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Atom Trap Trace Analysis

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Since the invention of radiocarbon dating in 1949, trace analyses of long-lived cosmogenic isotopes have contributed to a wide range of scientific and technological areas. We have developed an analytical method called Atom Trap Trace Analysis (ATTA), in which individual atoms of the desired isotope are selectively captured and detected with a magneto-optical trap. ATTA possesses a superior selectivity and is used to analyze environmental radio-isotopes: ^{81}Kr, ^{85}Kr, and ^{39}Ar. These three isotopes have extremely low isotopic abundances in the range of $10^{-16} - 10^{-11}$, and cover a wide range of ages and applications. This work is supported by DOE, Office of Nuclear Physics, and by NSF, Division of Earth Sciences.