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Deuteron Beam Driven Fast Ignition of a Pre-Compressed Inertial Confinement Fusion (ICF) Fuel Capsule XIAOLING YANG, GEORGE MILEY, University of Illinois, KIRK FLIPPO, Los Alamos National Laboratory, HEINRICH HORA, University of New South Wales, SANDRINE GAILLARD, HelmholtzZentrum Dresden-Rossendorf, DUSTIN OFFERMANN, EMC2, UNIVERSITY OF ILLINOIS TEAM, LOS ALAMOS NATIONAL LABORATORY TEAM — We proposed to utilize a new "Deuterium Cluster" type structure for the laser interaction foil to generate an energetic deuteron beam as the fast igniter to ignite inertial confinement fusion fuel capsule. The benefit of deuteron beam driven fast ignition is that its deposition in the target fuel will not only provide heating but also fuse with fuel as they slow down in the target. The preliminary results from recent laser-deuteron acceleration experiment at LANL were encouraging. Also, in most recent calculations, we found that a 12.73% extra energy gain from deuteron beam-target fusion could be achieved when quasi-Maxwellian deuteron beam was assumed, and when a ρrb = 4.5 g/cm2 was considered, where ρ is the fuel density, and rb is the ion beam focusing radius on the target. These results provide some insight into the contribution of the extra heat produced by deuteron beam-target fusion to the hot spot ignition process. If the physics works as anticipated, this novel type of interaction foil can efficiently generate energetic deuterons during intense laser pulses. The massive yield of deuterons should turn out to be the most efficient way of igniting the DT fuel, making the dream of near-term commercialization of FI fusion more achievable.

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