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Energy Dependence and Scaling Property of Localization Length near a Gapped Flat Band[1] LI GE, College of Staten Island, CUNY, HAKAN TURECI, Princeton University — Using a tight-binding model for a one-dimensional Lieb lattice, we show that the localization length near a gapped flat band behaves differently from the typical Urbach tail in a band gap: instead of reducing monotonically as the energy E moves away from the flat band energy Ef, the presence of the flat band causes a nonmonotonic energy dependence of the localization length. This energy dependence follows a scaling property when the energy is within the spread (W) of uniformly distributed diagonal disorder, i.e. the localization length is only a function of (E-Ef)/W. Several other lattices are compared to distinguish the effect of the flat band on the localization length, where we eliminate, shift, or duplicate the flat band, without changing the dispersion relations of other bands. Using the top right element of the Green's matrix, we derive an analytical relation between the density of states and the localization length, which shines light on these properties of the latter, including a summation rule for its inverse.

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Li Ge
College of Staten Island, CUNY

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