On methods of modeling a non-equilibrium plasmas

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At the numerical investigation of processes in a radiative plasma, the approximation of local thermodynamic equilibrium (LTE) is often used, which implies the Planck radiation field, the Boltzmann distribution of the populations for the main and excited states, the Saha distribution for ion species. Although the LTE approximation allows one to calculate the populations and radiation properties of plasma fairly quickly, its range of applicability is limited.

The actuality of a non-LTE plasma simulation is due to experiments carried out on modern high-energy facilities (XFEL, Z, Angara-5-1, etc.). While simulating a nonequilibrium plasma, it is necessary to use collisional-radiative models, where the non-Boltzmann populations and the non-Planckian radiation field are consistent. This work demonstrates some methods for accounting for non-equilibrium which implemented in the software complex THERMOS [1, 2]. The results of plasma properties calculations under various, including extreme, conditions are presented.

[1] THERMOS — Software package and database *http://keldysh.ru/thermos/en*
[2] Vichev I, Solomyannaya A, Grushin A and Kim D 2019 *High Energy Density Physics* 100713