9th Summer School

Plasmas in super-intense laser fiels

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Inertial Confinement Fusion Physics

In these lectures, we will study the physics of Inertial Confinement Fusion implosions. Starting with the basic physics that determine implosion parameters, we will move on to describing spherically symmetric implosions. We will then add more complexity, including the effect of perturbations on implosions. Examples from spherically symmetric and multi-dimensional simulations will be presented to illustrate these concepts.

The lectures will be organized as follows:

Lecture 1:

A. Key physics models

1. *Laser energy deposition*
2. *Heat Conduction*
3. *Radiation transport*
4. *Material properties*

B. Implosion details

1. *Shock transit*
2. *Shell adiabat*
3. *Mass Ablation Rate*
4. *Ablation Pressure*
5. *Implosion velocity*
6. *Rocket model*

Lecture 2:

A. Spherically symmetric implosions

1. *Yield, areal density, hot spot pressure*
2. *Hot spot dynamics*
3. *Modeling ICF implosions using radiation-hydrodynamic codes*

Lecture 3:

A. Multi-dimensional effects

1. *Hydrodynamic instabilities*
    - *Classical and ablatively-stabilized perturbation growth*
    - *In Flight Aspect Ratio*
2. *Laser pulse shaping and implosion stability*
3. *Modeling ICF implosions using multi-dimensional hydrodynamic codes*