Argonne NATIONAL LABORATORY

PHY Seminar

## Physics Division Seminar


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# Investigating Underground Production of $^{81}Kr$ and its Impact on Radiokrypton Dating

**Host: Paul Reimer**

**Monday, January 22, 2018 – 203, R150, 3:30 PM**


The development of Atom Trap Trace Analysis (ATTA), an efficient and selective laser-based atom counting technique, has recently provided regular and efficient radiokrypton ($^{81}Kr$ and $^{85}Kr$) dating to the earth science community. $^{81}Kr$ (half-life = 230,000 yr) is an ideal tracer for old water and ice with mean residence times of $10^5$-$10^6$ years, a range beyond the reach of $^{14}C$ dating. $^{85}Kr$ (half-life = 10.7 yr) is an increasingly important tracer for young groundwater in the age range of 5-50 years. As radiokrypton dating has become more precise and widespread, there is a greater need to study the potential anthropogenic and natural sources of contamination that affect the method. Our recent experiments have demonstrated that anthropogenic sources of contamination do not impact radiokrypton dating using $^{81}Kr$ when measuring abundances at the 2.5% level (90%C.L.). However, several groundwater measurements have shown anomalously high $^{81}Kr$ abundances (up to 5 times atmospheric abundance) believed to be due to natural radioactive production. These measurements are found to be at odds with theoretical estimates for subsurface production rates of $^{81}Kr$. We will report on the status of this conflict and present a plan for experimentally determining the $^{81}Kr$ spontaneous fission yield from natural uranium sources using ATTA in order to resolve said conflict. An absolute calibration of the ATTA method for $^{81}Kr$, a necessary tool for this determination, will also be discussed.