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Nanoplasmonic Laser Fusion

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Inertial Confinement Fusion is a promising option to provide massive, clean, and affordable energy for humanity in the future. The present status of research and development is hindered by hydrodynamic instabilities occurring at the intense compression of the target fuel by energetic laser beams. A recent proposal by Csernai et al.1 combines advances in two fields: detonations in relativistic fluid dynamics and radiative energy deposition by plasmonic nano-shells. The initial compression of the target pellet can be decreased, not to reach instabilities. A final and more energetic, short laser pulse can achieve rapid volume ignition, which should be as short as the penetration time of the light across the target. In the present study, we discuss a flat fuel target irradiated from both sides simultaneously, to acheve ignition on a time-like hypersurface like in high energy heavy ion reactions. Here we propose an ignition energy with smaller compression, by largely increased entropy increase, and instead of external indirect heating and huge energy loss, a maximized internal heating in the target with the help of recent advances in nano-technology. The reflectivity of the target can be made negligible, and the absorptivity can be increased by one or two orders of magnitude by plasmonic nano-shells embedded in the target fuel. Thus, higher ignition energy and radiation dominated dynamics can be achieved. Here most of the interior will reach the ignition energy simultaneously based on the results of relativistic fluid dynamics. This makes the development of any kind of instability impossible, which up to now prevented the complete ignition of the fuel.

Is this abstract from experiment?

Yes

Internet talk

Yes

Name of experiment and experimental site

Wigner RCP Budapest & ELI-ALPS Szeged, Hungary

Is the speaker for that presentation defined?

Yes

Details

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