The calculations of thermophysical properties of low-temperature lead plasma [[1]](#footnote-1)\*)

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For various fundamental and applied tasks of the physics of plasmas, appearing during the processes of the metallic wire explosions, interaction of radiation or particle beams with a substance etc., the knowledge of the thermophysical values (properties) is necessary. Their study presents especial difficulty under elevated temperatures. It is, in particular, the case for the low temperature plasmas of metals and semiconductors. In this state the temperature T of a metal or semiconductor si as a rule higher than 5 kK, which gives rise to natural hinders in the measurement design. In the theoretical and calculation studies there are also relevant problems. They are originated, in particular, due to increasing influence of the interparticle interaction in a dense substance even when its density is only 0.1 of the value at ambient conditions (the normal vaue). So it is difficult to describe the interaction correctly within various approximate models [1]. Nevertheless, during recent years new measurement and calculations data have appeared for a number of metal and semiconductor plasmas, which partially provided the necessary information [2,3]. However for Ga plasma corresponding data on the equation of states and electronic transport coefficients were absent [4].

Gallium is melt practically in hands - its melting temperature is 303 K. So various properties of liquid Ga are well studied. Presently, for example, there exist the accurate multiphase equations of states for it [5]. But they applicable only for T< 2000 К. At higher temperatures there are the shock-wave measurement data and corresponding ab initio calculations, which was specially carried out in addition to the measurements [6]. These investigations could reach T = 10 kK, but the studied densities was limited from below by 5.5 g/cm3 (the normal Ga density is 5.905 g/cm3). There are also the spectroscopic measurements for T= 100 kK and higher However at the density region below 5.5 g/cm3 and T = 10 - 100 kK any thermophysical data were absent up to now [4]. To fill this gap is the aim of present study.

Previously we have developed a model to calculate the properties under study - namely, the thermodynamics values (pressure, internal energy etc.) and the electronic transport coefficients (the electrical conductivity, thermal conductivity and thermal power). Our model was successfully app;ied for the low-temperature plasma of a number metals and semiconductors [7,8]. It is based on the chemical approach and the relaxation time approximation. (see details in [4]). Presently this model was modified and applied for the calculation of the above mentioned values in the low temperature Ga plasma.

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Lt/ru/EA-Apfelbaum.docx) [↑](#footnote-ref-1)