THERMOS Toolkit: Taking into account non-equilibrium plasma effects in radiative hydrodynamics calculations

Grushin A S[1,@], Vichev I Yu[1], Solomyannaya A D[1], Kim D A[1,2] and Tsygvintsev I P[1]

[1] Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences, Miusskaya Square 4, Moscow 125047, Russia
[2] National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Kashirskoe Shosse 31, Moscow 115409, Russia

[@] grushina@gmail.com

Modeling of non-local thermodynamic equilibrium (non-LTE) plasma is a complicated problem and although modern methods of atomic physics are capable of providing quite accurate results, the in-line use of precise models in radiative hydrodynamics simulations is still a rare phenomenon. Most of the practical plasma dynamics simulations are still run at the expense of accurate atomic physics simulations in favor for hydrodynamics and its associates. A commonly spread approach is to use one the most suitable for the task at hand approximation for opacity and equation of state calculations. Our research group has proposed more advanced method [1], that utilizes a certain pair of tables for two limiting cases. This model effectively takes into account the spatial finiteness of laboratory plasma, however the spectral features of local radiation field are amiss. In this report we investigate different radiation field limiting cases and interpolation parameter variations and outline the area of applicability of this method. The reported study was funded by the Russian Foundation for Basic Research (project No. 20-01-00485). Calculations have been performed at high performance computers K-100, K-60 (Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences) and MVS-10P (Joint Supercomputer Center of the Russian Academy of Sciences).

[1] Novikov V G and Solomyannaya A D 1998 *Teplofiz. Vys. Temp.* **36** 858–864