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Fusion Reactor Based on the Inductively Driven Metal Liner Compression of an FRC Target

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The Inductively Driven Liner (IDL) concept represents a transformational solution to the generation of fusion energy. A fusion gain demonstration device is described that would serve as a smaller-scale, prototype of the commercial fusion reactor, and would demonstrate all essential aspects of the reactor from the ability to form, heat, and confine plasmas at performance levels and establish the viability of the concept for low-cost fusion energy generation. The IDL fusion reactor is based on results from current research being done at MSNW and the University of Washington on the magnetically driven implosion of thin (0.5–1 mm) Aluminum hoops, as well as the simultaneous merging and magnetic compression of two FRC plasmoids to form a suitable target inside the metal bands. Both the driver and the target have been studied experimentally and theoretically by the MSNW/UW team. FRCs have been formed, translated and merged inside compression coils at the scale desired for the IDL concept. The FRC has been magnetically compressed up to ion temperatures over 3 keV with observed target lifetimes in excess of that required. Aluminum liners with radii from 6 to over 40 cm have been successfully imploded reaching speeds of 2 km/sec, and resulting in compression fields greater than 100 T. Due to limited funding, it was not possible to perform the most critical step - the combined, simultaneous operations of FRC merging and liner compression. The prime objective of the IDL project in future work is to perform this crucial test, and to do it at sufficient power and scale to achieve fusion gain. Comprehensive plans for this next step will be discussed including a detailed 1D model of the liner electrical and physical behavior, as well as a full, non-linear, dynamical calculation of the liner assembly using the ANSYS 3D Explicit Dynamics® solver.

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