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Nonlinear Simulations of the Parker Instability with Cosmic Ray Streaming[1] EVAN HEINTZ, CHAD BUSTARD, ELLEN ZWEIBEL, University of Wisconsin - Madison — The Parker Instability is a Rayleigh-Taylor like mode where the thermal gas is partially supported by magnetic and cosmic ray pressure. This instability occurs in the gas of galactic disks and possibly contributes to the dynamo effect in galaxies. We have performed a linear stability analysis on the Parker Instability where the stability of the system depends on how the cosmic rays couple to the thermal gas through microscopic instabilities. Since adding the additional effects of radiative cooling and a realistic gravitational potential, we have also been running numerical simulations of the Parker Instability in order to observe how the system evolves nonlinearly. In addition, we are investigating if a galaxy can produce enough cosmic rays to drive a galactic wind and blow itself apart. In order to study this, we evolve a system of magnetic flux tubes in a vertical gravitational potential into which we inject cosmic rays and observe how the flux tube evolves. This work aims to determine if the gas, magnetic fields, and cosmic rays are able to reach a stable equilibrium or if a threshold of cosmic ray injection can be reached where the flux tube continues to rise against gravity due to cosmic ray and magnetic buoyancy. We have and continue to use theory and simulations.

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