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The Standard Solar Model *versus* Experimental Observations

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The standard solar model (ssm) assumes that the Sun formed as a homogeneous body, its interior consists mostly of hydrogen, and its radiant energy comes from H-fusion in its core. Two sets of measurements indicate the ssm is wrong:

1. Analyses of material in the planetary system show that -

   (a) Fe, O, Ni, Si, Mg, S and Ca have high nuclear stability and comprise 98+% of ordinary meteorites that formed at the birth of the solar system;
   (b) the cores of inner planets formed in a central region consisting mostly of heavy elements like Fe, Ni and S;
   (c) the outer planets formed mostly from elements like H, He and C; and
   (d) isotopic heterogeneities accompanied these chemical gradients in debris of the supernova that exploded here 5 billion years ago to produce the solar system (See Origin of the Elements at http://www.umr.edu/~om/).

2. Analyses of material coming from the Sun show that -

   (a) there are not enough neutrinos for H-fusion to be its main source of energy;
   (b) light-weight isotopes (mass =L) of He, Ne, Ar, Kr and Xe in the solar wind are enriched relative to heavy isotopes (mass = H) by a factor, f, where

$$\log f = 4.56 \log [H/L] \qquad \text{Eq. (1)};$$

   (c) solar flares by-pass 3.4 of these 9-stages of diffusion and deplete the light-weight isotopes of He, Ne, Mg and Ar by a factor, f*, where

$$\log f^* = -1.7 \log [H/L] \qquad \text{Eq. (2)};$$

   (d) proton-capture on N-14 increased N-15 in the solar wind over geologic time; and
   (e) solar flares dredge up nitrogen with less N-15 from this H-fusion reaction.

Each observation above is unexplained by ssm. After correcting photospheric abundances for diffusion [Observation 2(b)], the most abundant elements in the bulk sun are Fe, Ni, O, Si, S, Mg and Ca, the same elements that comprise ordinary meteorites [Observation 1(a)]. The probability that Eq. (1) would randomly select these elements from the photosphere, i.e., the likelihood for a meaningless agreement between observations 2(b) and 1(a), is < 2.0E(-33).

Thus, ssm does not describe the Sun. Other stars are too distant for measurements to determine their origin/evolution.

Kluwer Academic/Plenum will publish observations summarized here in Proceedings of the 1999 ACS Symposium on the Origin of Elements in the Solar System, organized by Glenn T. Seaborg and Oliver K. Manuel.

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