SOME RESULTS CONCERNING THE LOCALIZATION PROBLEM IN ONE-DIMENSIONAL QUASIPERIODIC SYSTEMS

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One dimensional quasiperiodic tiling of the real line can be obtained by using the general method of projection introduced by Duneau and Katz [1].
The obtained tiling sequence depends on the slope of the projection line.

Problem:
look for the spectrum and eigenvectors of the discrete Laplace operator on the quasiperiodic lattice.

$$\frac{\phi_{n+1} - \phi_n}{\lambda_n} - \frac{\phi_n - \phi_{n-1}}{\lambda_{n-1}} + z\phi_n = 0$$

This problem can be transformed to the following on a regular lattice with quasiperiodic potential.

$$Q_{n+1} + Q_{n-1} - 2Q_n + z\lambda_n Q_n = 0$$

Results: [2,3]

a. For a class of quasiperiodic tilings (i.e. for a class of irrational slopes) there is no localized eigenstate.
b. For tilings obtained by projecting on a line with slope equal to the golden mean, self similarity properties of the spectrum are used to show that the states are neither extended nor localized.

References:

1. M. Duneau, A. Katz, Quasiperiodic tilings, CPT Ecole Polytechnique, Palaiseau preprint
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3. J.M. Luck, D. Petritis, Phonon spectra in one dimensional quasicrystals, SPhT, CEN Saclay preprint