

ALPHA HEATING AND BURNING PLASMAS IN INERTIAL CONFINEMENT FUSION

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Estimating the level of alpha heating and determining the onset of the burning-plasma regime is essential to finding the path toward thermonuclear ignition. In a burning plasma, the alpha heating exceeds the external input energy to the plasma. Using a simple model of the implosion, it is shown that a general relation can be derived connecting the burning-plasma regime to the yield enhancement caused by alpha-particle heating and to experimentally measurable parameters such as the fractional alpha energy or, equivalently, the Lawson ignition parameter. A general alpha-heating curve is found, independent of the target and suitable to assess the performance of all laser-fusion experiments for both direct and indirect drive. The first onset of the burning-plasma regime inside the hot spot of current indirect-drive implosions on the National Ignition Facility requires a fusion yield of ~50 kJ.

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