Contribution ID: **1055** Type: **Talk**

Cosmic Ray Transport, Energy Loss, and Influence in the Multiphase Interstellar Medium

Thursday 15 July 2021 13:18 (12 minutes)

The bulk propagation speed of GeV-energy cosmic rays is limited by frequent scattering off hydromagnetic waves, predominantly by waves that they generate themselves through a resonant streaming instability. In most simulations of galaxy evolution, cosmic rays are then assumed to be strongly coupled to the gas; however, when we zoom into the multiphase, frequently under-resolved ISM, we find a cosmic ray "obstacle course" of collisional targets and density inhomogeneities that induce cosmic ray decoupling. So how do cosmic rays navigate and influence such a medium, and can we constrain that transport with observations?

In this talk, I'll present a new set of idealized, high-resolution MHD+CR simulations that probes cosmic ray transport in multiphase gas. I'll discuss how cosmic rays sample the ISM and how they transfer energy and momentum to the gas, taking into account fast cosmic ray transport in partially neutral gas. Our simulations illuminate the important role of cloud interfaces in limiting cosmic ray streaming speeds, thereby generating steep cosmic ray pressure gradients that excite waves in opposition of ion-neutral damping, transfer energy to the thermal gas, and accelerate cold clouds in galactic winds. We also quantify differences in the density-weighted cosmic ray content and resulting gamma-ray emission, with and without taking into account gas ionization effects on cosmic ray transport. While the spatial footprints of gamma-ray emission clearly differ between models, the total gamma-ray luminosity is, interestingly, largely unchanged.

Keywords

Confinement, gamma-rays, galaxy evolution, galactic winds, ion-neutral damping, molecular clouds

Collaboration

other Collaboration

Subcategory

Theoretical Results

Primary author: BUSTARD, Chad (Kavli Institute for Theoretical Physics)

Co-author: Prof. ZWEIBEL, Ellen (University of Wisconsin - Madison)

Presenter: BUSTARD, Chad (Kavli Institute for Theoretical Physics)

Session Classification: Discussion

Track Classification: Scientific Field: CRD | Cosmic Ray Direct