Interpolating Aubry-André-Fibonnacci model

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Below we consider a model that interpolates between the Aubry-André and Fibonnacci models. The localization properties of this model were characterized theoretically at the single-particle level and experimentally in Ref. [1]. The many-body localization properties of this model with an additional nearest neighbor repulsion term were characterized in Ref. [2]. The Hamiltonian can be written as

$$H = -V \sum_n \frac{\tanh[\beta \cos(2\pi\tau n + \phi)]}{\tanh \beta} c_n^\dagger c_n + \sum_n \left(c_n^\dagger c_{n+1} + \text{h.c.} \right) \tag{1}$$

In Fig. 1 we reproduce the IPR results in Fig. (2a) of Ref. [2], where an extended phase can be hinted to emerge at intermediate β [our figure is a close-up of Fig. (2a)]. We show that these localization-delocalization transitions are associated to the conventional hidden dualities introduced in our manuscript, at the bottom of Fig. 1.

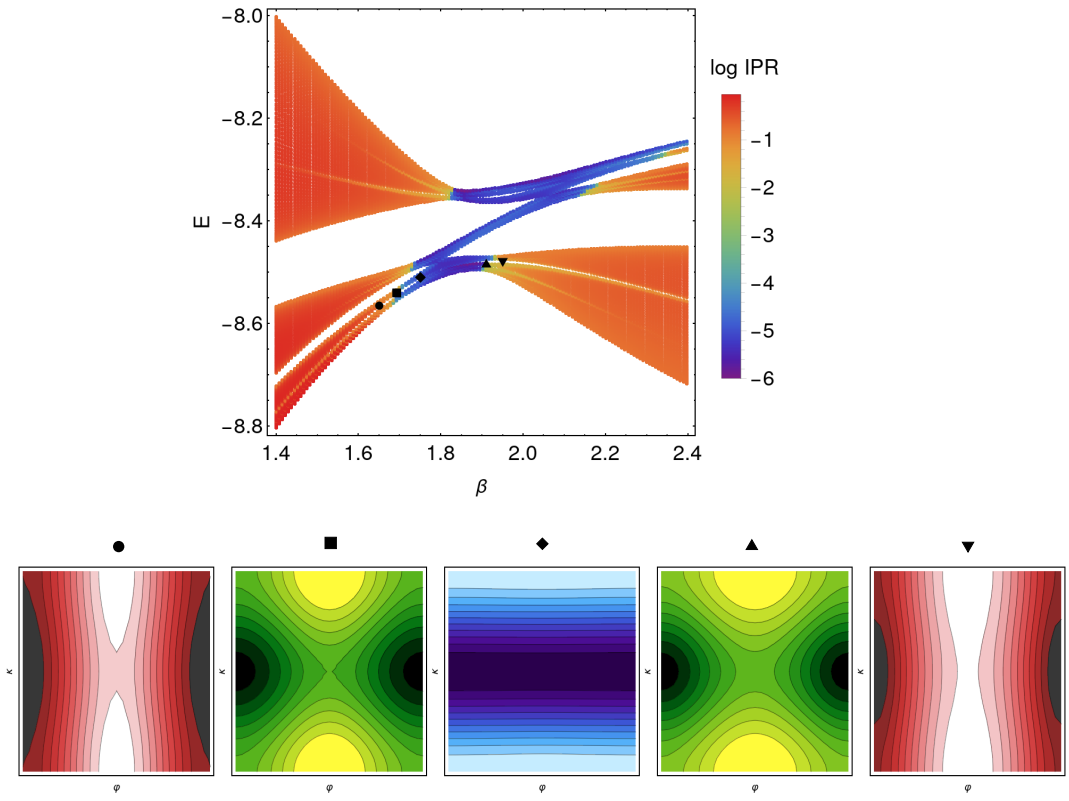

Figure 1: Results for the model in Eq. 1, for $V = 8$. The IPR figure (top) reproduces a region of parameters around the localization-delocalization transitions in Fig. 2(a) of Ref. [2]. In the bottom figures we show that these transitions are associated with the conventional hidden dualities that we introduced in our manuscript by plotting the Fermi surfaces in the (φ, κ) plane for $\tau_c = 13/21$ (CA with 21 sites). The mean energies of the considered energy bands are indicated by the black points in the top figure.

References

[1] V. Goblot, A. Štrkalj, N. Pernet, J. L. Lado, C. Dorow, A. Lemaître, L. Le Gratiet, A. Harouri, I. Sagnes, S. Ravets, A. Amo, J. Bloch, and O. Zilberberg, Nature Physics (2020), 10.1038/s41567-020-0908-7.

[2] A. Štrkalj, E. V. H. Doggen, I. V. Gornyi, and O. Zilberberg, Phys. Rev. Research **3**, 033257 (2021).