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GALPROP Framework for Galactic Cosmic Ray Propagation and Associated Photon Emissions

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The last decade brought spectacular advances in the astrophysics of cosmic rays (CRs) and gamma-ray astronomy. Improvements in sensitivity of new experiments and other technological breakthroughs allow them to explore unchartered territory, advancing in energy coverage, energy and angular resolutions, and probe subtle signatures of new physics. The accuracy of theoretical models becomes crucial in understanding our Galaxy and beyond, and identifying new phenomena. The state-of-the-art CR propagation code called GALPROP is designed to address exactly this challenge. Having 24 years of development behind it, the GALPROP code has become a de facto standard in astrophysics of CR, diffuse gamma rays, and searches of new physics. The GALPROP code uses information from astronomy, particle, and nuclear physics to predict CRs, gamma rays, synchrotron emission and its polarization in a self-consistent manner –it provides the modeling code unifying the results of individual measurements in physics and astronomy spanning in energy coverage, types of instrumentation, and the nature of detected species. The range of physical validity of the GALPROP code covers sub-keV–PeV energies for particles and from micro-eV–PeV for photons. The GALPROP framework includes the code and independently developed datasets, such as interstellar gas (H2,HI,HII), radiation and magnetic fields distributions as well as the nuclear and particle production cross sections. The code and the datasets are public and are extensively used by many experimental collaborations, and by thousands of individual researchers worldwide for interpretation of their data and for making predictions. We will present latest updates to the GALPROP framework that improve its accuracy and capabilities and will discuss its applications.

Keywords

GALPROP, Cosmic Rays, Gamma rays, diffuse emission, propagation

Collaboration

other Collaboration

Subcategory

Theoretical Results

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