SAND2014-17519D

Exceptional service in the national interest

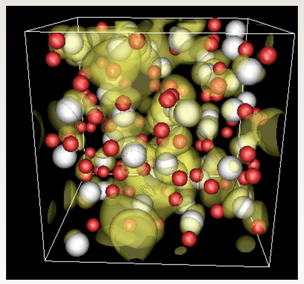
Sandia National Laboratories

We study planets using quantum mechanics and 90,000 mph flyer plates, compressing materials to millions of atmospheres pressure

High performance computing

- We apply quantum theory and use the world's largest supercomputer to simulate materials at extreme conditions

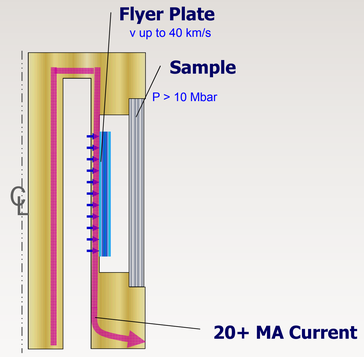
The LANL/Sandia Super-computer cielo



Quantum simulations of water. The size of simulation box is about 0.0000000005 m (5×10^{-10} m)

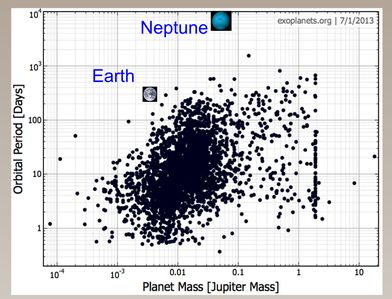
90,000 mph flyer plate impact experiments

- The enormous current from Z is used to create a magnetic field
- The magnetic field pushes on an aluminum panel, accelerating it to speeds up to 40km/s
- The flyer impacts samples that can be solid or liquid



These high precision shock experiments are unique in the world and data taken on Z is used as standard values across the world

Thousands of exoplanets have been discovered by the Kepler mission

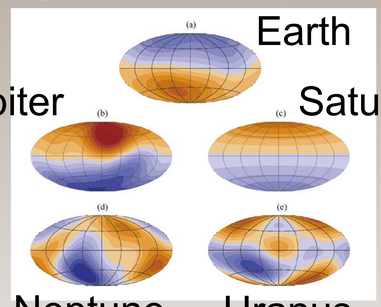


- Planets come in many more varieties than the 8 in our solar system
- Giant earths – rocky planets much larger than our earth
- Hot Neptunes – gas planets very close to their star
- ***We need data on solids and gases to very high pressures to understand the formation of our solar system and the billions other star systems***

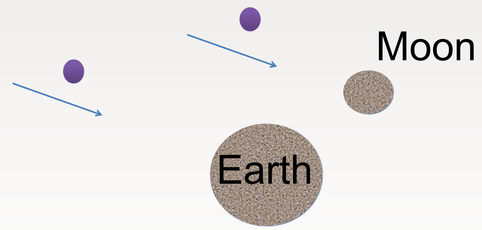
Explains planetary phenomena

- Why is Neptune's and Uranus' magnetic field so strange?

Magnetic field of planets



- When does a meteorite vaporize when hitting the earth or the moon?



Does shock vaporization of meteors explain the differences in concentration of rare elements like Re, Os, Ir, Ru, Pt and Pd in the Earth and the Moon?