Annular billiard dynamics in a strong laser field

A. Kamor[1,2], F. Mauger[1,2], C. Chandre[2], & T. Uzer[1]

[1] School of Physics, Georgia Institute of Technology, Atlanta, GA 30332-0430, USA
[2] Centre de Physique Théorique, CNRS – Aix-Marseille Université, Campus de Luminy, case 907, 13288 Marseille cedex 09, France
akamor@gatech.edu

We analyze the dynamics of a valence electron of the buckminsterfullerene molecule (C_{60}) subjected to a circularly polarized laser field by modeling it with the motion of a classical particle in an annular billiard. We show that the phase space of the billiard model gives rise to three distinct trajectories : "Whispering gallery orbits", which only hit the outer billiard wall, "daisy orbits" which hit both billiard walls (while rotating solely clockwise or counterclockwise for all time), and orbits which only visit the downfield part of the billiard, as measured relative to the laser term. These trajectories, in general, maintain their distinct features, even as intensity is increased from 10^{10} to 10^{14} $\mathrm{W \cdot cm^{-2}}$. We attribute this robust separation of phase space to the existence of twistless tori.

To perform this analysis of an atomic system we use many tools from nonlinear dynamics applied to the Hamiltonian framework within which we work. These tools are Poincaré sections to observe the dynamics, a frequency analysis to identify non-KAM tori, i.e. twistless tori, and an identification of periodic orbits to better understand the dynamics.

Références

1. A. Kamor, F. Mauger, C. Chandre, and T. Uzer - Annular billiard dynamics in a circularly polarized strong laser field - Physical Review E - 85, 016204 (2012)