Towards experimental signatures of disorder-induced criticality of quantum eigenstates *via* chaotic dynamics

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Cold atoms experiments are a platform of choice for the experimental study of quantum waves dynamics in disorder. A particular effect that remains elusive in such systems is the appearance of critical eigenstates, neither diffusive nor localized, for certain types of disorder, as in the metal/insulator transition of the celebrated 3D Anderson model. Theoretical results show that the probability distribution of these critical states is multifractal.

However, numerous difficulties arise when trying to experimentally observe such states. Firstly, a sufficiently rich model is needed so that criticality does not correspond to a single point in parameter space but a complete domain. Secondly, it is also necessary to average measurements over different realizations of the disorder, since predictions describe statistical properties. Finally, a relevant observable should be identified to detect multifractal quantum states which, in theory, exhibit fluctuations at every length scale.

In this poster, I will present how we use our experimental setup to manipulate a ^{87}Rb BEC in a 1D optical lattice to emulate critical disorder models. We exploit the deep connection between classically-chaotic dynamics and disorder in momentum space, as illustrated in the famous kicked-rotor model [1], to tailor models where we aim to observe signatures of criticality in momentum space.

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[1] J. Chabé *et al.*, *Phys. Rev. Lett.* **101**, 255702 (2008).

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