

## ADVANCED CONCEPTS: ANEUTRONIC FUSION POWER AND PROPULSION

**DEFINITION:** *Aneutronic fusion has been described as any type of fusion reaction where neutrons carry no more than 1% of the total released energy.*

**INTRODUCTION:** In the present study : The fusion reaction is spawned by a burst of Terrawatt laser accelerated protons accelerated via TNSA from the substrate & hydrogen content to liberate ~180 to 575 KeV Protons which react with the target

*Alternative fusion fuel concepts will be presented that either have been demonstrated or have the potential to use clean fuels for In-Space Propulsion and Power. Methodology to harness energetic ionic or sub-atomic particles momentum primarily to produce high Isp thrust and how to harness those ions for direct power conversion into electricity via extracted energy will also be discussed.*

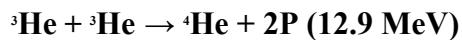
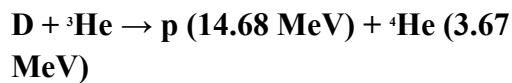
### Concepts

Aneutronic Fusion for In-Space thrust & power. Promise of clean energy and potential nuclear gains. Fusion plant concepts, potential to use advanced fuels. Methods to harness ionic momentum for high Isp thrust plus direct power conversion into electricity will be presented.

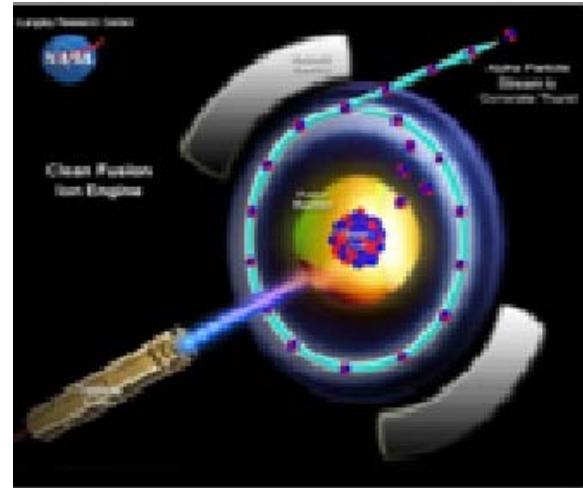
**Proton triggered**  $^{11}\text{Boron}$  fuel is abundant & inexpensive on earth with potential Gain ~5.9



**$^3\text{He}$  from Solar ejecta release into (Heliosphere)**



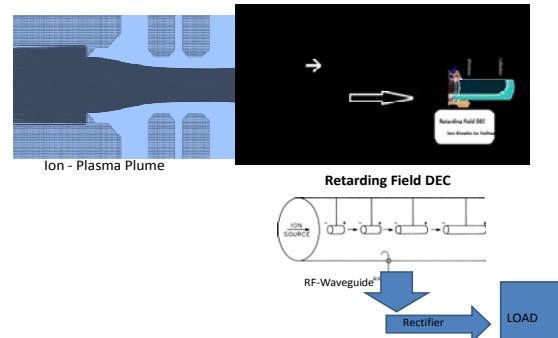
### Laser pulse ignition scheme:



**A-LIFT** “Block Ignition” via TNSA process ignites Solid / Condensed matter “Target”

### Direct Energy Conversion Scheme:

#### Direct Energy Conversion - DEC



*Ionic injection into TWT- like device    Inlet  
Aperture - Beam collimation, Retarding Field & Gradual braking of ions to limit Bremsstrahlung, Cavity structure w Induced “Ringing”, Waveguide extraction of RF energy from cavity Rectification of RF for power conversion & distribution*

**Conclusion:** *Methodology to derive abundant and sustainable yields of kinetic energy derived from advanced Fusion Fuels applied to In-Space vectored thrust and power has been presented.*

*Some Advanced aneutronic nuclear fusion reactions were presented as possible fuels. Some potential sources of such fuels and where they may be found. Some ideas related to fuel utilization. Some types of fusion plants that are capable of using such fuels for In-Space Propulsion and Power. Methodology for direct conversion of high kinetic energy ions into useful power.*

The reaction with  $^{11}\text{B}$  / fuel matrix in micro-target zone is :



*A second Aneutronic fuel from Lunar regolith adsorbed  $^3\text{He}$  deposits also exists:*



*Potential sources of fuels for last two reactions:  
Lunar regolith adsorbed  $^3\text{He}$  deposits  
Jupiter Atmosphere*

#### References:

*Plasma Physics Reports, Vol. 30, No. 6, 2004, pp. 473–495. “High-Energy Ion Generation by Short Laser Pulses” A. Maksimchuk, Center for Ultrafast Optical Science, University of Michigan, Ann Arbor, MI et al , 2004*