§27. Quantum and Plasma Screening Effects on the Wannier Threshold Law for the Double-electron Ionization in Strongly Coupled Semiclassical Plasmas

Jung, Y.-D. (Hanyang Univ.),
Kato, D.

The quantum and plasma screening effects on the Wannier threshold law for the double-electron ionization are investigated in strongly coupled semiclassical plasmas. The renormalized electron charge and Wannier exponent are obtained by considering the equation of motion in the Wannier configuration with the screened pseudopotential model as functions of the de Broglie wave length, Debye length, and charge of the residual ion. It is shown that the renormalized electron charge significantly increases with an increase of the de Broglie wave length, especially, for small radial distances. It is also shown that the quantum effects enhance the Wannier exponent for the double-electron ionization. In addition, the quantum effect on the Wannier threshold law is found to be more important than the plasma screening effect in strongly coupled semiclassical plasmas.

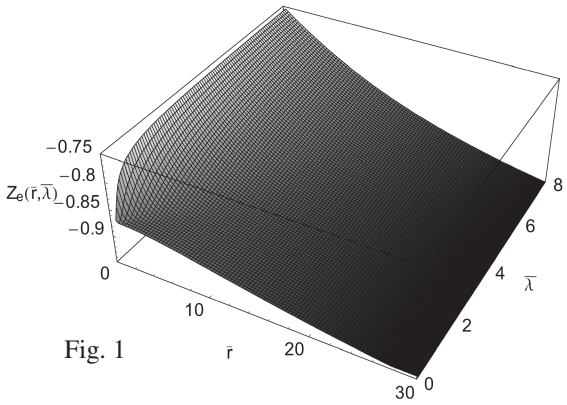

Fig. 1

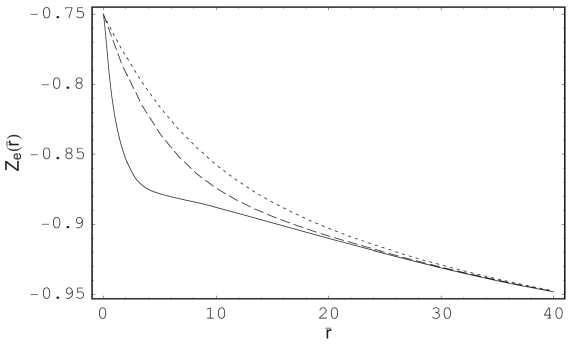

Fig. 2

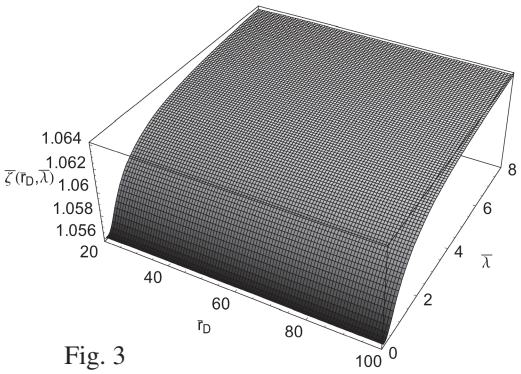

Fig. 3

FIG. 1 The three-dimensional plot of the renormalized electron charge Z_e as a function of the scaled de Broglie wavelength $\overline{\lambda}$ and scaled distance $\overline{r}$ when $Z=2$ and $\overline{r}_D=20$.

FIG. 2 The renormalized electron charge Z_e as a function of the scaled distance $\overline{r}$ when $Z=2$ and $\overline{r}_D=30$. The solid line represents the case of $\overline{\lambda}=1$. The dashed line represents the case of $\overline{\lambda}=4$. The dotted line represents the case of $\overline{\lambda}=6$.

FIG. 3 The three-dimensional plot of the Wannier exponent $\overline{\zeta}$ as a function of the scaled Debye length $\overline{r}_D$ and scaled de Broglie wavelength $\overline{\lambda}$ when $Z=2$.