Temperature-dependent break-down of disorder-induced localization

Ling-Na Wu[1], Alexander Schnell[1], Giuseppe De Tomasi[1], Markus Heyl[1], and André Eckardt[1]
[1]*Max Planck Institute for the Physics of Complex Systems, D-01187 Dresden, Germany.*
E-mail: lnwu@pks.mpg.de

We study the temperature-dependent transport of interacting fermions through a disordered tight-binding chain in the presence of a thermal bath of temperature T. This model describes electronic systems coupled to phonons and can also be realized with ultracold fermionic atoms immersed in a Bose gas. By employing two different methods, quantum-jump Monte-Carlo simulations and mean-field theory, we find different regimes with respect to temperature. For low temperatures, we encounter a (many-body) localized regime, where the transport is temperature-independent and decreases exponentially with the system size. Above a system-size dependent threshold temperature, a bath-assisted temperature-dependent conductivty σ is found. It is described by Mott's law for variable-range hopping, $\sigma \sim \exp(-\sqrt{T_0/T})$. Weak repulsive (attractive) interactions are found to enhance (lower) T_0.