HK 52: Kernphysik / Spektroskopie

Zeit: Donnerstag 17:00–18:30 Raum: B

HK 52.1 Do 17:00 B

Lifetime measurements in ^{168,170}Hf — •Alin Costin[1,2,3], Tan Ahn[1,2,3], Blagovest Bochev[2], Kevin Dusling[2], Tak Chu Li[2], Norbert Pietralla[1,2,3], Georgi Rainovski[2,4], Wolfram Rother[3], and Yale Plunger Group[5] — [1]IKP, TU Darmstadt — [2]NSL, SUNY, Stony Brook, USA — [3]IKP, Universität zu Köln — [4]University of Sofia, Sofia, Bulgaria — [5]WNSL, Yale University, New Haven, USA

Lifetime measurements were performed on ground state band levels of ^{168,170}Hf for testing relevant nuclear structure models. Geometrical models with a soft potential in the quadrupole deformation parameter β, such as the confined β-soft (CBS) rotor model [1], predict centrifugal stretching along a rotational band as a function of spin. This causes an increase of a few percent per $\hbar$ in transitional quadrupole moments Q_t in strongly deformed nuclei ($R_{4/2} \gtrsim 3.0$). The change in Q_t values of more rigidly deformed nuclei is predicted to be considerably smaller. Previous lifetime measurements [2] on ^{168,170}Hf are not accurate enough for testing these predictions. The new measurements are sufficiently precise and clearly show centrifugal stretching.

[1] N. Pietralla and O. M. Gorbachenko, Phys. Rev. C **70**, 011304(R) (2004).
[2] B. Bochev *et al.*, Nucl. Phys. A **282**, 159 (1977).

HK 52.2 Do 17:15 B

γ-Spektroskopie an Aktiniden mit MINIBALL — •Tanja Kotthaus[1], Peter Reiter[1], Peter Thirolf[2], Tom Morgan[2], Andrey Blazhev[1], Bart Bruyneel[1], Lorant Csige[2], Herbert Hess[1], Astrid Holler[1], Marijke Kalkühler[1], Michael Seidlitz[1], Wolfgang Schwertfeger[2], Andreas Wiens[1] und Hans-Jörg Maier[2] — [1]IKP, Köln — [2]LMU, München

Mittels verschiedener direkter Reaktionen mit Deuteronen- und ^{3}He-Strahl an ^{235}U- und ^{231}Pa-Targets wurden am Kölner Tandembeschleuniger angeregte Zustände in ^{232,234,236}U und ^{230,232}Pa populiert. Die einzelnen Reaktionskanäle wurden über den Nachweis des leichten Reaktionspartners in einem Si-Teleskop separiert. Die auftretende γ-Strahlung wurde mit dem hocheffizienten MINIBALL-Spektrometer gemessen. Mit den neuen $\gamma\gamma$-Koinzidenzdaten wurden die Termschemata der untersuchten U-Kerne erweitert und erstmals Zerfälle von angeregten Zuständen in ^{230,232}Pa untersucht. Die Ergebnisse sind u. a. im Vergleich mit kürzlich veröffentlichen Rechnungen zu Kernen in dieser Massengegend im Rahmen eines Cluster-Modells [1] interessant.

[1] Shneidman et.al, Physical Review C 74, 034316 (2006)

HK 52.3 Do 17:30 B

High-Resolution γ spectroscopy of the Odd-N Fission Isomer ^{237f}Pu* — •T. Morgan[1], A. Blazhev[2], B. Bruyneel[2], L. Csige[1], D. Habs[1], T. Kotthaus[2], H.J. Maier[1], P. Reiter[2], C. Schürmann[1], W. Schwerdtfeger[1], P.G. Thirolf[1], N. Warr[2], K. Wimmer[1], and MINIBALL Collaboration[1,2] — [1]LMU und Maier-Leibnitz Laboratorium München — [2]IKP Universität zu Köln

