## 2014 NIST Precision Measurement Grants

Eric Hudson, University of California, Los Angeles

Precision measurement of the optical transition in the $^{229}$Th nucleus

This project will contribute to a worldwide effort to determine the transition energy of the optical isomeric nuclear transition in the A = 229 isotope of thorium. If found, this transition is expected to enable a host of important precision measurements, including a definitive test of astrophysical claims that the fine-structure constant is varying in time. It is also expected that this transition could be used construct an optical frequency standard with a fractional uncertainty of $10^{-19}$, outperforming current optical clocks.

William Snow, Indiana University, Bloomington, IN

Absolute Neutron Measurements for the NIST Penning Trap Neutron Lifetime

This project is expected to lead to a precise value of the neutron lifetime. This is important to test weak interaction theory and to enable Big Bang Nucleosynthesis (BBN) to predict the primordial $^4$He abundance of the universe. Recent measurements of the neutron lifetime using ultracold neutrons stored in material traps are now understood to possess serious systematic errors. It is proprosed to measure the absolute neutron fluence needed to calibrate a detector for a neutron lifetime experiment using a Penning trap in a slow neutron beam at the NIST Center for Neutron Research. This experiment has been endorsed in a recent review of the fundamental neutron physics field.