Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Uranium doped LiSAF as a precursor for a ^{229}Th nuclear clock experiment EDMUND MEYER, MARKUS HEHLEN, BEAU BARKER, LEE COLLINS, XINXIN ZHAO, Los Alamos National Lab — We experimentally and numerically study the simple idea of growing ^{233}U doped LiSAF crystals. The micro-pulling-down technique is used to grow U:LiSAF single crystals with a high number density of U ions. The crystals are in the shape of rods that are geometrically well matched for imaging onto the spectrophotometer input slit. Growth is performed in an RF-heated chamber under argon inert atmosphere at elevated pressure. This reduces the evaporation of LiF and AlF3 from the melt and crystal surface during growth which otherwise tends to degrade the crystal quality. Through physical arguments and robust numerical calculation we determine the oxidation state of the U ion to likely be trivalent and occupying the Sr site. Charge compensation is numerically studied through F interstitials and Li vacancies. We determine the energetically most favorable state for U:LiSAF and investigate the effects upon α-decay of ^{233}U to ^{229}Th, which $\approx$2% of the time is in the excited isomeric state. Additional charge compensation mechanisms are needed to accommodate the Th^{4+} ground oxidation state and we investigate F interstitial as well as Li vacancy. The band structure is calculated and analyzed for select cases.

Edmund Meyer
Los Alamos National Lab

Date submitted: 30 Mar 2016 Electronic form version 1.4