# Hulls of quasiperiodic structures, spectral gaps, matching rules and single-particle eigenstates

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The topology of the Hull of quasiperiodic structures is related to surprisingly diverse aspects of the physics of quasicrystals. The K-theory of this space encodes the information about spectral gaps [1]. The homotopy properties of shape approximants to the Hull are responsible for the existence of matching rules and the structural stability of quasicrystals [2]. It was suggested recently [3] that the element of the first cohomology group of the Hull may play the role in the description of single-particle eigenstates in perfect quasicrystals, similar to that of the quasimomentum in the ordinary Bloch wavefunctions. Numerical results confirm this hypothesis for the most popular two-dimensional quasiperiodic tight-binding models. We also discuss possible experimentally detectable implications of these findings.

1. J. Bellissard, R. Benedetti, and J.-M. Gambaudo.*"Spaces of tilings, finite telescopic approximations and gap-labeling."* Communications in Mathematical Physics 261.1 (2006) : 1-41.

2. P. Kalugin *"Cohomology of quasiperiodic patterns and matching rules."* Journal of Physics A : Mathematical and General 38.14 (2005) : 3115.

3. P. Kalugin, and A. Katz. *"Electrons in deterministic quasicrystalline potentials and hidden conserved quantities."* Journal of Physics A : Mathematical and Theoretical 47.31 (2014) : 315206.