

Spécialité de Master « Optique, Matière, Paris »

Stage de recherche

Proposition de stage

Date de la proposition : 26 octobre 2016

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Titre du stage / internship title : Atomic coherent backscattering in an artificial gauge field
Résumé / summary This project is theoretical
<p>Advances in atom optics now allow to precisely control cold-atomic gases and the environment in which they evolve, at a level rarely attained in physics. In particular, it is possible to finely study the dynamics of cold atoms in random (i.e. spatially disordered) optical potentials, where the phenomenon of Anderson localization is expected [1].</p> <p>At weak disorder, interference gives rise to a precursor of Anderson localization known as the coherent backscattering effect. For a cold atomic gas, coherent backscattering manifests itself as a macroscopic interference peak that grows in the momentum distribution of the gas [2] and has been recently observed experimentally [3]. During the internship, the student will investigate the effect of a gauge field on the atomic coherent backscattering peak. Two types of gauge fields will be considered, one simulating the effect of a magnetic field and another of a spin-orbit coupling on the localization properties of the atoms. For this purpose, an analytical diagrammatic theory will be used.</p> <p>This project can be pursued in a Ph.D. A possible continuation of this work is the study of gauge fields in the (strong disorder) regime of Anderson localization, in particular in high dimensionalities where a quantum phase Anderson transition shows up [4].</p>
[1] D. Delande, J.-C. Garreau, L. Sanchez-Palencia, B. van Tiggelen, <i>La localisation forte d'Anderson</i> , Images de la Physique 70 (2009).
[2] N. Cherroret, T. Karpiuk, C. A. Müller, B. Grémaud, C. Miniatura, <i>Coherent backscattering of ultracold matter waves : momentum space signatures</i> , Phys. Rev. A 85 , 011604 (2012).
[3] F. Jendrzejewski, K. Müller, J. Richard, A. Date, T. Plisson, P. Bouyer, A. Aspect, and V. Josse, <i>Coherent Backscattering of Ultracold Atoms</i> , Phys. Rev. Lett. 109 , 195302 (2012).
[4] F. Jendrzejewski, A. Bernard, K. Müller, P. Cheinet, V. Josse, M. Piraud, L. Pezzé, L. Sanchez-Palencia, A. Aspect, P. Bouyer, <i>Three-dimensional localization of ultracold atoms in an optical disordered potential</i> , Nature Phys. 8 , 398 (2012).

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : Oui	
Si oui, financement de thèse envisagé / financial support for the PhD : bourse EDPIF ou autre	
Lumière, Matière, Interactions	Lasers, Optique, Matière