universität innsbruck

Department of Theoretical Physics

Theory Colloquium

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"Anderson Localisation of Light"

Abstract

Anderson localization of light is traditionally described in analogy to electrons in a random potential. Within this description, the random potential depends on the wavelength of the incident light. For transverse Anderson localization, this leads to the prediction that the distribution of localization lengths – and, hence, its average – strongly depends on the wavelength. In an alternative description, in terms of a spatially fluctuating electric modulus, this is not the case. Here, we report on an experimentum crucis in order to investigate the validity of the two conflicting theories using optical samples exhibiting transverse Anderson localization. We do not find any dependence of the observed average localization radii on the light wavelength.

We conclude that the modulus-type description is the correct one and not the potentialtype one. We corroborate this by showing that in the derivation of the traditional potential-type theory, a term in the wave equation has been tacitly neglected. In our new modulus-type theory, the wave equation is exact. We check the consistency of the new theory with our data using the nonlinear sigma model. We comment on the consequences for the general case of three-dimensional disorder.

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SR 1 | ICT building