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Transport of spectrally-resolved cosmic-ray protons and electrons in the multiphase interstellar medium

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Modeling cosmic-ray (CR) transport on galactic scale is a challenging task due to the complex physical processes that couple CRs to the thermal gas, which are not yet fully understood. As a result, in most interstellar-medium (ISM) studies involving CRs, the interaction between CRs and their scattering waves, that is unresolved on macroscopic scales, is treated via a constant scattering coefficient, whose value is motivated by observational constraints. To improve upon this approach, we recently developed a physically-motivated prescription for the transport of CRs, in which the scattering coefficient varies with the properties of the ambient gas, with a functional form motivated by the theory of self-confinement. In this talk, I will present our application of this prescription to compute the transport of spectrally-resolved CR protons and electrons with energies between 1 and 100 GeV within the TIGRESS MHD simulations of star-forming galactic disks. I will discuss the evolution of the CR spectral distribution as these particles propagate through the multiphase, magnetized ISM, and compare our simulation results with direct observations in the solar neighborhood, highlighting the remarkable agreement we found.

Primary author: ARMILLOTTA, Lucia (Istituto Nazionale di Astrofisica (INAF))

Presenter: ARMILLOTTA, Lucia (Istituto Nazionale di Astrofisica (INAF))

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