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High Compression of Matter by Hyperspherical Shock Waves for Application to Impact Ignition

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To achieve substantially high compression performance of the impact ignition, a novel compression scheme is proposed, in which hollow targets with specifically curved structures initially filled with uniform matter, are driven by converging shock waves. (i) Its self-similar dynamics is analyzed in detail. (ii) The dynamic behavior is demonstrated using two-dimensional hydrodynamic simulations. (iii) A rigorous linear perturbation analysis is proposed, which gives a new dispersion relation with cut-off mode numbers as a function of the specific heat ratio, above which eigenmode perturbations are smeared out in the converging phase. This study provides (1) a new scheme achieving super-high compression via strong shock with the special geometries as another path to achieve high pressures via orthodox adiabatic compression, and (2) a rigorous perturbation analysis to give the new growth rates that are significantly different from the widely accepted prediction. These new knowledge is expected to be applied to "Impact Ignition"–an advanced scheme of ICF, in terms of the reshaped cone casing that works as igniter.

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