HK 15: Struktur und Dynamik von Kernen III

Zeit: Dienstag 14:00–16:00 Raum: HG II

HK 15.1 Di 14:00 HG II

Suche nach superschweren Elementen mit Beschleunigermassenspektrometrie (AMS) * — •Peter Ludwig[1], Shawn Bishop[1], Iris Dillmann[1], Thomas Faestermann[1], Gunther Korschinek[1], Pankaj Kumar[1,2] und Georg Rugel[1] — [1]Physik Department E12 und E15, Technische Universität München, 85748 Garching, Germany — [2]Inter-University Accelerator Centre, Aruna Asaf Ali Road, New Delhi-110067, India

In der Natur könnte eine kleine Menge superschwerer Elemente vorkommen, die vor der Entstehung des Sonnensystems im r-Prozess erzeugt wurden, wenn ihre Halbwertszeit sehr lang ist (Größenordnung 10^9 Jahre). Besonders stabil sind Kerne mit abgeschlossenen Neutronen- und Protonenzahlen. Theoretische Modelle deuten auf Schalenabschlüsse mit N=184 und Z=108 hin. Ein möglicher Kandidat ist also ^{292}Hs. Solche extrem neutronenreichen Kerne können nicht durch Fusion im Labor erzeugt werden. Mit dem AMS Aufbau am Maier-Leibnitz-Laboratorium in Garching ließen sich kleinste Spuren von ^{292}Hs in seinem chemischen Homolog Osmium nachweisen. Hierfür wird im Moment ein Nachweissystem mit Flugzeit-Messung und einem Wien-Filter aufgebaut. Die bisherige Obergrenze für das Vorkommen von ^{292}Hs in Osmium liegt bei 10^{-14} [Briançon et al. (2007), SHIN Experiment] (angenommene Halbwertszeit $t_{1/2} = 10^9$ a) und wurde durch die Suche nach spontanen Spaltungen mit hoher Neutronenmultiplizität in einer Osmium Probe bestimmt. Diese obere Grenze sollte sich in wenigen Tagen AMS-Messung senken lassen.

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HK 15.2 Di 14:15 HG II

Observation of element 114 at LBNL — •Jan Dvorak[1,2], Liv Stavsetra[1], Kenneth. E. Gregorich[1], Paul A. Ellison[1,2], Irena Dragojevic[1,2], Mitch A. Garcia[1,2], and Heino Nitsche[1,2] — [1]Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA — [2]Department of Chemistry, University of California, Berkeley, Berkeley, California 94720, USA

We report on the first independent verification of element 114 at Lawrence Berkeley National Laboratory (LBNL). In the past years the Dubna Gas Filled Recoil Separator (DGFRS) group reported the successful synthesis of superheavy elements (SHE) in numerous ^{48}Ca irradiations of actinide targets. Cross sections reported from these experiments are remaining rather constant at the level of a few picobarns, breaking the strong downward trend obvious in hot fusion reactions with other projectiles. Verification of the DGFRS results hence is of paramount importance, but for a long time, confirmation attempts failed to produce SHE in ^{48}Ca induced reactions. In a 8-day experiment at the Berkeley Gas-filled Separator (BGS) at LBNL we have observed production of two atoms of element 114 in the reaction ^{48}Ca(^{242}Pu,3-4n)^{287,286}114. Based on the observed decay properties these decay chains were attributed to the decay of ^{287}114 and ^{286}114 produced in the 3n and 4n channel, respectively. Decay modes, lifetimes, and decay energies are consistent with those reported by the DGFRS group. The 1.4 pb cross sections measured in this work for both the 3n and 4n channels are lower than 3.6 pb and 4.5 pb, respectively, reported by the DGFRS group.

HK 15.3 Di 14:30 HG II

First direct Penning trap mass measurements on nobelium and lawrencium — •Christian Droese for the SHIPTRAP-Collaboration — Universität Greifswald

The mass measurements of the three nobelium isotopes $^{252-254}No$ and the lawrencium isotope ^{255}Lr measured with the Penning trap mass spectrometer SHIPTRAP/GSI have been evaluated. These were the first direct mass measurements of transfermium elements ever performed. The results mark the first step in the exploration of masses of even heavier nuclides which is planned at SHIPTRAP. The main objective is to measure the endpoints of alpha-decay chains starting from superheavy nuclei in the region of the predicted island of stability. The SHIPTRAP results were compared with previous measurements based on alpha-decay chains and new literature values were obtained.

HK 15.4 Di 14:45 HG II

Photofission at the S-DALINAC* — •Alf Göök[1], Roman Barday[1], Maksym Chernykh[1], Christian Eckardt[1], Joachim Enders[1], Franz-Josef Hambsch[2], Peter von Neumann-Cosel[1], Andreas Oberstedt[3], Stephan Oberstedt[2], Yuliya Poltoratska[1], Achim Richter[1,4], and Markus Wagner[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]EC-JRC Institute for Reference Materials and Measurements, Geel, Belgium — [3]Akademin för naturvetenskap och teknik, Örebro universitet, Sweden — [4]ECT*, Villazzano (Trento), Italy

The fission of ^{238}U and ^{234}U induced by bremsstrahlung with endpoint energies between 6 MeV and 9 MeV has been investigated at the superconducting Darmstadt electron linear accelerator S-DALINAC. The experiment is a step in preparing for an experimental investigation of parity violation in photofission. The parity violation effect is expected to be small, hence a high integrated luminousity will be needed for this experiment. The use of a radiation hard detector is therefore mandatory. A twin Frisch-grid ionization chamber has been used to determine fission fragment energy and mass distributions by means of the double kinetic energy technique in order to test the detector performance in the bremsstrahlung environment. The research program will be presented along with results of the experimental studies of fission fragment characteristics.

