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# CONDENSED MATTER, ELECTROMAGNETIC, LINER-IMPACTORS FOR SHOCK WAVE AND WARM DENSE MATTER APPLICATIONS

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Traditional shock wave physics experiments require the high precision (uniform) impact by a solid driver at well known, and controllable, velocity upon a target. Combining initial shock heating with controlled compression can provide access to the challenging conditions called warm-dense matter. High velocity, electromagnetically driven cylindrical liners can be a convenient and controllable technique for accessing both shock states inaccessible with normal techniques and warm dense matter states.

The basics techniques of controlled, condensed matter implosion have been developed over the last two decades, with the principle obstacle to achieving very high velocities and high precision (accurately cylindrical) impacts is the development instabilities. The growth of magneto-Rayleigh Taylor-like (MRT) instability at the (outer) magnetic field / liner can be limited by materials strength in some cases, but under high acceleration frequently feeds through the thickness of the liner distorting the inner surface so that high precision is not attained.

Where large amounts of kinetic energy, high efficiency of conversion of electrical to kinetic energy, and/or high final implosion velocities are required, the traditional approach is to match the liner implosion time to the energy delivery time of the pulsed power driver, but this approach favors MRT growth. An alternate approach is to introduce the driving impulse, and hence momentum to the liner early in the implosion ("kick" ) when radii are large, circumferential current density, ohmic heating rates and acceleration are relatively low, but allowing the nearly incompressible line to "coast"during the later stages of the implosion. Nearly incompressible convergence accelerates the inner surface, while maintaining overall liner momentum and kinetic energy unchanged in these later stages.
Analytic and circuit-model (zero D) calculations will be presented indicating that significant advantages are to be realized by this approach, additional modeling further supports the conclusion of the simple models. (LA-UR-17-21235)

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