Gradient Field Imploding Liner Fusion Propulsion System

A new approach to magneto-inertial fusion for in-space propulsion

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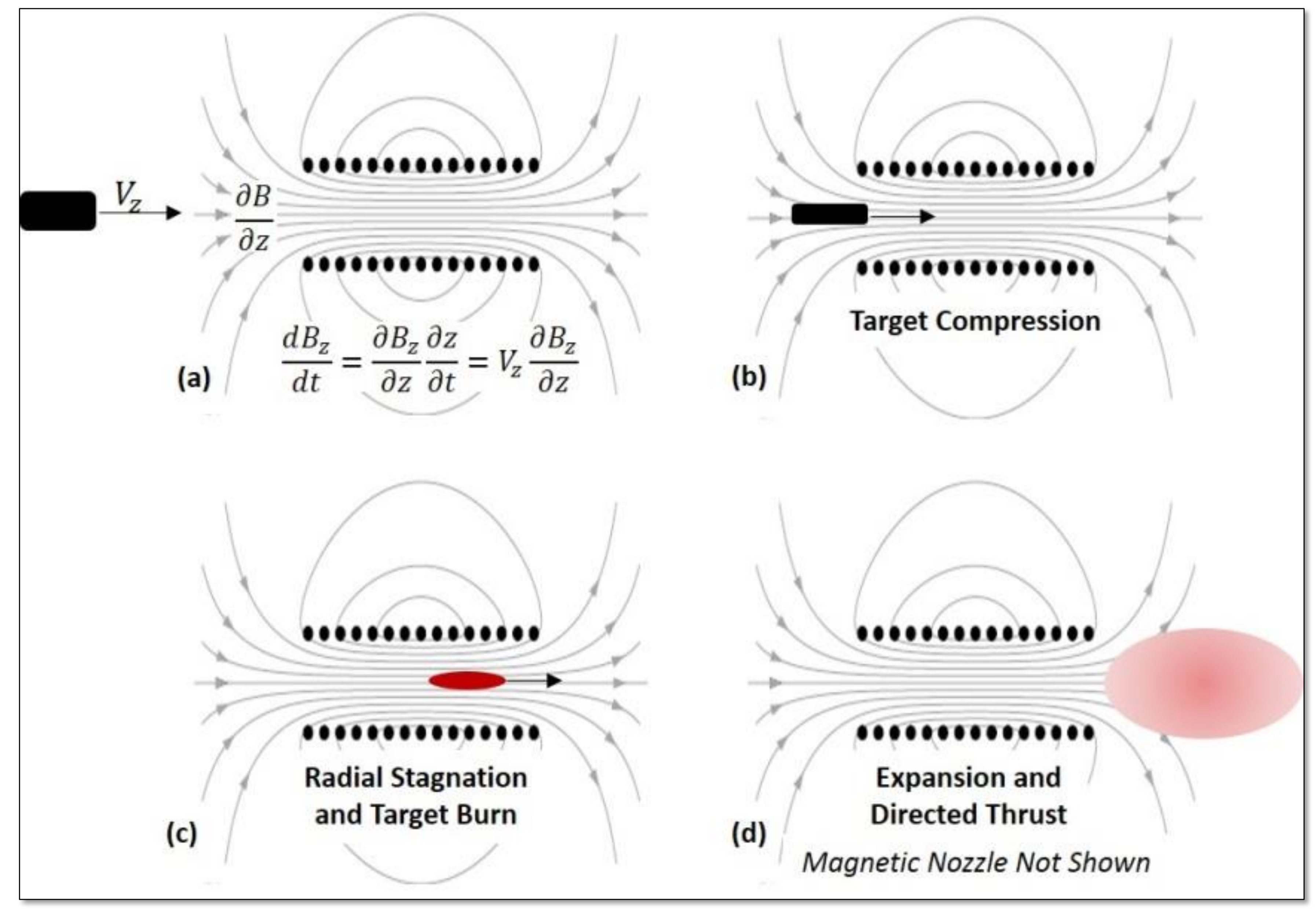
NASA Innovative Advanced Concepts

