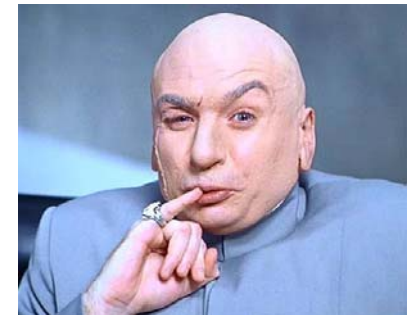




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Inertial fusion energy studies in the UK

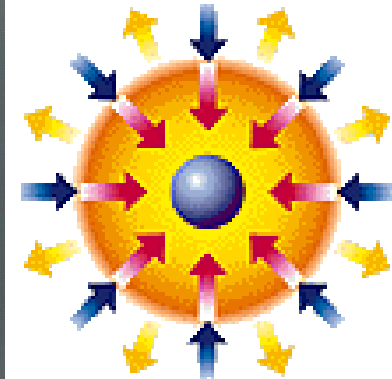
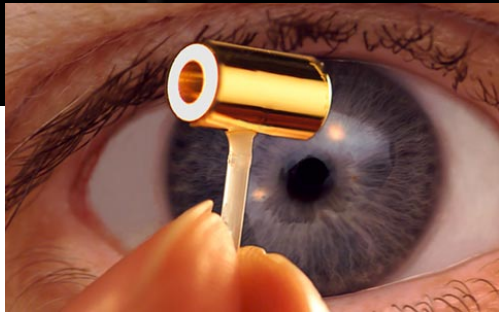
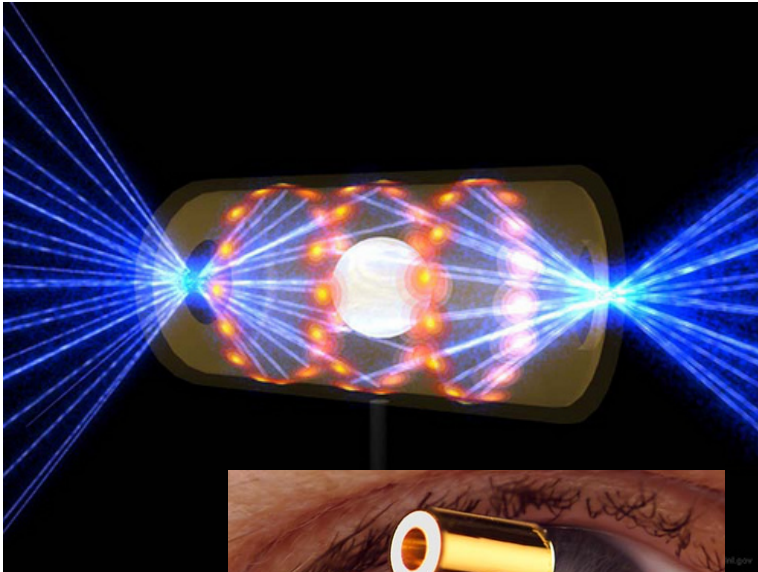
Dr Kate Lancaster





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Inertial Confinement Fusion





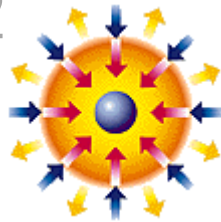
The basic concept

1



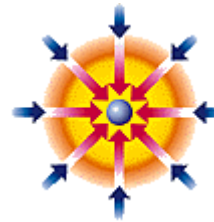
Laser irradiates capsule – laser is absorbed in lower density material

2



Higher density material heats and blows off (ablation), rest of fuel is compressed to 1000 g/cc via rocket action

3



Shocks forming as the fuel compresses and raise the fuel to 100 million degrees Kelvin

4



Fuel burns because the alpha particles produced deposit more energy and make more fusion reactions happen



- **Energy** for ignition

~1000000J

4 finger KitKat....

973,000 J



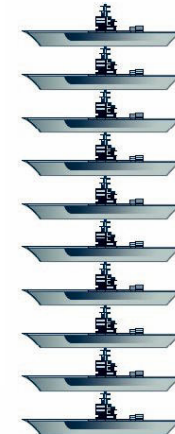
- **Timescales :**

Compression -Long pulse: nanosecond =

1/1000000000 s

Time for computer to access memory

- **Gigabar pressures**



Pressure equivalent
to 10 air craft carriers
on your thumb!!!



