Manipulating the orbital charge-currents of compressed Li and Na atom embedded in quantum plasma

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Abstract:

In this study, for the first time, a theoretical investigation is carried out on the persistent orbital charge-currents (cc) and induced magnetic field (imf) of Li and Na atom compressed by spherical confinement, embedded in a quantum plasma. The more general exponential cosine screened Coulomb (MGECSC) potential is considered for interactions in the quantum plasma. There are four different forms of the MGECSC potential in describing Debye and quantum plasmas, but the most general form is used for the most detailed examination. The model potential approach is employed to popularize the interactions of many body electron systems and to overcome the computational difficulty arising from complex electron-electron interactions through a very valid approach. Therefore, the MGECSC potential for the quantum plasma-immersed Li and Na atom is modified within the framework of the model potential approach. The wave equation including the modified potential is solved using the tridiagonal matrix method. The interaction potential between the valence electron and the atomic core alters significantly by the plasma screening effect. This change also creates observable changes in the persistent charge-current (cc) and induced magnetic fields (imf) of Li and Na atom. The effects of plasma screening parameters and spherical confinement strength on the persistent cc and imf are studied in detail. In addition to the effects of plasma and spherical confinement parameters on the spectrum, the cc and imf of Li and Na atom, their critical values, if any, their dominance and alternatives to each other are also discussed in a cause-effect relationship. In the case of stronger spherical confinement, the quantum plasma has a predominant response on the cc and imf compared to a Debye plasma and free-plasma environments.

Keywords

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