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Effects of externally applied Lorentz force on liquid metal flow ADAM FISHER, EGEMEN KOLEMEN, MIKE HVASTA, Princeton Univ — This work looks at methods of controlling liquid metal flows using externally induced Lorentz forces. Large fusion reactors face an unsolved issue of heat fluxes at the divertor causing reactor damage. Fast-flowing liquid metal divertors can solve the heat flux problem, but to be viable there are various unfavorable flow phenomena that need to be suppressed and controlled. Some of those studied here are hydraulic jumps and surface waves. Externally induced Lorentz forces may be created by injecting electric currents into a liquid metal flow immersed within a magnetic field. Uniform Lorentz forces aligned with gravity work nearly analogously to changing gravity, and as such any flow features driven or affected by gravity may experience changes. As Lorentz force is dependent on current density which can be highly variant as cross-sectional flow depth changes, a non-uniform force field is created that is mostly unique to these types of flows; non-uniform magnetic fields yield similar effects. Lorentz force has been historically used as a driving force in pump applications, but little has been done in the way of flow control. The experiments in this work are galinstan channel flows that investigate the effects that Lorentz force has on hydraulic jump features and surface waves.

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