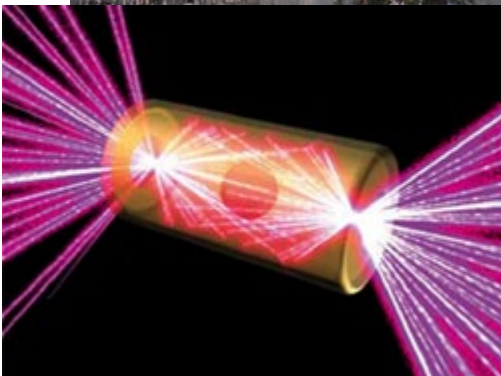
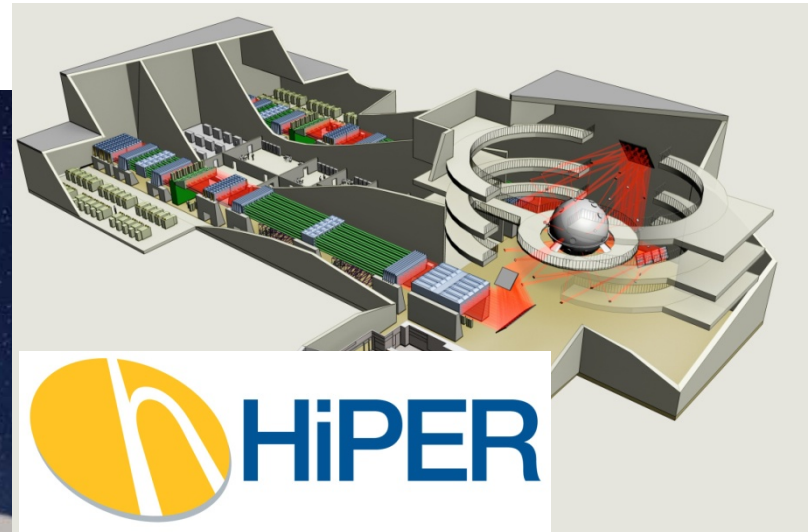
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The landscape





Challenges to solve....

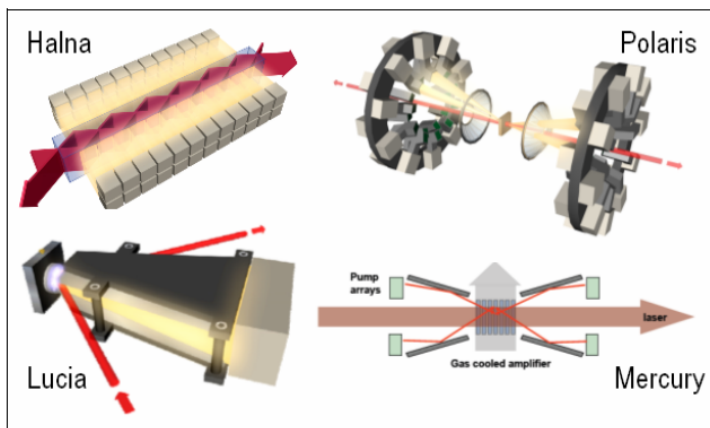
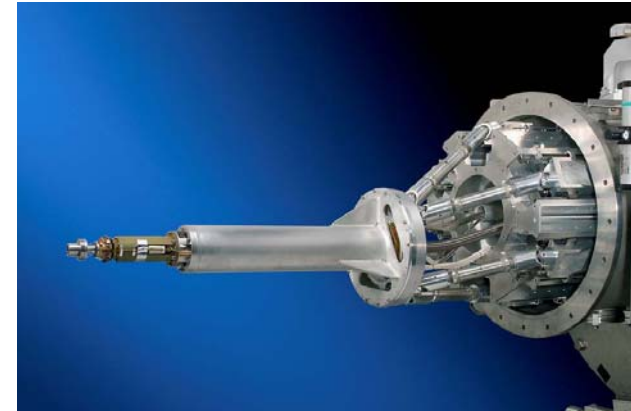
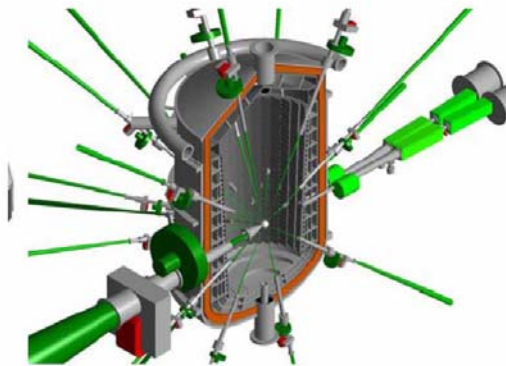


Figure 3.1-b: Pump and extraction axis for Halna, Polaris, Lucia and Mercury

n reactor (Norimatsu et al.)

