Nuclei in the Sun

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The Sun comprises 99.8 % of the entire solar system and serves as a model for other stars in the cosmos. In the solar wind, the light (L) isotopes of helium (He), neon (Ne), argon (Ar), krypton (Kr) and xenon (Xe) are enriched relative to heavier (H) ones by a common fractionation factor, f, where log f = 4.56 log (H/L) [1]. Application of this empirical power law to the photosphere indicates that the interior of the Sun consists mostly of iron (Fe), nickel (Ni), oxygen (O), silicon (Si), sulfur (S), magnesium (Mg) and calcium (Ca) - the same seven, even-numbered elements that comprise 99% of ordinary meteorites [2]. Light (L) isotopes of He, Ne, Mg and Ar are less enriched in solar flares, as if these events by-pass some of the nine fractionation stages [3]. The *Wind* spacecraft found that heavy elements are also methodically enriched in impulsive solar flares [4]. In meteorites, primordial He and Ne are trapped with isotopically "strange" Ar, Kr and Xe, and a rare gas component devoid of He and Ne is found from the region where Fe, Ni, S, etc. were made [5]. Other linked elemental and isotopic variations were noted in material that formed meteorites and planets in the solar system [6], as might be expected in the supernova debris that condensed around pulsars [7,8]. These observations suggest that the more stable nuclei may be more abundant in the Sun, although its surface consists mostly of the lighter elements. Systematics of 2850 nuclides indicate that neutron emission from a central neutron star may initiate a series of reactions that produce solar luminosity, the observed neutrino flux, and an outpour of protons in the solar wind [9]. Circularly polarized light from this neutron star may have caused homochirality in the molecules of living creatures [10].

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