Observations of Exceptional Elemental and Isotopic Composition Patterns in ^{3}He-Rich Solar Energetic Particle Events

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Large enhancements of ^{3}He and Fe abundances in impulsive solar energetic particle events are commonly thought to result from resonant heating by plasma waves occurring at the solar flare site. To test and discriminate among models for these processes it would be of great interest to observe additional abundance enhancement patterns which are not simply smooth functions of the particle charge-to-mass ratios. Using three instruments on the Advanced Composition Explorer (ACE) spacecraft we have observed several ^{3}He-rich SEP events in August 2002 that had unusually hard energy spectra. In addition to obtaining spectral measurements over two decades in energy, we also derive elemental abundances of more than 20 elements between C and Ni as well as isotopic composition for 10 of these. Significant abundances of elements heavier than Ni are also observed in some of these events. Our measurements provide, for the first time, a detailed picture of the isotopic as well as the elemental composition in individual ^{3}He-rich events. We find large enhancements of a number of neutron-rich isotopes. For example, ^{22}Ne/^{20}Ne and ^{26}Mg/^{24}Mg are each $>$0.5, significantly in excess of the solar wind values of 0.07 and 0.14, respectively. We report the ACE spectra and composition observations and compare with the elemental composition in ''average'' ^{3}He-rich events as well as in several recently-reported events with unusual enrichment patterns [Mason et al. 2002]. We discuss these new observations in the context of models of particle acceleration in ^{3}He-rich events.

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