§23. Electron Collision Effects on the Bremsstrahlung Emission in Lorentzian Plasmas

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The electron-electron collision effects on the electron-ion bemsstranhlung process are investigated in warm Lorentzian plasmas. The effective electron-ion interaction potential is obtained by including the far-field terms caused by the electron-electron collisions with the effective Debye length in Lorentzian plasmas. The bremsstranhlung radiation cross section is obtained as a function of the electron energy, photon energy, collision frequency, spectral index, and Debye length using the Born approximation for the initial and final states of the projectile electron. It is shown that the non-Maxwellian character suppresses the bremsstrahlung radiation cross section. It is also shown that the electron-electron collision effect enhances the bremsstrahlung emission spectrum. In addition, the bremsstrahlung radiation cross section decreases with an increase of the plasma temperature.

Figure 1. The three-dimensional plot of the scaled bremsstrahlung radiation cross section $\partial_{\bar{\varepsilon}}\overline{\chi}_b$ as a function of the scaled photon energy $\overline{\varepsilon}$ and spectral index κ for $\overline{\lambda}_D = 50$, $\overline{E} = 10$, $\overline{E}_T = 20$, and $\overline{\nu} = 1$.

Figure 2. The scaled bremsstrahlung radiation cross section $\partial_{\bar{\varepsilon}}\overline{\chi}_b$ as a function of the scaled photon energy $\overline{\varepsilon}$ for $\kappa = 2$, $\overline{\lambda}_D = 50$, $\overline{E} = 20$, and $\overline{E}_T = 30$. The solid line represents the result for $\overline{\nu} = 0$, the dashed line for $\overline{\nu} = 1$, and the dotted line for $\overline{\nu} = 2$.

Figure 3. The scaled bremsstrahlung radiation cross section $\partial_{\bar{\varepsilon}}\overline{\chi}_b$ as a function of the scaled photon energy $\overline{\varepsilon}$ for $\kappa = 9$. The conditions are the same as in Figure 2.

Figure 4. The three-dimensional plot of the scaled bremsstrahlung radiation cross section $\partial_{\bar{\varepsilon}}\overline{\chi}_b$ as a function of the scaled electron-electron collision frequency $\overline{\nu}$ and spectral index κ for $\overline{\lambda}_D = 50$, $\overline{E} = 20$, $\overline{\varepsilon} = 10$, and $\overline{E}_T = 30$.

Figure 5. The scaled bremsstrahlung radiation cross section $\partial_{\bar{\varepsilon}}\overline{\chi}_b$ as a function of the spectral index κ for $\overline{\lambda}_D = 50$, $\overline{E} = 20$, $\overline{\varepsilon} = 10$, and $\overline{\nu} = 1$. The solid line represents the result for $\overline{E}_T = 30$, the dashed line for $\overline{E}_T = 40$, and the dotted line for $\overline{E}_T = 50$.

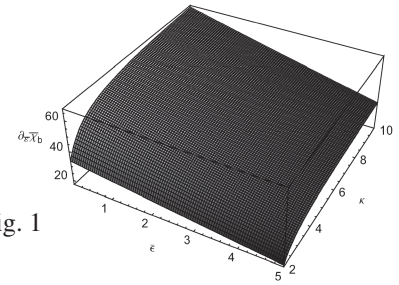

Fig. 1

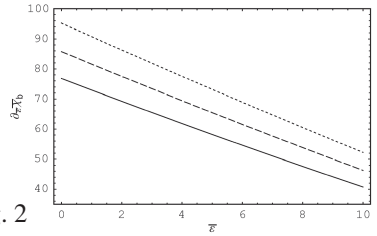

Fig. 2

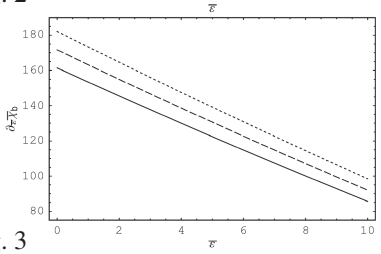

Fig. 3

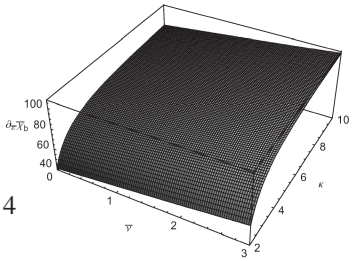

Fig. 4

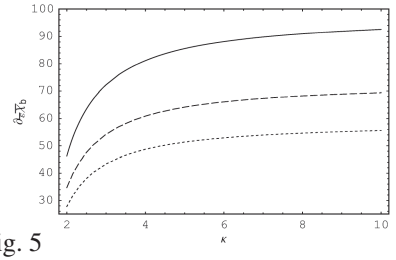

Fig. 5