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The scaling limit of the critical one-dimensional random Schrodinger operator

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We consider two models of one-dimensional discrete random Schrodinger operators (H_n \psi)_l = {\psi}_{l-1}+{\psi}_{l +1}+v_l {\psi}_l, {\psi}_0={\psi}_{n+1}=0 in the cases v_k=\sigma {\omega}_k/ \sqrt{n} and v_k=\sigma {\omega}_k/ \sqrt{k}. Here {\omega}_k are independent random variables with mean 0 and variance 1.

We show that the eigenvectors are delocalized and the transfer matrix evolution has a scaling limit given by a stochastic differential equation. In both cases, eigenvalues near a fixed bulk energy E have a point process limit. We give bounds on the eigenvalue repulsion, large gap probability, identify the limiting intensity and provide a central limit theorem.

In the second model, the limiting processes are the same as the point processes obtained as the bulk scaling limits of the beta-ensembles of random matrix theory. In the first model, the eigenvalue repulsion is much stronger.

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