High repetition rate, High energy laser beams

Higher laser efficiency

Reactor wall technology

Cryogenic target systems

+ Unknown unknowns!

Also.....Persuading the people with lots of money to give it to us!





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Universities and establishments

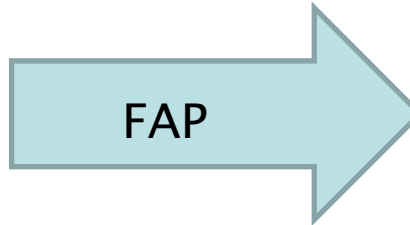


Dual beam,
15J / beam,
30fs, different
focal options,
1 shot/ min



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**Imperial College
London**



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8 beam
system, two
main target
areas, most
powerful beam
500J, 500fs,
f/3 focusing, 1
shot / hour





International context

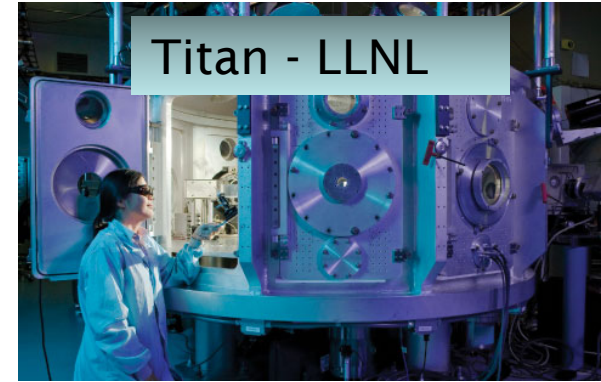
GEKKO/FIREX -
Osaka



Phelix - GSI



Titan - LLNL



PALS - prague



TIFR - Mumbai



Omega EP - Rochester



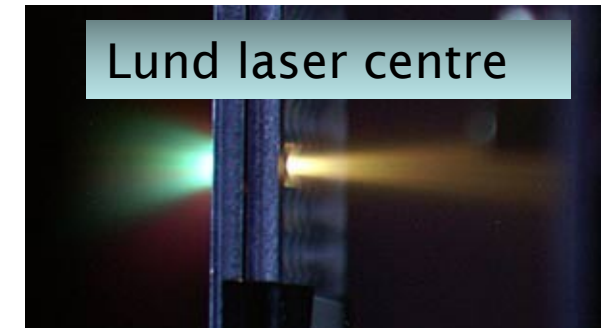
Orion - AWE



LULI - Paris



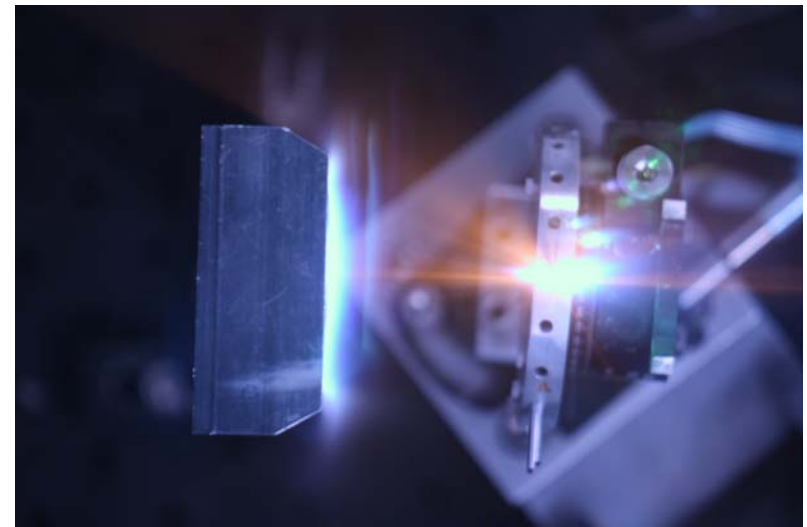
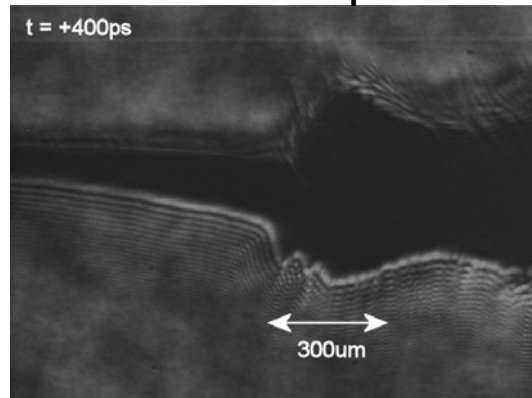
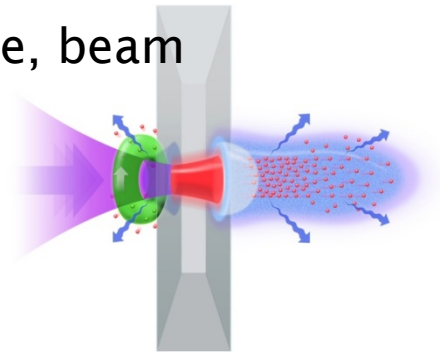
Lund laser centre





