Particle Simulations for Nanoplasmonic Laser Induced Fusion Experiment

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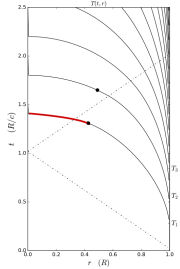


Simultaneous volume ignition happens only up to 12% in an irradiated target

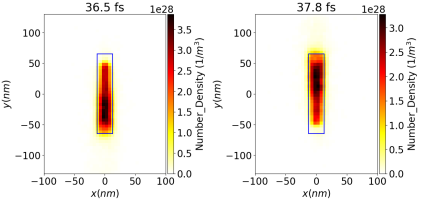
NAno-**P**lasmonic **L**aser **I**nduced **F**usion **E**xperiment was proposed to overcome instabilities and **increase** light **absorption** in the target. **Resonant gold nanoantennas** can be used to **enhance** absorption. [L.P. Csernai, M. Csete, I.N. Mishustin, A. Motornenko, I. Papp, L.M. Satarov, H. Stcker & N. Kroó, Radiation- Dominated Implosion with Flat Target, *Physics and Wave Phenomena*, **28** (3) 187-199 (2020)]

Classically, when simulating gold nanoparticles, electromagnetic responses are described by **bulk permitivity** and Maxwell's equations are solved with Finite Difference Time Domain methods, **without** focusing on **motion of electrons**.

$\epsilon(\omega) = 1 - \frac{\omega_p^2}{(\omega^2 + i\gamma\omega)}$ where ω_p is the plasma frequency, γ is the damping factor or collision frequency.

On these scales conduction electrons behave like strongly coupled **plasma**. [Lukas Novotny, Effective Wavelength Scaling for Optical Antennas, Phys. Rev. Lett. **98**, 266802 (2007).]

We simulated nanoantennas with colliding electrons around heavy gold ions using **Partcle-In-Cell** method (EPOCH). [T.D. Arber et al 2015 Plasma Phys. Control. Fusion 57 113001]



Result in vacuum for 25x130 nm nanorod orthogonal to the beam direction, x. The electro-magnetic field drives the conduction electrons into fluctuations.

The nanorod here has a light absorption cross section **66.5** times bigger than its geometrical cross section.

The model is **idealized**, however, it shows **qualitative potential** for future use in plasma simulations.