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Measurements of the Elemental Composition and Energy Spectra of Anomalous Cosmic Ray Nuclei by the Solar Isotopic Spectrometer on ACE.

E.R. Christian[1], C.M.S. Cohen[2], A.C. Cummings[2], R.A. Leske[2], R.A. Mewaldt[2], P.L. Slocum[3], L.S. Sollitt[2], E.C. Stone[2], T.T. von Rosenvinge[1], and M.E. Wiedenbeck[2]

[1]*NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA*

[2]*California Institute of Technology, Pasadena, CA 91125, USA*

[3]*Jet Propulsion Laboratory, Pasadena, CA 91109, USA*

Abstract

The Solar Isotope Spectrometer (SIS) instrument on the Advanced Composition Explorer (ACE) spacecraft provides high resolution measurements of the elemental and isotopic compositions of energetic nuclei between approximately 10 and 100 MeV/nucleon from He to Zn (Z = 2 to 30). Solar quiet times from late 1997 to the present will be used to measure the energy spectra of elements previously observed in the anomalous cosmic rays, as well as search for new, rare elements. Relative abundances of the observed species will also be derived and related to the abundances of neutral atoms in the local interstellar medium.

1 Introduction:

Anomalous cosmic rays (ACRs) are believed to be interstellar neutrals (Fisk, Kozlovsky, and Ramaty 1974), which flow into the heliosphere due to the relative motion of the solar system with the very local interstellar gas. In the heliosphere, the neutrals are ionized, either through photoionization from solar UV or charge-exchange with the solar wind, and then are convected out to the solar wind termination shock, where they are accelerated (Pesses, Jokipi, and Eichler 1981).

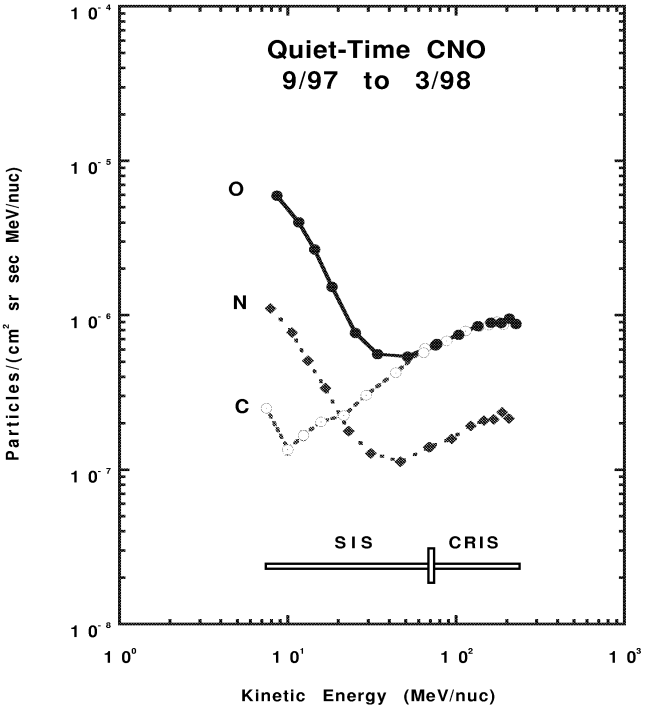

Figure 1: Energy Spectra for C, N, and O.

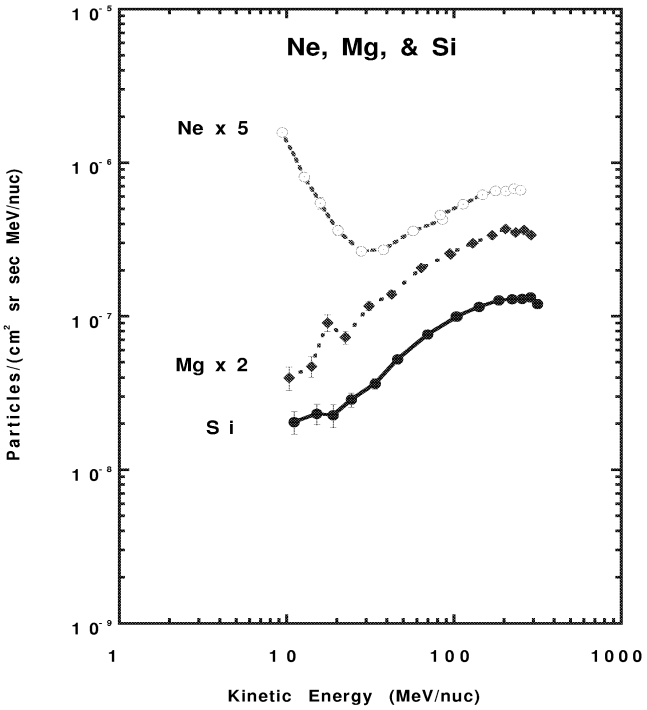

Figure 2: Energy Spectra for Ne, Mg, and Si.

ACR components have been reported for ten elements, H, He, C, N, O, Ne, Si, S, Ar, and Fe (Garcia-Munoz *et al.*, 1973; Hovestadt *et al.*, 1973; McDonald *et al.*, 1974; von Rosenvinge and McDonald, 1975; Cummings and Stone, 1988, 1990, 1997; Christian *et al.*, 1988, 1995; McDonald *et al.*, 1995; Hasebe *et al.*, 1997; Reames, Barbier, and von Rosenvinge, 1997; Takashima *et al.*, 1997).

2 Observations:

Figures 1, 2, and 3 show preliminary energy spectra for C, N, O, Ne, Mg, Si, Ar, and Fe as measured with the SIS and CRIS (Cosmic Ray Isotope Spectrometer) instruments on ACE during the first six months of the ACE mission. The error bars, in most cases, are smaller than the points, showing the excellent statistics that have been obtained with these instruments.

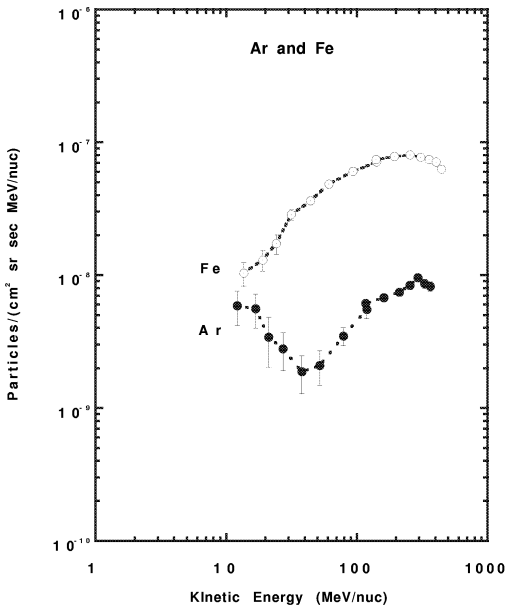

Figure 3: Energy Spectra for Ar, and Fe.

3 Summary:

The three plots shown here are a few of the elements observed by SIS and CRIS on ACE, and only a subset of the data that we have collected to the present. At the ICRC in Salt Lake City, we will present energy spectra for more elements and a longer time integration.

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