Conductance distribution in the two dimensional Anderson transition

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The two dimensional metal-insulator transition has been attracting renewed interest. Since the conductance is a fluctuating quantity, to describe the transition, an analysis of the distribution function of the conductance is necessary. Here we have performed a large scale numerical calculation of conductance and analysed in detail the critical conductance distribution. We report results for two models, namely the Chalker-Coddington (CC) model [1] and SU(2) model [2]. The former describes the quantum Hall transition, and the latter systems where there is strong spin-orbit scattering. Using the transfer matrix method, we calculated the transmission matrix t, and the dimensionless two terminal conductance given by

$$g = 2\mathrm{Tr}tt^{\dagger} = 2\sum_{i}^{n} \tau_i \tag{1}$$

where $0 \le \tau_i \le 1$ is the transmission eigenvalue. In Fig. 1 we show the critical conductance distributions for the CC and SU(2) models. Both show a linear increase near $g = 0$ and a kink at $g = 2$. We also analysed the distribution of the transmission eigenvalues. We found that the conductance is almost determined by the largest transmission eigenvalue τ_{max}, and that the distribution of this largest transmission eigenvalue, after being transformed to ν_{min} by $\tau_{\mathrm{max}} = 2/(\cosh \nu_{\mathrm{min}} + 1)$, is well described by the distribution function [3]

$$P(\nu_{\mathrm{min}}) = \frac{\nu_{\mathrm{min}}}{2} \exp(-\nu_{\mathrm{min}}^2/4). \tag{2}$$

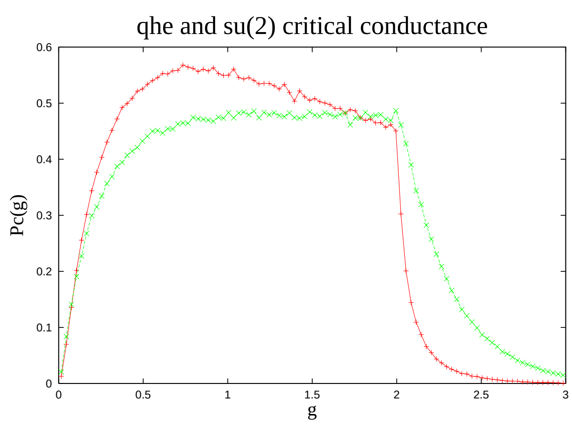

Figure 1: Conductance distribution at the 2D Anderson transition, for CC model (+) and for the SU(2) model (×).

References

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