ARGON, KRYPTON, AND XENON ABUNDANCES IN THE SOLAR WIND MEASURED IN SILICON FROM THE GENESIS MISSION.

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Introduction. Up to now solar wind (SW) abundances of Kr and Xe have been exclusively determined using SW irradiated regolith [1]. Hence, one of Genesis' major objectives is to obtain the heavy noble gas composition of the present-day SW using artificial targets exposed to the SW for 2.5 years. SW abundances will allow to study fractionation processes upon SW formation, e.g. due to the first ionization potential (FIP-effect) [2]. This is of importance to deduce solar abundances of noble gases and other elements from SW data. Solar, i.e. photospheric, abundances of noble gases are indirectly determined due to the lack of suitable lines in the spectrum. Recently, solar abundance estimates for Ne and Ar were strongly reduced whereas Kr and Xe changed only slightly [3]. This led to a dramatic decrease of the solar Ar/Kr ratio by a factor of ~3 from the earlier value [4] of 2140. If true, this change would invalidate theories of heavy noble gas fractionation in the SW identified with regolith data [1, 5]. The Kr and Xe composition in present-day SW will enable us to reassess solar abundances and fractionation theories. Thus, we concentrate here on abundances of Ar, Kr and Xe in the bulk SW.

Experimental: Kr and Xe are rare in the SW, expected abundances are 7×10^{-13} ccSTP/cm^2 ^{84}Kr and 9×10^{-14} ccSTP/cm^2 ^{132}Xe. Their analysis is further challenged by a possible surface contamination due to atmospheric gases. Additionally, many targets contain traces of indigenous atmospheric gases. To monitor potential atmospheric contamination, two major isotopes ^{84,86}Kr and ^{129,132}Xe will be analyzed with different abundances in the atmosphere and SW. Analyses will be carried out using CZ Si (Czochralski-pulled Si), considered to be one of the purest target materials flown on Genesis. Noble gases will be extracted from ~1cm^2 by UV laser ablation (213nm). A beam size of 200µm, the maximum repetition rate of 20Hz and a raster speed of 1mm/s will allow a complete extraction of solar wind particles from this large area within ~40min. Extraction line and mass spectrometer blanks are 8×10^{-16} ccSTP ^{84}Kr and 6×10^{-16} ccSTP ^{132}Xe, thus contributing only 0.1% and 0.6% to expected Kr and Xe amounts, respectively. More crucial is, however, the material blank. One first CZ Si measurement resulted in 1.13×10^{-14} ccSTP ^{132}Xe/cm^2 [6], corresponding to ~11% blank contribution to expected SW Xe. This value, however, may be an overestimate due to suboptimal experimental conditions [S.A. Crowter, pers. comm. 2008]. Daily mass spectrometer performance is controlled by a highly diluted (10^{-13}-10^{-12} ccSTP) Kr, Xe calibration to keep the Kr and Xe memory in the mass spectrometer low. Sensitivity for Kr and Xe is $1\times10^{+15}$ and $1.3\times10^{+15}$ counts/ccSTP, respectively.

At the conference we will present the Ar/Kr and Kr/Xe composition of the bulk solar wind.

References: [1] Wieler R., Baur H. (1995) ApJ 453, 987;[2] von Steiger R., et al. (2000) JGR. 105, 27217;[3] Asplund M., et al. (2005) ASP 336, 25;[4] Anders E., Grevesse N. (1989) GCA 53, 197;[5] Heber V.S., et al. (2001) AIP,598, Bern, Switzerland, 387;[6] Crowter S.A., et al. (2008) LPSC 39th #1762.