ISOTOPE RATIOS IN JUPITER CONFIRM INTRA-SOLAR DIFFUSION. O Manuel, Nuclear Chemistry, University of Missouri, Rolla MO 65401, USA.

In January of this year, Dr. Daniel Goldin ordered the release of mass spectrometer data from the 1995 entry of the Galileo probe into Jupiter [1]. The presence of Xe-X in Jupiter gives an positive answer to the last of three proposed tests for diffusive enrichment of lighter nuclei at the solar surface [2]. Xe-X is the isotopically strange X that has been found to be tightly coupled with primordial He in meteorites [3]. Xe in Jupiter is closer to Xe-X than to solar wind (SW) Xe. The latter is a mass fractionated form of terrestrial Xe (Xe-T) with lighter isotopes selectively enriched by about 4% per amu [4] from diffusive mass fractionation [5].

The first and second proposed tests of intra-solar diffusion were answered affirmatively by a) mass fractionation across SW Mg isotopes that parallel those seen across rare gas isotopes [6], and b) the low flux of solar neutrinos observed with the Kamiokande and the ^{71}Ga detectors [7].

The finding of Xe-X in the He-rich atmosphere of Jupiter has two important implications: (1) The primordial linkage [3] of Xe-X with He spanned planetary distances in the proto-solar nebula, as has also been concluded for the primordial linkage of Xe-T with FeS [8]. (2) The proto-solar nebula was chemically and isotopically heterogeneous, as expected of supernova debris [3]. Thus, Jupiter formed out of material containing Xe-X and much He, while the Sun and the terrestrial planets formed in a central region that included Xe-T and abundant Fe, S.

The presence of mass fractionated Xe-T in the solar wind suggests that the H,He-rich solar surface may conceal an Fe,S-rich interior, much as the red peel of an apple conceals an interior of different color. Although H and He are abundant elements in the photosphere, major elements in the bulk Sun are (in decreasing order): Fe, Ni, O, Si, S, and Mg [2] after correcting for the mass fractionation effects seen across isotopes in the solar wind (see Fig. 1). This shows that the Sun and the four terrestrial planets consist of the same elements.

High energy events, such as flares, disrupt intra-solar diffusion [6]. Hence, solar energetic particles are less enriched in light isotopes than are elements in the quiet solar wind [6]. Since the average weight of particles in the sun is closer to 56 than to 1 amu, the average temperature must be higher to explain the Sun's overall density. Thus, fusion reactions may not be limited to the Sun's inner core. The inverse correlation between the solar neutrino flux and sun spot number [7] suggests that solar flares also disrupt nuclear fusion reactions outside the Sun's core.

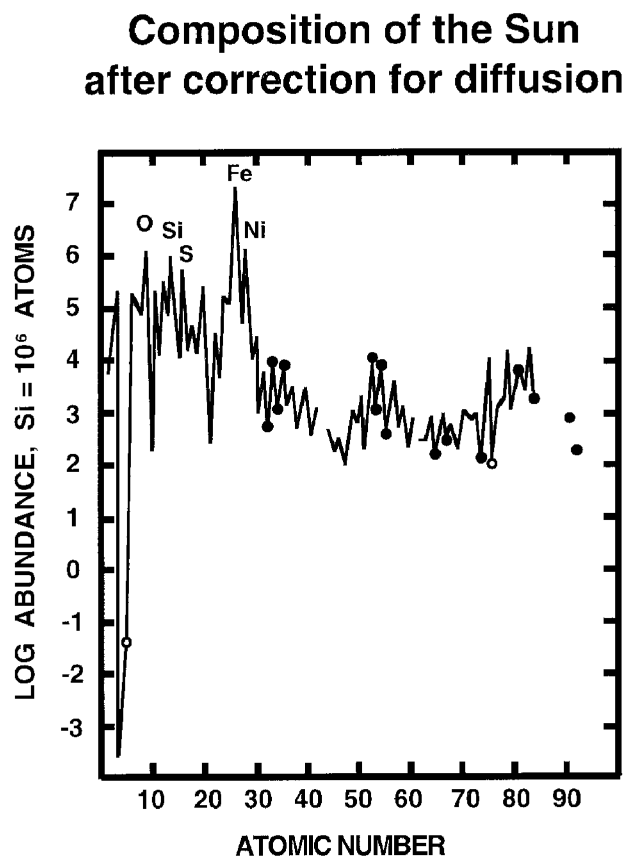

Fig. 1

Acknowledgments: This paper is dedicated to my students and colleagues.

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