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Radiation dominated implosion with flat target

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Inertial confinement fusion achieved with highly energetic laser pulse is a promising method to provide clean, affordable energy in the future. The state of the art of present research and development is hindered by hydrodynamic instabilities occurring at the high compression of the target fuel. Recent studies [1,2] show that a simultaneous ignition could prevent these instabilities. Combining advancements in two fields, detonations in relativistic fluid dynamics and radiative energy deposition by plasmonic nano-shells lead to decreased or eliminated initial compression of the target. Rapid volume ignition can be achieved with a short final energetic laser pulse, having penetration time closely matched to the speed of light across the target. Here, we discuss a flat fuel target irradiated from both sides simultaneously, proposing ignition with smaller compression, largely increased energy, entropy and temperature increase. Instead of external indirect heating with losing energy, we aim for maximized internal heating in the target with the advances in nano-technology. Neglecting the reflectivity of the target we propose increasing the absorptivity by using plasmonic nano-shells embedded into the target. Therefore, we achieve higher ignition temperature and radiation dominated dynamics. Based on relativistic fluid dynamics calculations with this method, the ignition temperature can be reached simultaneously in a bigger volume of the target's interior. This reduces development of instabilities, which prevents the complete ignition of the target.

References:

- [1] L. P. Csernai, N. Kroo, and I. Papp, "Radiation dominated implosion with nano-plasmonics," *Laser Part. Beams*. 36 (2), 171–178 (2018).
- [2] L. P. Csernai and D. D. Strottman, "Volume ignition via time-like detonation in pellet fusion," *Laser Part. Beams*. 33 (2), 279–282 (2015).

Internet talk

Is this abstract from experiment?

No

Name of experiment and experimental site

N/A

Is the speaker for that presentation defined?

No

Details

N/A

Primary authors: Prof. CSERNAL, Laszlo Pal (University of Bergen); Dr CSETE, Maria (Department of Optics and Quantum Electronics, University of Szeged); MISHUSTIN, Igor (Goethe University); Mr MOTORNENKO, Anton (Frankfurt Institute for Advanced Studies); Dr PAPP, Istvan (University of Babeş-Bolyai); Prof. SATAROV, Leonid Mikhailovich (Frankfurt Institute for Advanced Studies); STOECKER, Horst (GSI); Prof. KROO, Norbert (Wigner Research Centre for Physics, and Hungarian Academy of Sciences)

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