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Anomalies in Cosmic Ray Composition: Explanation Based on Mass to Charge Ratio ADRIAN HANUSCH, TATIANA LISEYKINA, Rostock University, Germany, MIKHAIL MALKOV, UCSD — Observations of galactic cosmic rays (CR) revealed the lack of our understanding of how CR elements are extracted from the supernova environments to be further accelerated in their shocks. Comparing the spectra of accelerated particles with different mass to charge ratios is a powerful tool for studying the physics of particle injection into the diffusive shock acceleration (DSA). Recent AMS-02 demonstration of the similarity of He/p, C/p and O/p rigidity spectra provide new evidence that injection is a mass-to-charge (A/Z) dependent process. We performed hybrid simulations of collisionless shocks and analyzed a joint injection of p and He^{2+} in conjunction with upstream waves they generate. Our results equally apply to C and O fully ionized ions, since they have similar A/Z values. By convolving the time-dependent injection rates of p and He, obtained from the simulations, with a decreasing shock strength over the active life of SNRs, we generate the integrated SNR spectra for p and He. These spectra are consistent with the AMS-02 and Pamela data and earlier theoretical predictions. Our interpretation of the elemental anomaly is therefore intrinsic to collisionless shock mechanisms and does not require contributions from several different SNRs.

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