THERMOS Toolkit: Simulation of non-stationary Plasma [[1]](#footnote-1)\*)

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Modern high energy density experimental facilities, such as NIF, ORION, DESY, provide more and more experimental data with one of the distinct feature being very short characteristic times (femto- and picoseconds) of laser interaction with matter. In this case, the rates of elementary atomic processes can be significantly lower than the rate of change of thermodynamic parameters, as a result of which the plasma does not have time to attain equilibrium within the characteristic times of temperature and density change.

Modeling of such non-stationary plasma requires solving the system of rate equations at each time step in order to determine the ionic composition and spectral distribution of emission.

The THERMOS Toolkit [1,2] is a software package designed to calculate atomic data and spectral properties of high-temperature plasma, including the capability of non-stationary plasma simulations. In case of dense plasma, the non-stationary rate equations system is solved consistently with ionization potential depression. For these problems a specialized algorithm has been developed for cutting off or adding states of ions at each time step.

The presented model of non-stationary plasma has been tested on a number of problems discussed at the NLTE [3,4] and RPHDM international workshops, which are specializing on non-LTE plasma. Comparison of calculation results obtained using THERMOS code with the most advanced codes for cases of non-stationary neon, aluminum, and vanadium plasmas showed good agreement.

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References

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