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The role of weak interactions on the mobility-edge of strongly disordered electron systems[1]

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New insights into the nature of the mobility edge of a weakly correlated, disordered Anderson spectra will be presented within the typical medium dynamical cluster approximation (TMDCA). The TMDCA systematically incorporates non-local spatial correlations (beyond the single-site approximations) treating the disorder to all orders and the interacting, non-local cluster self-energy up to second order in the perturbation expansion of the interactions, U. An arbitrary small interaction is found to lead to an exponential fast crossover of the sharp mobility edge that separates the localized and extended states in the non-interacting regime below the critical disorder strength $W_c^{U=0}$ whenever the chemical potential of the non-interacting typical density of states is below the mobility edge energy. This smearing of the mobility edge is ascribed to the inelastic scattering due to U. However, as the chemical potential, μ approaches the smeared edge, reduction of the phase space for scattering by U causes the edge to once again become sharp. A concomitant soft-pseudogap is found at energy, $\omega = 0$ independent of filling, which is linear rather than quadratic in ω, due to the lack of momentum conservation. The method is demonstrated on realistic low-dimensional structures.

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