Contribution ID: **71** Type: **Oral Presentation**

# Wider in spectral range, narrower in line width – upgrades of the RILIS titanium:sapphire lasers for in-source spectroscopy

*Friday, 15 May 2015 12:20 (20 minutes)*

High purity ion beams are of utmost importance for most experiments on exotic isotopes at state-of-the-art radioactive ion beam facilities. Resonant multi-step laser ionization in RILIS laser ion sources, including the LIST approach, is the appropriate technology for their creation. It provides the unique combination of highest efficiency and elemental selectivity together with lowest background and cross contaminations in the beam. Today the long-standing competition between dye laser and solid-state laser technology about optimum RILIS suitability has been reconciled by the demonstration of outstanding advantages of combined operation of both lasers systems at ISOLDE´s RILIS.
Mainz University serves as off-line development and test facility for titanium:sapphire lasers, laser excitation schemes and new ion source geometries. Steadily on-going developments include further optimizations of the lasers and the ion sources units. New excitation schemes for quite a number of elements along the Periodic Table were investigated, which include Pd as well as different rare earth elements, i.e. Pr, Tb, Dy, Ho and Er. For measurements at the gas cell facilities at LLN and Jyvaeskylae the studies were extended to the actinides Ac, Th, Pa, U, Np and Pu.
For the study of the alkaline elements, tunable laser emission in the green to yellow spectral range of 500 - 680 nm is required, easily achieved by conventional dye lasers but a particular challenge for state-of-the-art solid-state Titanium:sapphire lasers. These wavelengths were obtained successfully in a non-linear crystal by difference-frequency generation of the radiation of two lasers, one operating in the fundamental infrared range, and one in the frequency doubled blue range. Performance was demonstrated by two- and three-step resonance ionization spectroscopy of atomic Rydberg levels of sodium involving the famous ground state dublett at 589 nm.
For high resolution in-source as well as in-jet laser spectroscopy at on-line facilities the narrowing of the laser band width is of primary relevance. Two complementary techniques are presently investigated, involving ring resonator designs: passive frequency band width reduction using two etalons complements the more extensive process of injection locking by a tunable continuous wave laser. Both approaches, which require advanced stabilization techniques, have been demonstrated by high resolution hyperfine structure investigations in Tc, Ac and Th.

**Primary author:** Prof. WENDT, Klaus (Institute of Physics, University of Mainz)

**Co-authors:** Mr SCHNEIDER, Fabian (Institute of Nuclear Chemistry, University of Mainz); Mrs MARIN SAEZ, Julia (Institute of Physics, University of Mainz); Mr NAUBEREIT, Pascal (Institute of Physics, University of Mainz); HEINKE, Reinhard (Institute of Physics, University of Mainz); Dr RAEDER, Sebastian (KU Leuven); Dr ROTHE, Sebastian (CERN, Geneva, Switzerland); Mr KRON, Tobias (Institute of Physics, University of Mainz)

**Presenter:** Prof. WENDT, Klaus (Institute of Physics, University of Mainz)

**Session Classification:** Session 17