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Thermodynamic parameters of the electron gas in CdSe nanoplatelets

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Semiconductor nanoplatelets (NPL) are quasi-two-dimensional systems occupying an intermediate position between quantum wells and quantum dots [1]. NPL is considered a promising area for the role of an elementary base for semiconductor devices of a new generation and various applications including ion channeling, sensing, green energetics, etc. [2-5].
The single-electron spectrum in NPL has a pronounced subband character when each level of axial quantization (Oz) is associated with a family of levels characterizing the state of the electron in the NPL cross-section plane [6-8]. In this regard, the movement of one particle within each subband is two-dimensional. NPL has several interesting physical characteristics [9-10]: electronic, optical, excitonic, etc.
If a several-particle electron gas is localized inside the NPL, it will exhibit statistical properties. At low densities and high temperatures of the electron gas, one can use Boltzmann statistics for an ideal gas. For the lower temperatures, we need to use Fermi –Dirac statistics.
The thermodynamic characteristics of weakly interacting electron gas in CdSe NPL are studied theoretically. Thermodynamic characteristics including free energy, entropy, and heat capacity are calculated in the framework of Boltzmann and Fermi –Dirac statistics. The main results are obtained in terms of the Ramanujan theta function. The dependencies of the entropy and heat capacity on the size of the NPL are determined.

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