2004 Vol.41 No.6 pp.929-934 DOI:

Semiclassical Calculation of Recurrence Spectra of He Rydberg Atom in Strong External Fields

WANG De-Hua,[1,2] DING Shi-Liang,[2] and LIN Sheng-Lu[3]

[1] Department of Mathematics and Physics, Shandong Institute of Architecture and Engineering, Jinan 250014, China

[2] School of Physics and Microelectronics, Shandong University, Jinan 250100, China

[3] Department of Physics, Shandong Normal University, Jinan 250014, China

(Received: 2003-7-17; Revised: 2003-9-1)

Abstract: Using core-scattered closed-orbit theory and region-splitting iterative method, we calculated the scaled recurrence spectra of helium atom in parallel electric and magnetic fields. Closed orbits in the corresponding classical system have also been obtained. When we search the closed orbits, in order to remove the Coulomb singularity of the classical Hamiltonian motion equations, we implement the Kustaanheimo-Stiefel transformation, which transforms the system from a three-dimensional to a four-dimensional one. The Fourier transformed spectrum of helium atom has allowed direct comparison between peaks in such plot and the scaled action values of closed orbits. The results are compared with those of the hydrogen case, which shows that the core-scattered effects play an important role in the recurrence spectra of the multi-electron Rydberg atom.

PACS: 32.60.+i, 03.65.Sq, 05.45.Mt

Key words: closed-orbit theory, region-splitting iterative method, recurrence spectra, core-scattered effects