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COMPUTER MODELING OF THE COMPRESSION AND HEATING OF A MAGNETIZED PLASMA TARGET FOR MAGNETO-INERTIAL FUSION

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Perspective high energy density systems such as different sources of neutrons and protons will be used in the near future to perform cutting-edge materials research, non-destructive analysis, medical isotope production, chemical waste disposal, train personnel, etc. The goal of the investigation is complex numerical research and optimization of the pulsed high-temperature processes in a dense magnetized plasma (target). Distinctive feature of this problem is the presence of initial seed fields (the imposed external pulse magnetic field) and compression of a magnetic flux by laser beams (laser driver) or plasma jets (plasma liner). An embedded magnetic field is compressed along with the target plasma to achieve magnetic insulation. The presence of the megagauss magnetic field strongly inhibits electron thermal conduction losses by several orders of magnitude. The electron and ion thermal conductivity coefficients in the case of magnetized plasma are calculated. Regimes of quasi-spherical plasma at the final stage of compression are presented.

Radiation magneto-hydrodynamic model of the interaction of powerful sources with a magnetized plasma is presented. An improved two-dimensional radiation-gasdynamics code NICA (Nonstationary Instruments and Codes for fusion Applications) which simulates plasmas in cylindrical or spherical geometries is created. New program takes into account radiation transport in multi-group diffusion approach. Since the most stringent requirements for the plasma parameters in the final stage of compression, here are the results of the evaluations just for this regime. For the calculations we take $T_i = T_e$. We considered two limiting cases. In the first case takes into account both longitudinal and transverse losses in the second case transverse losses are neglected. It is obvious that the second case is preferable, but the question of how much turbulent transverse losses can be suppressed, of course, requires further detailed study.

Modeling of a magnetized plasma compressed by the laser beams and plasma jets is described. The plasma jet/laser driven compression of compact plasmoids to fusion conditions is investigated. External and spontaneous magnetic fields are taken into account. For magneto-inertial fusion (MIF), the liner heating by fusion products, especially of the liner's inner layer, called the "afterburner," will be very important for evaluating whether significant fusion energy can be generated in this layer. Parameters of an afterburner, plasma liner and magnetized target are presented.

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