While so far spectroscopic studies of fission isomers concentrated on even-even nuclei, high-resolution γ spectroscopy of odd-N fission isomers may allow to identify Nilsson orbitals in heavy actinide nuclei. As the first case ever studied for odd-N nuclei, the fission isomer in ^{237}Pu ($t_{1/2}$ = 110ns/1.1 μs) was investigated using the ^{235}U(α,2n) reaction with a pulsed α beam (E_α =24 MeV, pulse distance 400 ns) from the Cologne Tandem accelerator. A self-supporting thick metallic ^{235}U target (3.7 mg/cm^2) was used, where the ^{237}Pu reaction products were stopped and fission products were emitted in opposite directions. The rare γ-rays from the second potential well in delayed coincidence with fission products were measured with the MINIBALL spectrometer. Due to the small population cross section of about 2 μb a large solid angle coverage both for the γ-rays as well as for the fission fragments was required. A very compact 4π parallel plate detector array (diameter ca. 15 cm) was used for the fission fragment detection, allowing for a discrimination between the dominant prompt fission products and the rare isomeric fission events. Results, such as the identification of rotational bands, isomeric lifetimes and angular distributions etc., will be presented. *Supported by DFG under contract no. HA1101/12-1

HK 52.4 Do 17:45 B

Doubly Magic Nucleus $^{270}_{108}$Hs$_{102}$ — •Jan Dvorak[1], Willy Brüchle[2], Christoph Düllmann[2], Reiner Krücken[1], Matthias Schädel[2], Andreas Türler[1], and Alexander Yakushev[1] — [1]Technische Universität München, D-85748 Garching, Germany — [2]Gesellschaft für Schwerionenforschung mbH, D-64291 Darmstadt, Germany

Investigating short-lived nuclei using rapid chemical separation and subsequent on-line detection methods provides an independent and alternative means to electromagnetic on-line separators. The predicted enhanced stability around ^{270}Hs has mayor importance for the experimental investigation of super heavy elements by chemical means. Chemical separation of Hs in the form of HsO_4 provides an excellent tool to study the formation reactions and nuclear structure of nuclei close to the deformed nuclear shells at Z=108 and N=162 due to a high overall efficiency and a very high purification factor.

Here we report on results of a recent Hs chemistry experiments performed at GSI Darmstadt. Element 108, hassium, was produced in the reaction ^{248}Cm(^{26}Mg, xn)$^{274-xn}$Hs and chemically isolated. After gas phase separation of HsO_4, 26 genetically linked decay chains have been observed. These were attributed to the decays of three different Hs isotopes - ^{269}Hs in 5n, ^{270}Hs in 4n, and ^{271}Hs in 3n evaporation channel. The observed decay properties provide strong indications for enhanced stability in this area of the heaviest known elements and are in agreement with theoretical predictions. New decay properties for these Hs isotopes and their daughters are discussed.

HK 52.5 Do 18:00 B

Role of the rearrangement time in nuclear fission — •Christian Ythier and Genevieve Mouze — Faculte des Sciences, Universite de Nice, France

The two-step model of nuclear fission [1] is based on the representation of fissile nuclei as dinuclear systems ,which can change into new dinuclear systems. Arguments are presented in favour of rearrangement times in fission as short as 1.1 10-25 second [2]. A comparison is made with the shortest rearrangement times encountered in chemical diatomic molecules, where femtosecond pulse lasers are in current use [3], e.g. 0.4 10 -18 s expected in HCl. Consequences of so-short reaction times in fission, in particular the uncertainty in mass and charge of the fission fragments, are discussed. The narrowly- symmetric mass spectrum of 258Fm (s.f.) [4] can be explained as resulting from Coulomb-barrier-free fission events. 1. G. Mouze and C. Ythier, Nuovo Cimento A 103 (1990)617; 2. G.Mouze, Varenna Conference, June 2006, Uni. Milano, in press; 3. A. H. Zewail, Nobel Lecture 1999;4.D.C. Hoffman et al., Los Alamos Report LA-UR 677, 2901 (1977).

HK 52.6 Do 18:15 B

A mass-data-based description of fusion reactions — Genevieve Mouze and •Christian Ythier — Faculte des Sciences, Universite de Nice, France

Any heavy nucleus has a tendency to dissociate into a dinuclear system, made of core and cluster, having a definite Coulomb barrier and a definite internal energy. This allows a new description of fusion reactions,in which the excitation energy of the compound nucleus is made of two parts, an intrinsic and an extrinsic excitation energy. For example, the yield of 262Bh formed in two different reactions depends on the intrinsic excitation energy of the compact compound nucleus 263Bh; the maximal yrast level obtainable in the gamma-deexcitation of two different levels of a nucleus formed at two different projectile energies can be the same, since it depends only on the intrinsic excitation energy after particle evaporation. The case of a negative affinity of dissociation will be discussed. Entrance-channel effects depend on intrinsic properties of the compound nucleus. Bohr's model of the compound nucleus must be reviewed: this revision is necessary for understanding the synthesis of superheavy elements.