Rydberg States and Spectral Lines of a Single Ion in a Paul Trap

Mariusz Pawlak[1,*] and H. R. Sadeghpour[2]

[1]Faculty of Chemistry, Nicolaus Copernicus University in Toruń, Gagarina 7, 87-100 Toruń, Poland
[2]ITAMP, Harvard-Smithsonian Center for Astrophysics, Cambridge, Massachusetts 02138, USA
*teomar@chem.umk.pl

Long storage time and fast gate operations are among the most desirable features to assess any quantum computing platform. Trapped Rydberg ions have recently drawn considerable attention as promising candidates that may meet the both criteria. We develop an accurate numerical scheme to calculate and analyze Rydberg states and spectral lines of an ion in a Paul trap. The energy spectra of a highly excited singly ionized calcium are calculated for *S*, *P*, *D*, *F*, and *G* states, using the one-electron model potential with spin-orbit coupling. The coupling of the Rydberg electron and the ion to the electric potential of the trap is incorporated in the Floquet method. Detailed comparison with recent experimental data is made.