

Abstract Submitted  
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**Origin of Helical Instability Modes in Premagnetized Thin-Foil Liner Z-pinch** Using PERSEUS JEFF WOOLSTRUM, Univ of Michigan - Ann Arbor, CHARLES SEYLER, Cornell University, RYAN MCBRIDE, University of Michigan — In z-pinch-driven liner implosion experiments with a pre-imposed axial magnetic field, helical magneto-Rayleigh-Taylor (MRT) instability structures have been observed. We show that the formation of these helical structures can be described using Hall magnetohydrodynamics (MHD). Additionally, the use of Hall MHD leads to an axial asymmetry in the trailing spikes of the MRT structure. This asymmetry, with rolled-up wavelike features, has also been observed in experiments and is likely related to the mode-merger process observed in MRT instability evolution. We used the 3D extended MHD simulation code PERSEUS (which includes Hall physics) [C. E. Seyler and M. R. Martin, *Phys. Plasmas* **18**, 012703 (2011)] to study these helical instabilities and asymmetries. We also show that the so-called Hall instability is responsible for producing helically bunched plasma around the z-pinch which causes a bunching of magnetic field and current. This allows for the seeding of the helical pitch angle in the electron flow and therefore current, which seeds the pitch angle of the helical instability without the need for significant axial magnetic flux compression. This is a new explanation for the origin of the helical instabilities observed in axially premagnetized z-pinch implosions. This work was supported by the NNSA SSAP under DOE Cooperative Agreement DE-NA0003764.

Jeff Woolstrum  
Univ of Michigan

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