Coexistence of extended and localized states in one-dimensional systems

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Mobility edge transitions from localized to extended states have been observed in two and three dimensional systems, for which sound theoretical explanations have also been derived. One-dimensional lattice models have failed to predict their emergence, offering no clues on how to actually probe this phenomenon in lower dimensions. This work reports results for a class of tight-binding models with electron-mass position dependence, for which localized-extended wave function transitions can be identified. We show that it is possible to control the density of localized and extended states by tuning the transition-related parameter for a continuous range of energy values. Our framework provides a clear point of view on the phenomena and can also be harnessed for setting up experiments to probe to precisely evaluate the associated mobility edges using state-of-the-art technology.