Lattice Confinement Fusion-Fast-Fission

U.S. Space Disrupters Day

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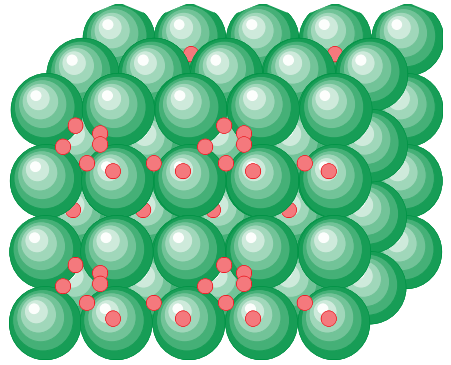
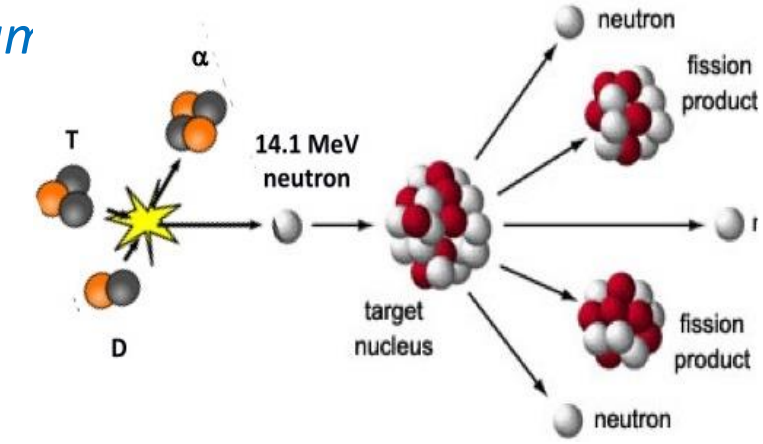
Nuclear Fusion Without Large Magnets or Lasers

- **Lattice Confinement Fusion (LCF)**[1]
  - Fusion of hydrogen isotopes into helium
  - No tokamak magnets or laser power supplies
  - Nuclear fuel is confined and triggered within lattice
  - *Nuclear reactions enhanced by electron screening*
  - *Extended Electrodynamics role*
  - NASA published results in *Physical Review C* [2,3]
  - *Locally hot but globally cold*
  - Commercialized in 2024 to produce medical radioisotopes
- **Lattice Confinement Fusion Fast-Fission Hybrid Reaction**
  - *Fusion neutrons fission uranium, spent fuel rods or thorium*
  - *No enriched uranium, cleaner fission!*
  - Demonstrated with US Navy and GEC
- **Application**
  - LEO and Deep Space
  - Terrestrial



Green electron screened lattice
Red deuterium nuclear fuel



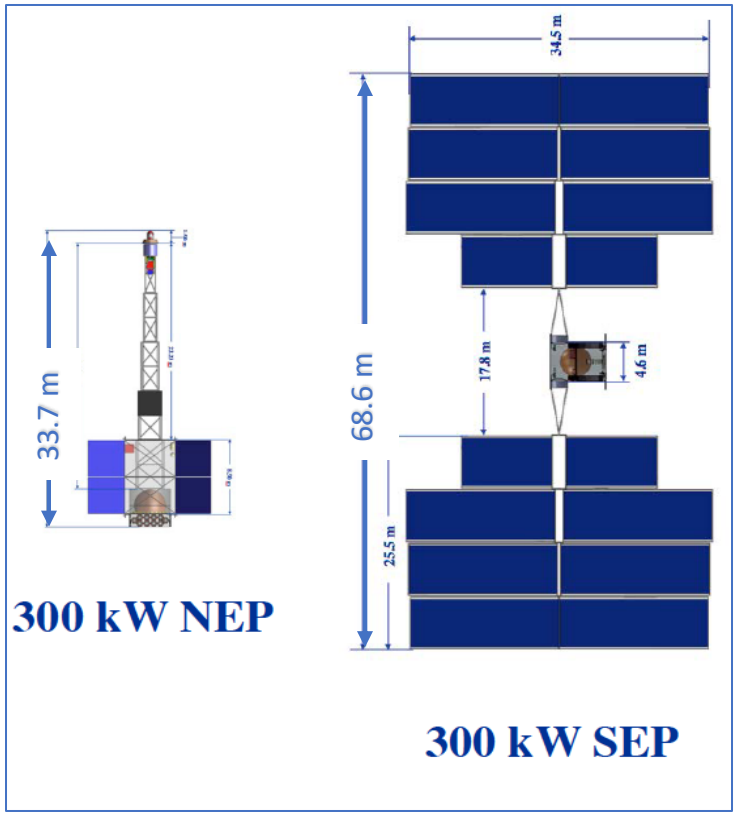
1. US Patent 8,419,919, "System and Method to Generate Particles"
2. V. Pines, *et al*, "Nuclear Fusion Reactions in Deuterated Metals", *Phys Rev C*, **101**, (20Apr2020) 044609.
3. B. M. Steinetz, *et al*, "Novel Nuclear Reactions Observed in Bremsstrahlung-Irradiated Deuterated Metals", *Phys Rev C*, **101**, (20Apr2020) 044610.

Application

- **Deep space Power**
  - Melt through 45 km of Ice shells of Icy worlds
  - Nuclear Electric Propulsion
  - Planetary Surface Power
    - 10 – 100 kWe Lunar and Mars Power
    - *Fabricate fuel rods in situ, "living off the land"*
  - LEO Power
  - *No LEU, HALEU or HEU*
  - *Untended operation 5+ years*

- **Terrestrial**
  - DoD Operational Energy < 1 MWe
  - Small Modular Reactors: Data Centers > 1 MWe

- **Going Forward**
  - NIAC supported LANL MCNP modeling finished
  - NSF Supported scaling on-going at NASA GRC



Nuclear Electric Power and Propulsion (NEP) heat dissipation panels as compared to Solar Electric Propulsion (SEP)[1] solar panels. *Mass, volume, lifetime matter!*

If It's safe enough to launch from Florida, its safe enough to use in Florida!™

[1] L. Mason, "High Power NEP Power Concepts", *NASA GRC*, (2017) where the 300 kW NEP was for JIMO/Project Prometheus.