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Anderson localization of matter waves in 3D anisotropic disordered potentials

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We study quantum transport and Anderson localization of matterwaves in 3 dimensional correlated disorder, focusing on the effects of the anisotropy. Indeed, understanding the anisotropy effects is fundamental for experiments with ultracold atoms as well as for several other systems, such as electrons in MOSFETs, light in biological medium, liquid crystals. A major challenge is to understand whether the anisotropy of the diffusion tensor is altered by the interference terms at the origin of Anderson localization. In particular, its anisotropy at the mobility edge remains to be investigated. So far, all theoretical analysis have assumed - more or less implicitly - that the anisotropy of the diffusion tensor is preserved by interference effects [1], and have focussed on the vanishing of diffusion as a whole. In this talk, I will start by presenting the usual description of

matterwave transport in disordered medium. I will then present our method to go beyond the standard self-consistent theory, which includes in particular the full anisotropic structure of the spectral function. It thus avoids the infrared divergence [2] of the usual self-consistent theory and, most importantly, does not make any assumption on the anisotropy of the renormalized diffusion tensor when including quantum interference terms. Using a generic model of disorder with elongated correlations, we find that the diffusion tensor is strongly affected by the quantum interference terms and that the anisotropy strongly diminishes in the vicinity of the mobility edge [3]. Our work paves the way to further investigation with speckle potentials,

which are directly relevant to ultracold-atom experiments. It will permit comparison with previous predictions for the mobility edge [4,5] and shed new light on ongoing experiments in the field of ultracold atoms.

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