Physics AT QUEENS COLLEGE

Colloquium Notice

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Statistical properties of wave scattering in disordered wires: Surface roughness versus bulk disorder

In this work we present a detailed analysis of the metal-insulator crossover based on Random Matrix Theory (RMT) and the scaling approach of Dorokhov, Mello, Pereyra, and Kumar (DMPK) [2] together with exact numerical calculations of different model systems. By using a Monte Carlo technique, we have obtained the exact conductance distribution of the DMPK equation all the way from the metallic to the insulating regimes [3]. In the crossover, P(G) presents a sharp behaviour which is clearly different from that observed in SDW. However, the predictions based on the DMPK are in full agreement with microscopic (exact) calculations when the disorder is uniformly distributed through the wire. For classical waves, the absorption leads to a smooth crossover and the calculated statistical fluctuations of transmittances [3] are in good agreement with microwave experiments [4]. We have also analyzed the correlations between waves transmitted through, and reflected from, random media. Although the intensity and conductance fluctuations are practically independent of the sample length L, the correlations present a strong dependence on the length of the disordered region. In the diffusive regime, the RMT structure of both angular and spatial correlations is in full agreement with that obtained by perturbative diagrammatic approaches [5]. Interestingly, for small lengths, we predict a transition from positive to negative correlations for both angular [6] and spatial [7] correlations. [1] A. Garcia-Martin and J.J. Sáenz, Phys. Rev. Lett. 87, 116603 (2001) [2] P.A. Mello and N. Kumar, Quantum transport in mesosc. systems (Oxford Univ., 2004) [3] L. S. Froufe-Pérez, et. al, Phys. Rev. Lett. 89, 246403 (2002) and to be published [4] Chavanov, A.A., Stoytchev, M., and Genack, A.Z., Nature 404 850 (2000) [5] P. Sebbah, et. al. Phys. Rev. Lett. 88, 123901 (2002) [6] A. García-Martín et. al., Phys. Rev. Lett. 88, 143901 (2002). [7] G. Cwilich, L. S. Froufe-Pérez and J.J. Sáenz, to be published.

Monday
March 27, 2006
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326