The thermophysical properties of low-temperature gallium plasma

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The thermophysical properties of a substance (the pressure, the internal energy etc. and the electronic transport coefficients) are investigated for more than a century due to their importance for various fundamental tasks and applications. It concerns as well the low-temperature plasma (LTP) region of some elements at the temperatures T = 10-100 kK. Appropriate data (calculations and measurements) have appeared in the recent years for a number of practically important elements [1]. However, for Ga (gallium) in LTP state the measurements and calculations of thermophysycal properties have been still absent. There are only *ab initio* simulations along pricipal Hugoniot [2] at relatively high densities $\rho \geq \rho_n$ and $T \leq 10$ kK, where $\rho_n = 5.905$ g/cm^3 is the density at ambient conditions. At higher temperatures and low densities there are no appropriate data. Thus, it is necessary to fill this gap.
To do it, we have used previously developed model for the considered properties in this area, which has been successfully used for different elements (see [3,4] and references therein). This model was modified to apply it to the low-temperature partially ionized plasma of Ga. So we have calculated the properties under study for Ga LTP (see details in [5]). As far as there are no other data to compare, we have checked only the asymptotic behavior of our results and found that it corresponds to existing theories.

[1] Clérouin J *et al* 2012 *Phys. Plasmas* **19** 082702
[2] Sheppard D *et al* 2015 *Phys. Rev. E* **91** 063101
[3] Apfelbaum E M 2018 *Phys. Plasmas* **25** 072703
[4] Apfelbaum E M 2019 *Contrib. Plasma Phys.* **59** e201800148
[5] Apfelbaum E M 2020 *Phys. Plasmas* **27** 042706