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Testing the consistency of propagation between light and heavy cosmic rays

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Thanks to the precise cosmic ray data measured by recent space experiments, we are able to investigate the cosmic ray acceleration and propagation models more comprehensively and reliably. In this work, we combine the secondary-to-primary ratio and the primary spectra measured by PAMELA, AMS02, ACE-CRIS and Voyager-1 to constrain the cosmic ray source and transport parameters. The study shows that the Z > 2 data yield a high-energy diffusion slope between 0.37 and 0.44. The Z <=2 species obtain a looser constraint on the diffusion slope between 0.34 and 0.44. The best-fit propagation parameters show that the heavy and light cosmic ray species can give compatible results. But disagreements exist between the heavy and light elements at low energies. The B/C ratio yields a much larger diffusion slope variation around 4 GV or a stronger Alfven velocity than the light nuclei. This indicates that the heavy and light particles may suffer different low-energy transport behaviors in Galaxy. However, better understanding on the consistency/inconsistency between the heavy and light relies on more accurate calculations on cross-sections, correlations in data systematic errors and Solar modulation.

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Cosmic rays

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