The thermophysical properties of low-temperature bismuth plasma

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The measurements and calculations of thermophysical properties of a substance (thermodynamics and the electronic transport coefficients) are continued for more than a century due to their importance for various fundamental tasks and applications. So during recent years many new data for different substances have appeared in various regions of phase diagram including the low-temperature plasma (LTP) area, which for most of metals is located at the temperatures T = 10-100 kK [1, 2]. Nevertheless, some elements are still poorly studied in LTP and Bi (bismuth) is among them. There are many measurements and calculations for liquid and shock-compressed states at relatively high densities $\rho \sim \rho_n$ and $T \leq 10$ kK, where $\rho_n = 9.79$ g/cm^3 is the density at ambient conditions (see, for instance, [3] and references therein). However at higher temperatures and lower densities presently there are only measurements along release isoenthropes [4] and there are no data on the transport coefficients at all. Thus, it is necessary to fill this gap.
Previously we have developed a model to calculate the considered properties in LTP, which has been successfully used for different elements [5–7]. This model was modified to apply it to the low-temperature partially ionized plasma of Bi and to calculate the properties under study. The comparison with few available experimental data [4] have shown that the pressure in our model is systematically lower than in the measurements.

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