Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Directly Driven Magnetized Targets with Steep Density Gradients for Inertial Fusion Energy[1] A. B. SEFKOW, Departments of Mechanical Engineering and Physics and the Laboratory for Laser Energetics, University of Rochester, B. G. LOGAN, Lawrence Berkeley National Laboratory, J. H. NUCKOLLS, Lawrence Livermore National Laboratory — The development of advanced targets capable of achieving ignition, with improved energy gain at lower driver energies, is one of four key technical challenges to be solved in order to realize economical inertial fusion energy [J. H. Nuckolls, J. Phys.: Conf. Ser. 244, 012007 (2010)]. We determine the minimum energy necessary for a small hemispherical mass of high-density DT fuel to explosively ignite a significantly larger hemispherical mass of separately assembled cold fuel with much lower mass density. Propagating fusion burn sensitivity to the rapid alpha-particle and conduction heating, as well as to a flux-compressed magnetic field connecting the two regions, has been investigated. As the strength of the magnetic field increases, thermal conduction losses are suppressed and alpha-particle propagation is better confined, so the burn rate improves and lower energy states become more effective. The imploded fuel reservoir available in the lower-density, larger-mass region of the steep density gradient determines whether the yield is several MJ or up to a GJ. The improved energy gain over the conventional spark-ignited approach is presented, as well as a discussion of integrated design simulations to realize the desired stagnation state.

[1]This material is based upon work supported by the Department of Energy, Office of Science, Office of Fusion Energy Sciences under Award Number DE-SC0017951

Adam Sefkow
University of Rochester

Date submitted: 29 Jun 2020

Electronic form version 1.4