Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Magnetothermal instability resulting from gradients in plasma composition[1] JAMES SADLER, HUI LI, BRIAN HAINES, Los Alamos National Laboratory — The magnetothermal instability can arise in situations of parallel electron temperature and density gradients, such as in laser ablation fronts. We show that there is a related instability occurring when the gradient of the average ion charge state Z is antiparallel to the electron temperature gradient. The transverse magnetic field arises from the collisional thermal force, not the Biermann term, and grows exponentially with a linearized growth rate on hydrodynamic timescales. An MHD simulation shows that the instability can occur even in pressure equilibrium, such that hydrodynamic motion can be neglected to first order. Gradients in Z are prominent in high energy density plasmas, and often have an opposing temperature gradient due to increased radiative cooling.

[1]Directed Research and Development program of Los Alamos National Laboratory under project number 20180040DR

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Date submitted: 26 Jun 2020 Electronic form version 1.4