XENON ISOTOPES IN SOLAR WIND, COMET 67P/C-G, AND JUPITER: A STEP TOWARD THE UNDESTANDING OF THEIR RELATIONSHIP.

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Introduction: Xenon composition in contemporary Solar wind is now known with high precision [1] and can be compared with Xe isotopic composition in the Solar System planets, satellites and their atmospheres. Comparison of Solar wind Xe captured by Genesis mission and Xe in lunar soils brought by Apollo missions is under way [2]. Here we consider Xe compositions obtained by the Galileo probe that entered Jupiter's atmosphere in 1996 [3] and by Rosetta spacecraft that studied the 67P/C-G in 2016 comet [4]. Both measurements were performed without separation of Xe from major gases. Having isotopic composition of Xe measured remotely in the distant objects by onboard instruments is an incredible achievement; these analyses would be extremely challenging even in the ground-based laboratories.

Interpretation of Galileo and Rosetta Xe analyses are not straightforward because of the large statistical uncertainties and model-dependent estimation of systematical errors. This interpretation also depends on the choice of the normalizing isotope, typically the most abundant ^{132}Xe. Here we re-normalized Xe composition to fission free ^{130}Xe. This re-normalization evidently further increases the uncertainties on the isotopic ratios and effectively shifts isotopic compositions along the vertical axis (Fig. 1):

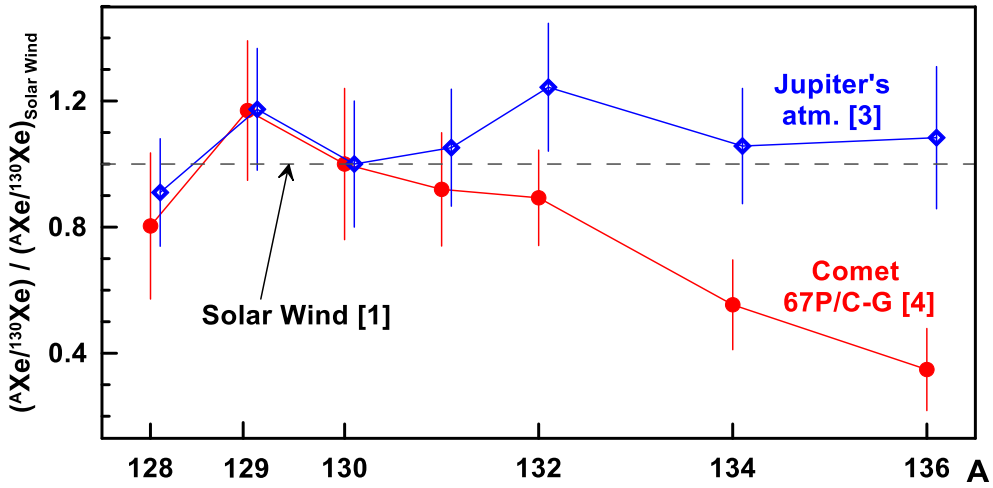

Figure 1. Xe composition measured by Galileo and Rosetta missions relative to Solar wind captured by Genesis. Normalized to ^{130}Xe. Errors propagated in the manner similar to [5].

Results. When normalized to ^{130}Xe:

(1) Cometary and Jovian ^{128}Xe/^{129}Xe and ^{129}Xe/^{130}Xe ratios are nearly identical supporting the validity of ^{128}Xe correction for unresolvable $^{32}S_4$ cometary interference in ROSINA instrument;

(2) Jupiter's atmospheric Xe does not resemble the hypothetical primordial U-Xe component [6], as it was suggested by [3]. Within experimental uncertainties the Jovian atmospheric Xe is close to Solar wind Xe and does not exhibit a "Strange Xenon" as proposed by [7].

(3) 67P/C-G cometary gases are evidently depleted in fission Xe isotopes. However, large uncertainties do not allow to unambiguously attributing this to the ^{244}Pu-fission (most likely progenitor) contribution to the Solar wind and Jupiter's Xe composition.

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References: [1] A. Meshik, O. Pravdivtseva, and D. Burnett (2020) *Geochimica et Cosmochimica Acta* 276:289–298. [2] A. Meshik, O. Pravdivtseva, and B. F. Rauch (2020) *LPS LII* Abstract # 2548. [3] P. R. Mahaffy et al. (2000) *Journal of Geophysical Research E* 105:15061–15071. [4] B. Marty et al. (2017) *Science* 356:1069–1072. [5] R. Wieler (2002) Noble gases in the Solar System, in: *Noble Gases in Geochemistry and Cosmochemistry*. Vol. 47, ISN 0-939950-59-6: 21–70. [6] R. O. Pepin (2000) Space Science Review 92:371–395. [7] O. Manuel et al. (1998) *Journal of Radioanalytical and Nuclear Chemistry* 238:119–121.