Calculation of electron transport properties of hot metallic plasma using semiclassic average atom model

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Interaction of intense laser pulses with metals usually leads to the formation of hot plasma, so that thermodynamic and transport properties of metals experience a dramatic change. To predict material response in such conditions adequate wide-range models are required. Electron transport properties are usually defined in terms of Onsager theory [1]. Using the Boltzman equation [2] one can express the Onsager coefficients via the electron relaxation time and the transport cross section [2, 3]. The latter can be expressed using phase shifts of electron wave functions in an atomic potential [4]. In this study we calculate the electric and heat conductivity for electrons in tin and aluminum plasma using a semiclassical average atom model: the bound electron states are evaluated using semiclassic wave functions, while Thomas–Fermi model is used to account for the free electrons. The resulting self-consistent potential is used to obtain the transport cross section and the Onsager coefficients. The calculated transport properties are then compared to available experimental data and more accurate theories. The work is supported by RSF, grant No. 20-42-04421.

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