

## Reflectivity of the dense xenon plasma

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The investigation of optical properties of the dense xenon plasma is important for the realization of different technological applications [1-2].

In this work we consider the dense partially ionized xenon plasma consisting of the electrons, ions and atoms. Particle densities are in the range of  $n = 10^{20} \div 10^{23} \text{ cm}^{-3}$  and the temperature range is from  $2.5 \times 10^4 \text{ K}$  up to  $5 \times 10^4 \text{ K}$ .

In work [3] the effective potential of electron-atom interaction, taking into account both quantum-mechanical effect of diffraction and screening effects, is presented. The way to take into account the dynamic screening was proposed in work [4], where the statical Debye radius was replaced by the dynamic one:

$$r_o = r_D \left(1 + \frac{v^2}{v_{Th}^2}\right)^{1/2}, \quad (1)$$

here  $v$  is the relative velocity of the colliding particles,  $v_{Th}$  is the thermal velocity of the particles in the system. Then the effective potential of electron-atom interaction with dynamic screening can be rewritten as [5]:

$$\Phi_{ea}^{dyn}(r) = -\frac{e^2 \alpha}{2r^4 (1 - 4\lambda_{ea}^2 / r_o^2)} \left( e^{-Br} (1 + Br) - e^{-Ar} (1 + Ar) \right)^2, \quad (2)$$

where  $A^2 = \frac{1}{2\lambda_{ea}^2} \left( 1 + \sqrt{1 - 4\lambda_{ea}^2 / r_o^2} \right),$

$$B^2 = \frac{1}{2\lambda_{ea}^2} \left( 1 - \sqrt{1 - 4\lambda_{ea}^2 / r_o^2} \right).$$

In the framework of these pseudopotential models for the particle interactions, the scattering phase shifts were calculated on the basis of the Calogero equation [6].

Phase shifts enable us to calculate the transport scattering cross section  $Q_{ea}^T(k)$ . The collision fre-

quency of electrons with atoms  $\nu_{ea}$  can be obtained by the following expression:

$$\nu_{ea} = 4 \sqrt{\frac{2}{\pi}} n_a \sqrt{\frac{k_B T}{\mu_{ea}}} \int_0^\infty Q_{ea}^T(g) g^3 \text{Exp}(-g^2) dg, \quad (3)$$

here  $\mu_{ea} = m_e m_a / (m_e + m_a)$  is the reduced mass of the electron-atom pair,  $g$  is dimensionless reduced velocity. The results will be compared with earlier results which were based on experiments for the transport cross section [7].

After that the dielectric function due to the electron atom interactions was calculated using the generalized Drude-Lorentz [8] equation:

$$\varepsilon(\omega) = 1 - \frac{\omega_p^2}{\omega^2 - i\nu_{ea}\omega}. \quad (4)$$

However, for the total electronic dielectric functions contributions due to electron-ion and electron-electron interactions will also be considered [8,9]. From the dielectric function the reflectivity of the semiclassical electron plasma is calculated, using the Fresnel formula, and is compared with experimental results [10].

### References

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