HELIOSPHERIC ENERGIZATION OF RARE IONS: ASTROPHYSICAL IMPLICATIONS

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Analysis of intermittent heliospheric observations indicating enhanced abundances of rar isotopes, modified abundance ratios of elements and isotopes, or elements with unusual charge states present challenges with astrophysical connotations. The most spectacular heliospheric enhancement with an anusual abundances involves the ^{3}He isotope and heavy elements (mainly Mg, Ne, Si and Fe) in impulsive solar flares. Primordial nucleosynthesis and galactic evolution confines the coronal ratio of the He isotopes, ^{3}He/^{4}He, to several times 10^{-4}; this ratio is enhanced during impulsive flares by several orders of magnitude due to resonant wave-particle interaction with electromagnetic ion cyclotron waves. Measurements at numerous planetary nebulae indicate low progenitor masses and enhanced abundances of ^{3}He. Solution of this "^{3}He problem" may involve stellar resonant plasma processes which enrich the surrounding nebula with ^{3}He, resolving partly the "astrophysical ^{3}He problem", with important implications for galactic evolution. Ca-Al inclusions (mm textures with Alrich minerals) in carbonaceous chondrite (meteorites) contain a large excess of radiogenic Mg-26 which results from in situ Al-26 decay. Coronal acceleration and heliospheric enrichment of rare elements and isotopes in the solar nebula may help in understanding the puzzles of (a) abundances during the formation of meteorites at the early solar system, and (b) consistency of observation in the late life of hot solar-like stars nebulae.