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# COMPACT ANEUTRONIC FUSION PROPULSION

**Abstract**

This paper presents the design of a compact aneutronic fusion engine which will enable more challenging exploration missions in the solar system. The engine uses a Deuterium-Helium-3 reaction to produce fusion energy. The Deuterium-Helium-3 reaction requires a temperature three times greater than a Deuterium-Tritium (D-T) reaction but produces much lower levels of neutrons than a D-T reaction. Lower neutron levels reduce the needed shielding and also reduces the waste energy unavailable for propulsion. The engine employs a field reversed magnetic field configuration (FRC) and a novel radio-frequency heating system. The FRC has a relatively simple linear solenoidal coil configuration yet permits higher plasma pressures for a given magnetic field than other designs. Waste heat generated from bremsstrahlung and synchrotron radiation can be recycled to maintain the fusion temperature. The charged reaction products are exhausted directly for propulsion through a magnetic nozzle. The heating scheme only works for reactors with radii less than 0.5 hence the optimal size for each engine is between 5 and 10 MW. The paper provides a system design of the engine. Analysis of electrical power generation, thermal management and magnetic coil subsystems are included. Results are presented for the Jupiter Icy Moon Orbiter Mission and a manned Mars mission.