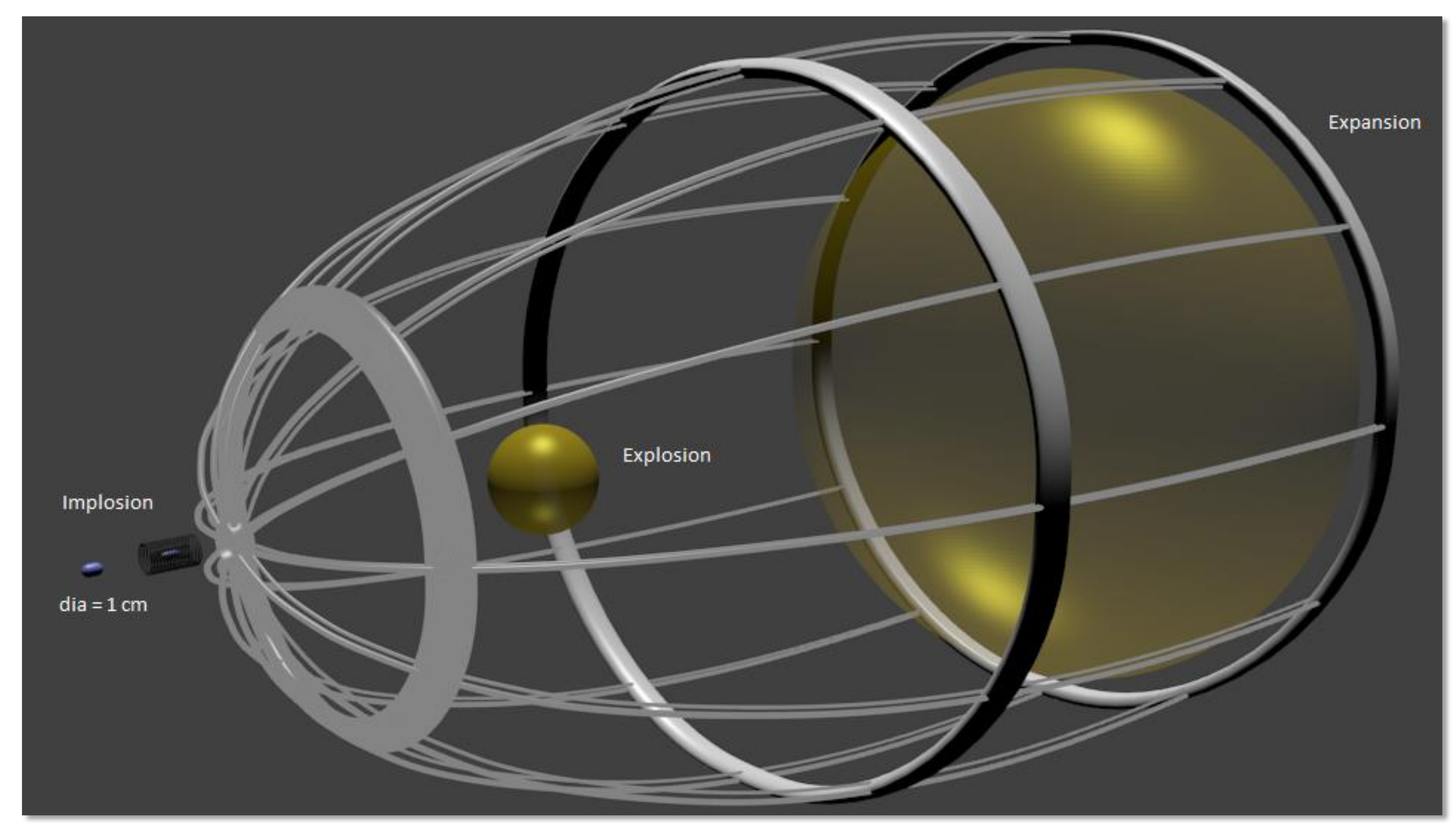
Background: Magneto-inertial fusion concepts often use a pulsed high current discharge in a cylindrical coil to generate a rapidly changing axial magnetic field, inducing a counter-propagating current in the conducting outer liner of a centrally aligned cylindrical fusion target. The Lorentz force arising from the axial field and azimuthal liner current rapidly implodes the target radially inward, compressing the fuel to reach fusion conditions.



Innovation: Replacing the pulsed high current magnetic field coil and stationary target with a fast moving target fired axially into a static, high gradient magnetic field can significantly reduce power storage and transfer requirements while providing the same implosion forces as standard MIF

Benefits:

- Allows the use of efficient, constant current superconducting coils
- Lends itself more naturally to repetitively pulsed in-space propulsion
- The axial magnetic field inhibits electron thermal conduction losses, enhances alpha deposition, and lowers the (ρr) threshold for ignition
- Pulse rate, fuel type, and yield can be varied to provide mission flexibility



Key Challenges:

- Pellet accelerator (efficient acceleration to several km/s)
- Magnetic field design (compression, burn, expansion, detachment)
- Pellet design and implosion physics (fuel/liner composition and yield)
- Mission analysis and SOA comparisons (benefits for human exploration)

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