# The ATTA-USTC instrument for radio-Kr dating

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**Abstract**

An atom counter based on laser cooling and cold atom trap trace analysis (ATTA) is built in University of Science and Technology of China (USTC, Hefei). The instrument is devoted to measure the trace radioactive krypton atoms ($^{85}$Kr and $^{81}$Kr) in environmental samples. Rare krypton atoms are counted one-by-one with a sensitive camera imagining the fluorescence of single atom. Using a "quench-and-load" method, the capture rate of the stable $^{83}$Kr isotope is measured used to calibrate the counting rate of the rare isotopes. The calibration method has been verified by measuring the $^{85}$Kr/$^{83}$Kr ratios of different samples at different experimental conditions. As shown in Fig.1(a), the $^{85}$Kr/$^{83}$Kr ratio can be determined with an uncertainty less than 5%. The $^{85}$Kr concentrations of four different samples have been measured both by ATTA in USTC and decay count method in University of Bern. The results are shown in Fig.1(b) and the deviation to a linear fit of the results is below 5% (Fig.1(c)). In the ATTA measurements, each used sample size is 8uL (stp). The instrument is ready for routine analysis of the trace radio-Kr, which can be widely applied in earth sciences including ground water dating.

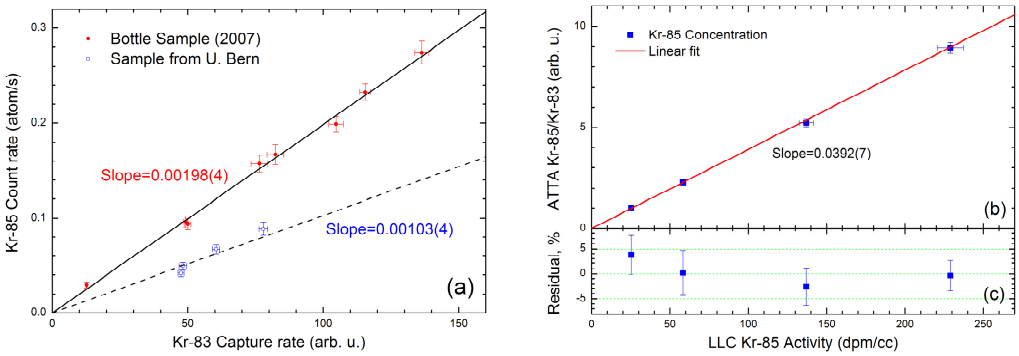


Fig.1 Kr-85 concentration determined by ATTA-USTC. (a) $^{85}$Kr count rates and the corresponding $^{83}$Kr capture rates measured for two different samples. (b) $^{85}$Kr/$^{83}$Kr measured by ATTA compared with that given by decay count (LLC, U. Bern). (c) Relative residuals of the linear fit shown in (b).