the absence of diffusion of light in a disordered medium, has been intensively sought by many different groups since the 80`s. However, absorption and nonlinear effects from different media have mimicked experimental signatures and made indisputable observation of 3D Anderson localization a challenge [1-4]. More recently, cold atoms have emerged as promising samples to investigate Anderson localization of light. Even though the existence of Anderson localization of light has been theoretically questioned when the vectorial nature of light is taken into consideration [3], an additional magnetic field or disorder induced in the atomic levels by a speckle field in a cloud of laser-cooled atoms have been suggested as possible routes to observe this phase transition.

In this talk, the state of the art of the experimental setup will be presented, including details on the laser system, the Ytterbium magneto-optical trap and the next experimental steps. Different approaches that will be used to observe Anderson localization of light by cold atoms will be discussed, alongside their advantages and technical challenges. In the first one, diagonal disorder will be obtained by a 3 dimensional speckle field that will be applied to the atomic cloud in order to induce spatial dependent light shifts. One of the advantages of this setup is that the disorder can be fastly switched on or off, which is not simple for different media like solid state devices. The second method consists in the application of a bias magnetic field to split the atomic Zeeman levels and the analysis of light transmited through the sample for different experimental parameters, as proposed in [4], can reveal experimental signatures of 3D Anderson localization.

[1] Frank Scheffold, Ralf Lenke, Ralf Tweer & Georg Maret, Nature 398, 206–207 (1999)

[2] T. van der Beek, P. Barthelemy, P. M. Johnson, D. S. Wiersma, and A. Lagendijk, Phys. Rev. B 85, 115401 (2012)

[3] F. Scheffold et al., Nat. Photon. 7, 934 (2013)

[4] T Sperling et al., New J. Phys. 18, 013039 (2016)

[5] S. E. Skipetrov and I. M. Sokolov, Phys. Rev. Lett. 112, 023905 (2014)

[6] S. E. Skipetrov and I. M. Sokolov, Phys. Rev. Lett. 114, 053902 (2015)

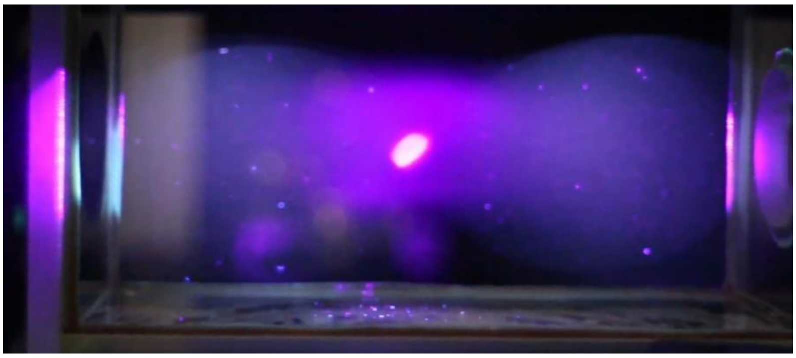

Figure 1 : Ytterbium MOT on the $^1S_0 - {}^1P_1$ line, with $2\ 10^9$ atoms.