How Common are Flare Suprathermals in the Inner Heliosphere?

M. E. Wiedenbeck[1], G. M. Mason[2], E. R. Christian[3], C. M. S. Cohen[4], A. C. Cummings[4], J. R. Dwyer[5], R. E. Gold[6], S. M. Krimigis[6], R. A. Leske[4], R. A. Mewaldt[4], J. E. Mazur[5], P. L. Slocum[5], E. C. Stone[4], T. T. von Rosenvinge[3]

1. Jet Propulsion Laboratory, California Institute of Technology
2. University of Maryland
3. NASA Goddard Space Flight Center
4. California Institute of Technology
5. Florida Institute of Technology
6. Applied Physics Laboratory, Johns Hopkins University
7. Aerospace Corporation

Abstract

Sensitive measurements of the elemental and isotopic composition of solar energetic particles (SEPs) detected near the orbit of Earth have led to the realization that impulsive solar flares must be providing a suprathermal particle population which can efficiently be further accelerated by interplanetary shocks. The isotope ^{3}He, which tends to be strongly enriched in impulsive SEP events, provides a reliable indicator of the presence of this material. Using data collected by the Solar Isotope Spectrometer (SIS) and the Ultra-Low-Energy Isotope Spectrometer (ULEIS) on the Advanced Composition Explorer (ACE) over a period of ~4 years, we have investigated the frequency of occurrence of ^{3}He intensity enhancements over the energy range ~150 keV/nuc to ~15 MeV/nuc. Although there are numerous instances of ^{3}He enhancements which extend over this entire energy range, it is not unusual to find a relatively high intensity of ^{3}He at the lower energies without a significant flux at the higher energies, or vice versa. Some factors which could be contributing to these complicated time and energy dependences include varying spectral forms of the accelerated ^{3}He, velocity dispersion during the transit from the Sun to Earth, and the variation of the magnetic connectivity between the spacecraft and the acceleration site on short time scales. We discuss these patterns and their implications for further interplanetary acceleration of flare suprathermals.

This work was Supported, in part, by NASA under grants NAG5-6912 (Caltech) and PC 251429 (Maryland).