Rotating plasma for separation - Shocks and magnetosonic soliton dynamics

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Rotating plasmas have the potential to offer unique solutions to outstanding separation needs through the differential confinement properties that inertia produces \(^1\). In the first part of this talk, I will review how plasma rotation can in principle be leveraged to create conditions favorable for mass separation in magnetized plasmas, and discuss how turning these concepts into practical devices hinges upon the ability to impose an electric field perpendicularly to the magnetic field in a rotating plasma.

In the second part of this talk, I will show that a feature common to both astrophysical collisionless shocks and fast magnetic compression laboratory experiments is the formation of a magnetosonic (MS) soliton propagating upstream of the shock \(^2\). I will then present recent numerical results suggesting that the combination of MS solitons’ structure and peculiar reflection properties at interfaces creates new opportunities to manipulate plasmas \(^3\).

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\(^1\) Gueroult, R., Rax, J.-M., Zweben, S. and Fisch, N. J. (2018), PPCF, 60, 014018