Periodic orbits as a tool for analysis and quantization of global phase space structures in a multidimensional Hamiltonian system

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Abstract

We demonstrate an organizing principle for periodic orbits in a strongly coupled multidimensional Hamiltonian system, namely the hydrogen atom in crossed electric and magnetic fields for energies below and above the ionization threshold. This observation allows us to assign winding numbers to the periodic orbits and finally to reconstruct quantitatively an entire hierarchy of phase space structures only from the knowledge of the periodic orbits. The quantitative calculation of action variables allows a torus quantization using the Einstein-Brillouin-Keller method.