773rd ASRC Seminar

Date: 12月10日(火) 13:30 ～

Location: Meeting Room 302, ASRC bldg.
先端基礎研究交流棟 第二会議室 (302号室)

Speaker: Dr. Sebastian Raeder (独GSI)

Title: Shedding light on heavy actinides
(recent activities in laser spectroscopy
at the upper end of the nuclear chart)

要旨: Laser spectroscopy probing the atomic level structure allows for a precise determination of atomic properties and in turn also of the chemical behavior of an element, which for such heavy systems is strongly influenced by electron-electron correlations and relativistic effects. This technique furthermore allows extracting properties of the center nucleus by measuring subtle changes in atomic level energies for different isotopes of the same element. Due to their limited availability the atomic structure of the heavy actinides is only scarcely investigated.

Actinide elements up to fermium are produced in nuclear reactors in minute quantities. Here a sample containing Fm-257 and Es-253-255 became available from the Cf-252 production cycle in Oakridge and was provided by Florida state university. Using an efficient off-line mass separator at Mainz University laser spectroscopy on these elements was recently performed, which allowed refining the atomic structure information of einsteinium and providing first laser spectroscopy of Fm-257. Elements above fermium (Z=100), in contrast, are only accessible through fusion-evaporation reactions at minute quantities and at high energies. These conditions challenge any laser spectroscopy and demand sensitive detection techniques. In a pioneering experiment we identified for the first time optical transitions in nobelium (Z=102) employing the RAdiation Detected Resonance Ionization Spectroscopy (RADRIS) technique. The observed atomic transitions in nobelium were characterized in detail which resulted, e.g., in an accurate determination of the first ionization potential of nobelium. Detailed spectroscopy of the atomic $^{1}S_0 \rightarrow {}^{1}P_1$ ground state transition in the isotopes $^{252\text{-}254}$No revealed hyperfine splittings in ^{253,255}No and gave access nuclear moments and the changes of the charge radii. The present status of laser spectroscopic studies for the heaviest elements will be discussed and perspectives for further laser spectroscopic studies will be discussed.

＜Contact＞
佐藤哲也 (81-5795)
Advanced Science Research Center