Abstract Submitted
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A Multi Fluid Analysis of the Ignition Criterion[1] LUCA GUAZZOTTO, Auburn University, RICCARDO BETTI, University of Rochester — In magnetic confinement nuclear fusion experiments, performance with respect to ignition is expressed in terms of the Lawson criterion, a zero-dimensional, single-fluid, steady-state power balance expressing the plasma properties needed for ignition through the energy confinement time τ_E and the plasma temperature and density. Several improvements to the classical criterion are investigated. Ions, electrons and α particles are allowed to have different energy confinement times and energy coupling times are expressed through physics-based relations. The effect of multi-fluid physics is examined in a steady-state analysis and for the time-dependent case, which requires a nonlinear treatment more detailed than the standard "$\dot{T}$ vs. T" single-fluid one. A one-dimensional analysis is also considered to investigate the importance of density and temperature profiles on the τ_E needed for ignition. Rather than by solving the 1D transport equations, this is done with a parametric study.

[1] J. D. Lawson, Proc. Phys. Soc. London Sect. B 70, 6 (1957)

[2] J. P. Freidberg, Plasma Physics and Fusion Energy, Cambridge University Press, Cambridge UK, 2007

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