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Spectroscopic modelling of highly magnetized cylindrical implosions

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We present a comprehensive simulation study of magnetized cylindrical implosions of Ar-doped D_2-filled targets at OMEGA using a 15 kJ, 1.5 ns laser drive. The plasma dynamics are investigated in 1 and 2-D with the MHD code GORGON, which, for a seed B-field of 50T, predicts a compressed B-field >10kT over the entire radius of the compressed core and significantly higher temperatures compared to the unmagnetized case. Synthetic X-ray emission spectra calculated with the NLTE atomic kinetics code ABAKO and detailed Stark-Zeeman broadening codes (MERL, PPP-B, and DinMol) show distinctive spectral features between magnetized and unmagnetized implosions. These results suggest that Ar K-shell spectroscopy can be used to extract the plasma conditions throughout the implosion and bring information about hydrodynamic changes due to the impact of the B-field. Experiments at the OMEGA 60 facility have started, with the first data currently being analyzed, and a second shot-day happening in August 2021. A proposal for extending this platform to LMJ in FY24 is being prepared.

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