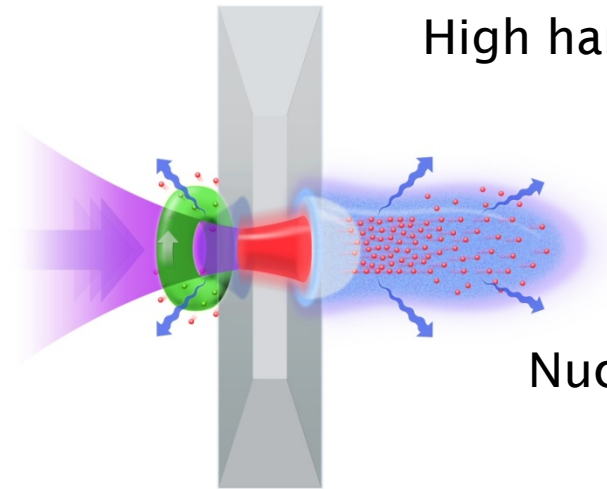
The types of research - Fusion

- Absorption and partition of laser energy - effects of laser conditions, target conditions
- Hot electron generation - energy spectrum, beam divergence, beam quality
- Hot electron transport - target heating
- Proton fast ignition and other novel schemes
- Long pulse laser plasma interactions
- Neutron damage to first wall and optics
- Channel formation





The types of research – the wider field



High harmonic generation

Secondary
radiation sources

Nuclear physics

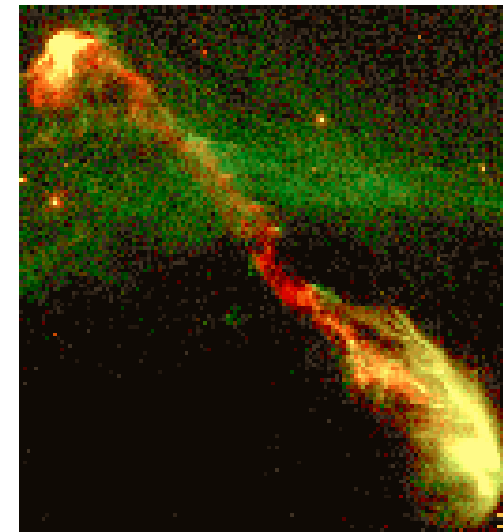
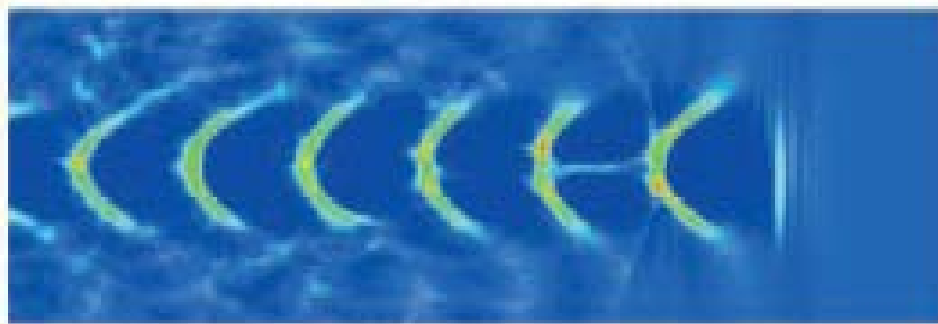
Fundamental laser plasma
interaction physics

Atomic physics

Laboratory astrophysics

Particle acceleration – proton acceleration

Particle acceleration – laser wakefield



High energy density
physics



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What's coming up in Laser-plasma?

