Island myriads in periodic potentials

Matheus Lazarotto[1,2], Iberê Caldas[2], Yves Elskens[1]

[1] Aix-Marseille Université, CNRS, UMR 7345 PIIM, F-13397, Marseille cedex 13, France
[2] Instituto de Física, Universidade de São Paulo, Rua do Matão 1371, São Paulo 05508-090, Brazil
matheus_jean_l@hotmail.com

A phenomenon of emergence of stability islands in phase-space was identified for two periodic potentials with tiling symmetries, one square and other hexagonal, as inspired by bidimensional Hamiltonian models of optical lattices. The structures found, here named as island myriads, resemble web-tori with notable fractality and arise at energy levels reaching that of unstable equilibrium points 1. In general, the myriad is an arrangement of concentric island chains with properties relying on the translational and rotational symmetries of the potential functions [1,?]. In the square system, orbits within the myriad come in isochronous pairs and can have different periodic closure, either returning to their initial position or jumping to identical sites in neighbor cells of the lattice, therefore impacting transport properties. As seen when compared to the generic case, i.e. the rectangular lattice, the breaking of square symmetry disrupts the myriad even for small deviations from its equilateral configuration. For the hexagonal case, the myriad was found but in attenuated form, mostly due to extra instabilities in the potential surface that prevent the stabilization of orbits forming the chains.

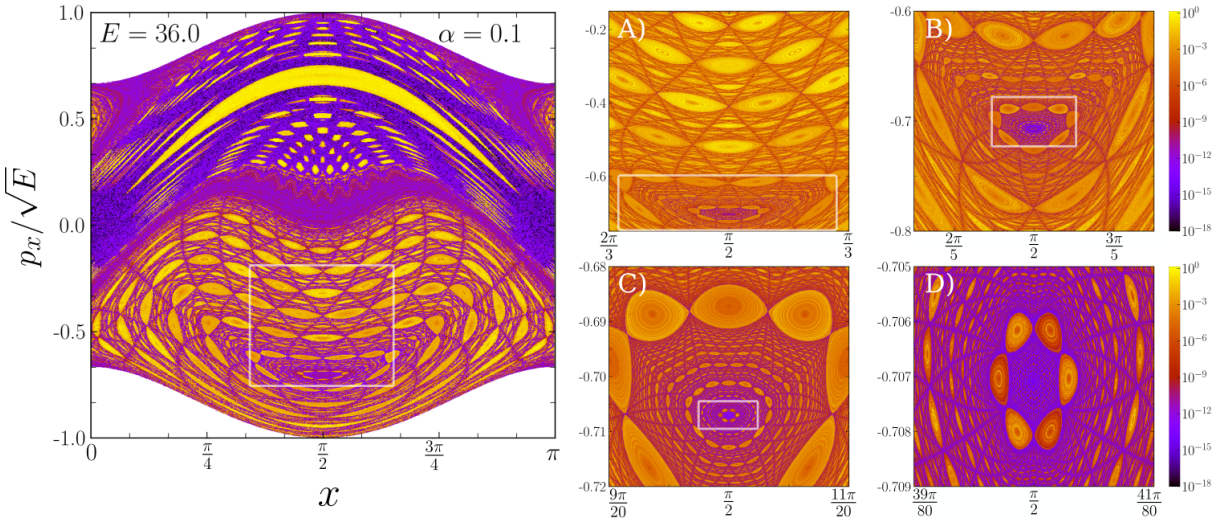

Figure 1. Colorized phase-space showing the island myriad and successive zooms (white rectangles) into the myriad core.

Références

1. M. Lazarotto & I. Caldas & Y. Elskens, Diffusion transitions in a 2D periodic lattice, *CNSNS*, **112**, 106525 (2022).
2. M. Lazarotto & I. Caldas & Y. Elskens, Island myriads in periodic potentials, *Arxiv*, **2311.04227** (2023).