# Determining the absolute abundance of atmospheric $^{81}$Kr

J. C. ZAPPALA[1]*, D. BAGGENSTOS[2], M. BISHOF[1], C. GERBER[2], W. JIANG[3], B. M. KENNEDY[4], Z.-T. LU[3], P. MUELLER[1], R. PURTSCHERT[2], A. VISSER[5]

[1]Physics Division, Argonne National Laboratory, Argonne, IL 60439, USA (*correspondence: jzappala@anl.gov)
[2]Climate and Environmental Physics, Physics Institute and Oeschger Centre for Climate Change Research, University of Bern, 3012 Bern, Switzerland
[3]University of Science and Technology of China, Hefei, Anhui 230026, China
[4]Earth Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA
[5]Nuclear and Chemical Sciences Division, Lawrence Livermore National Laboratory, Livermore, CA 94550, USA

$^{81}$Kr (half-life = 229 ± 11 kyr) is a radioisotope of cosmogenic origin residing in the atmosphere. Its absolute abundance records the galactic component of cosmic-ray flux entering the earth's atmosphere on the timescale of $10^5$ years in a complimentary manner to other long-lived cosmogenic nuclides (e.g. $^{10}$Be and $^{36}$Cl). However, the three low-level counting measurements conducted to determine the absolute abundance of $^{81}$Kr/Kr in the atmosphere vary by over a factor of two [1-3], ranging from 3.0 to 6.6 × $10^{-13}$. Furthermore, the single accelerator mass spectrometry measurement of $^{81}$Kr/Kr in the atmosphere has large statistical (20%) and unknown systematic uncertainties [4].

We report on progress towards a new measurement of $^{81}$Kr/Kr in the atmosphere using a new methodology. We have conducted mass spectrometry (MS) on a krypton gas sample enriched in $^{81}$Kr/Kr to the part-per-million level, and then precisely diluted that sample to the part-per-trillion level. We then conducted a relative abundance measurement of the diluted sample using Atom Trap Trace Analysis (ATTA) [5], a technique now routinely used for radiokrypton analysis of air, water, and ice samples. The MS and ATTA measurements will provide an absolute calibration for the ATTA system, and thus determine the absolute abundance of $^{81}$Kr/Kr in the atmosphere at the ~5% uncertainty level.

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