Bunched periodic orbits: The skeleton of classical and quantum chaos

Fritz Haake

Universität Duisburg-Essen

It was recently discovered that long (quasi-ergodic) periodic orbits of fully chaotic dynamics come in narrowly packed bunches. Under weak resolution a bunch looks like a single orbit but in fact the orbits contained are topologically distinct. The construction principle of bunches is related to close self-encounters wherein two or more stretches of one orbit lie very close.

In particular, for close enough self-encounters the orbits in a bunch have arbitrarily small action differences and therefore give rise to constructively interfering quantum amplitudes. That latter constructive interference turns out to be the basis of universal fluctuations in quantum energy spectra and conduction properties of chaotic dynamics.