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Direct weak localization signature with ultracold atoms: the CBS revival

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Ultracold atomic systems in presence of disorder have attracted a lot of interest over the past decade, in particular to study the physics of Anderson localization (AL) in a renewed perspective. Landmark experiments have been demonstrated, in 1D [?, ?] and 3D [?, ?, ?] geometries. However many challenges remain and new ideas have emerged, as for instance the search for original signatures of Anderson localization in momentum space [?].

Here I will describe our progresses along that line where a weak localization effect has been directly observed, i.e. the Coherent Backscattering (CBS) phenomenon [?]. In particular I will report on the recent observation of suppression and revival of CBS when a controlled dephasing kick is applied to the system [?]. This observation demonstrates a novel and general method, introduced by T. Micklitz and coworkers [?], to study probe phase coherence in disordered systems by manipulating time reversal symmetry. J. Billy *et al.*, *Nature* **453**, 891 (2008). G. Roati *et al.*, *Nature* **453**, 895 (2008). S. Kondov *et al.*, *Science* **334**, 66 (2011). F. Jendrzejewski *et al.*, *Nat. Phys.* **8**, 398 (2012). S. Semeghini *et al.* *Nat. Phys.* **11**, 554 (2015). T. Karpiuk *et al.*, *Phys. Rev. Lett.* **109**, 190601 (2012). F. Jendrzejewski *et al.*, *Phys. Rev. Lett.* **109**, 195302 (2012). K. Müller *et al.*, *Phys. Rev. Lett.* **114**, 205301 (2015). T. Micklitz *et al.*, *Phys. Rev. B* **91**, 064203 (2015).