# A RE-INVESTIGATION OF $^{41}$K-K COSMIC RAY EXPOSURE AGES FOR IRON METEORITES

H. Khan[1] and I. Leya[2], [1]University of Bern, Physics Institute, Space Research and Planetary Sciences, Sidlerstrasse 5, 3012 Bern, Switzerland, [2]University of Bern, Physics Institute, Space Research and Planetary Sciences, Sidlerstrasse 5, 3012 Bern, Switzerland.

**Introduction:** In studies of constancy of galactic cosmic rays the cosmic ray exposure (CRE) ages calculated via $^{10}$Be-$^{21}$Ne, $^{26}$Al-$^{21}$Ne, and/or $^{36}$Cl-$^{36}$Ar have often been compared to so-called $^{41}$K-K cosmic ray exposure ages that have been measured earlier by H. Voshage [1,2]. Such comparisons often indicate that the $^{36}$Cl-36Ar CRE ages are on average 30% lower than $^{41}$K-K CRE ages. Such a massive change could have some consequences not only for meteorite CRE ages, but they would also impact studies of the dynamics of small bodies in the solar system; it even might also influence Earth climate [1]. While the $^{40}$K-K ages are often used for such studies, they come with their own complications. For example, the production of $^{39}$K, $^{40}$K, and $^{41}$K in iron meteorites is far from understood and is expected to depend on radius and shielding. In the original study this size and shielding dependence has been empirically corrected using relationships between $^{39}$K/$^{41}$Kr and $^{4}$He/$^{21}$Ne [2]. However, the established relationship is most likely compromised by too high and extremely variable cosmogenic $^{21}$Ne concentrations caused by contributions from the common trace elements sulphur and phosphorous [3]. This effect has never been fully considered for the calculations of $^{41}$K-K CRE ages. Moreover it is also important to state that not only the database for these CRE ages only cover meteorites before 1984, but also there has been no new data produced for more than 30 years; whereas there are hundreds of meteorites waiting to be dated.

We have started re-studying $^{41}$K-K CRE ages for iron meteorites. For the extraction of extremely low amounts of potassium, which is in the range of 10-13 ng/g, we plan two different, but complementary extraction procedures. First, we developed a system for in vacuum melting and electric extraction of potassium from the iron meteorite. Thus, the system is very similar to the extraction device originally used by H. Voshage. Briefly the iron meteorite samples are molten in a hot crucible and the potassium is electrically extracted with a strong electric field and is collected onto a filament. Second, we plan for chemical extraction if the blanks can be kept low enough. Considering the isotope ratio measurements, we also plan two different approaches; first measurements on a thermal ionization mass spectrometer (TIMS). First test were very successful and we managed to measure $^{40}$K/$^{41}$K ratios in 100 ng of potassium with a precision of 6 ng/ml. Current tests with even lower potassium amounts down to 1 ng are underway. Secondly, we plan to measure potassium isotopes using the ionprobe 1280HR.This data is not only vital to answer whether or not the fluence of galactic cosmic rays (GCR) was constant over long time periods, but also is needed by both the planetary sciences and astrophysics community.

**References**

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