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Self-Generated Magnetic Fields in Stagnation-Phase ICF Implosions. CHRISTOPHER WALSH, JEREMY CHITTENDEN, KRISTOPHER MCGLINCHEY, NICOLAS NIASSE, Imperial College London — 3-D extended-MHD simulations of the stagnation phase of an ICF implosion are presented, showing significant self-generated magnetic fields (1000-5000T) due to the Biermann Battery effect. Perturbed hot-spots generate magnetic fields at their edges, as the extremities of hot bubbles are rapidly cooled by the surrounding low temperature fuel, giving non-parallel electron pressure and density gradients. Larger amplitude and higher mode-number perturbations lead to an increased hot-spot surface area and more heat flow, developing greater non-parallel gradients and therefore larger magnetic fields. Due to this, largely perturbed hot-spots can be affected more by magnetic fields, although the accelerated cooling associated with greater deviations from symmetry lowers magnetisation. The Nernst effect advects magnetic field down temperature gradients towards the outer region of the hot-spot, which can also lower the magnetisation of the plasma. In some regions, however, the Nernst velocity is convergent, magnetising the tips of cold fuel spikes, resulting in anisotropic heat-flow and an improvement in energy containment. Low-mode and multi-high-mode simulations are shown, with magnetisations reaching sufficiently high levels in some regions of the hot-spot to suppress thermal conduction to lower than 50% of the unmagnetised case. A quantitative analysis of how this affects the hot-spot energy balance is included.

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