Looking for the mobility edge of Anderson localization

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The structure of the phase diagram of localization in the energy-disorder plane, for random tight-binding Hamiltonians exhibits several well-known properties: below dimension d=2, all eigenfunctions are localized for non-vanishing disorder. Above d=2, a delocalized phase appears separated from the localized phase by a transition line called the “mobility edge,” predicted by the so-called self-consistent theory of localization in the case of uniform disorder. We will show that, with a closer examination, a more complicated structure emerges in which several types of mechanisms interplay to give rise to this diagram and its localization/delocalization transition. In particular, we will present the latest advances obtained using the localization landscape theory that brings a new understanding on the mechanisms at work across the transition.