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Helium, Neon, and Argon in Solar Wind Regimes Collected by the Genesis Mission: A first Attempt to Reveal Solar Abundances of Noble Gases

V. S. Heber (1), H. Baur (1), D. S. Burnett (2), D. B. Reisenfeld (3), R. Wieler(1), and R. C. Wiens (4).

(1) Isotope Geology and Mineral Resources, ETH Zürich, Switzerland, (2) CalTech, JPL, Pasadena, USA, (3) Physics and Astronomy, University of Montana, Missoula, USA, (4) LANL, Space & Atmospheric Science, Los Alamos, USA.

(heber@erdw.ethz.ch / 0041 44 6326423)

NASA's Genesis mission collected solar wind in space for two years and returned samples for analyses on Earth. A major objective of Genesis was to determine solar abundances of ultra-volatile elements, especially noble gases. The term "solar abundances" corresponds to photospheric abundances, since the photosphere is considered to be primitive, i.e. with exception of some gravitational settling, no fractionation processes are expected to have taken place, and its composition is assumed to represent solar nebula composition. Volatile elements are depleted in carbonaceous chondrites, otherwise the most primitive accessible material representing solar nebula composition. Noble gases in particular show no lines in the photospheric spectrum.

Recently, photospheric abundances were considerably reduced for elements such as O, C, N and Ne [1]. Although noble gases are not detectable in the photospheric spectrum they are an integral part of most solar abundance compilations [1-3]. Generally Ne and Ar are derived from coronal sources as active regions and in the quiet corona by UV- and X-ray spectroscopy, solar wind, and solar energetic particles. [1] determined their abundances relative to oxygen. Thus the new photospheric oxygen abundances directly affected Ne and Ar abundances. These new, low heavy-element abundances disagree with helioseismological determination of solar properties. Thus, especially

the revised solar Ne abundance led to considerable controversy [4-6].

The main objective of this work is to derive solar abundances for Ne and Ar independently, using the solar wind composition of different solar wind regimes collected by the Genesis mission. The Genesis spacecraft collected SW from three main regimes separately: Fast solar wind emanating from coronal holes (CH), the slow, interstream solar wind (IS) and solar wind from coronal mass ejection (CME) events. Additionally, two collector arrays continuously sampled bulk solar wind. Helium, Ne and Ar were analyzed in Diamond-like carbon on Silicon targets. Gases were released by UV laser ablation. Experimental details and the elemental and isotopic compositions of He, Ne and Ar are given in [7].

We will examine potential fractionation processes between photosphere and solar wind and their influence on composition. Also, we will discuss advantages and possible drawbacks of the different methods applied to determine solar abundances. Our data will be compared to solar abundances obtained by other means. Another objective of this work is to emphasise the large influence of the revised solar Ar abundances [1] on the solar Ar/Kr and Ar/Xe abundance ratios as well as on assumptions placed on fractionation processes in the solar wind revealed previously from solar wind implanted in lunar soils [8].

[1] Asplund M., et al. (2005) Cosmic Abundances as Records of Stellar Evolution and Nucleosynthesis ASP 336, 25-38; [2] Anders E., Grevesse N. (1989) Geochim. Cosmochim. Acta 53, 197-214; [3] Lodders K. (2003) ApJ 591, 1220-1247; [4] Bahcall J.N., et al. (2005) ApJ 631, 1281-1285; [5] Bochsler P. (2007) Astronomy & Astrophysics 471, 315-319; [6] Drake J.J., Testa P. (2005) Nature 436, 525-528; [7] Heber V.S., et al. (2008) LPSC 39th CD#1779; [8] Wieler R., Baur H. (1995) ApJ 453, 987-997.