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HK 15.5 Di 15:00 HG II

Spectroscopy of actinides — •Tanja Kotthaus[1], Peter Reiter[1], Thomas Faestermann[2], Ralf Hertenberger[3], Herbert Hess[1], Marijke Kalkühler[1], Thomas Morgan[3], Peter Thirolf[3], Andreas Wendt[1], Andreas Wiens[1], and Hans-Friedrich Wirth[3] — [1]IKP, Köln — [2]TU, München — [3]LMU, München

Nuclear structure of heavy deformed nuclei is dominated by the interplay of collective and single-particle excitations. In the actinide region the octupol degree of freedom has to be added. There is still no satisfying theoretical description which includes all this. Experiments were performed at the Munich Q3D spectrometer utilizing the direct transfer reactions ($\vec{d}$,p) and ($\vec{d}$,t) to study the isotones ^{231}Th, ^{232}Pa and ^{233}U and the isotope ^{230}Pa. The use of the polarized deuteron beam enables to deduce not only the orbital angular momentum transfer Δl but also the angular distribution of the analyzing power. This provides direct access to the total angular momentum transfer Δj. For the two odd-odd nuclei ^{230}Pa and ^{232}Pa first time results on excited states will be presented. Several new spin and parity assignments were obtained for the well known isotopes ^{231}Th and ^{233}U as a basis of future theoretical investigations in this mass region.

HK 15.6 Di 15:15 HG II

Measurement of the prompt neutron emission spectrum of 235U(n,f) induced by cold neutrons using time-of-flight spectrometry and neutron activation — •Imrich Fabry[1], Franz-Josef Hambsch[1], Nikolay Kornilov[2], Stephan Oberstedt[1], Goeran Loevestam[1], Mikael Hult[1], and Tamas Belgya[3] — [1]European Commission, JRC-IRMM, B-2440 Geel, Belgium — [2]Accelerator Lab, Ohio Univ., Athens, OH 45701, USA — [3]Inst. of Isotopes HAS, Budapest, Hungary

As 235U is the most important isotope for nuclear energy production, it is essential for a safe and economic use of nuclear power, as well as for the development of new generation of power plants, to understand the correct prompt fission neutron emission spectrum (PFNS). The PFNS of 235U(n,f) at 100 oK incident neutron energy was measured in two experiments at the Budapest Reactor. The experiments were motivated by the long-standing discrepancy between differential literature data and the fact that the measured PFNS at thermal incident neutron energy cannot be reproduced by theory and contradict integral and benchmark experiments. The measured PFNS at thermal energy does not confirm the model calculations based on the assumption that fission neutrons are emitted from fully accelerated fragments alone. Instead, a new neutron production mechanism, scission neutron emision, is proposed to play an important role in the generation of the spectrum. In the second experiment, a new neutron activation method (DONA) was used to validate our new results. Results are presented.

HK 15.7 Di 15:30 HG II

The odd-even Z isospin anomaly in the yields from high-

energy reactions — •M. Valentina Ricciardi[1], Kalr-Heinz Schmidt[1], Aleksandra Kelic-Heil[1], and Beatriz Jurado[2] — [1]GSI - Helmholtzzentrum fuer Schwerionenforschung, Darmstadt, Germany — [2]CENBG, Centre d'Etudes Nucleaires de Bordeaux-Gradignan, France

The odd-even Z isospin anomaly was discussed for the first time in 1999 by L.B. Yang et al., who observed this effect in the experimental production cross-sections of Ni+Ni and Fe+Fe at 75 A MeV. Since then, the analysis of experimental production cross-sections of final products of several nuclear reactions at very different energies confirmed the existence of this effect. In this talk we want to show that odd-even Z isospin anomaly is a direct consequence of the de-excitation process by particle evaporation occurring in the hot remnants of the nuclear reaction. In particular, the characteristics of the odd-even Z isospin anomaly can be reproduced providing that two effects are properly considered: the memory effects, which hold some reminiscences of the primary impinging nuclei, and the effect of pairing, which is responsible for the even-odd staggering in the yields. The latter correlates strongly with the lowest particle separation energy of the final experimentally observed nuclei, but it does not correlate with their binding energy, contrary to what at first one is tempted to think. Our study shows that it is precisely the memory effect combined with the characteristics of the lowest particle separation energy which determine the "isospin anomaly".

HK 15.8 Di 15:45 HG II

Evaporation and pre-equilibrium emission in GeV p-induced spallation-fragmentation reactions — •Frank Goldenbaum — for the PISA collaboration, Forschungszentrum Jülich GmbH, Institut für Kernphysik, Jülich, Deutschland

The emphasis will be on the description of nuclear data taken by the PISA (Proton Induced SpAllation) experiment at the Cooler Synchrotron in Juelich, Germany. The typical energy range of incident protons is 150 MeV-2.5 GeV with luminosities for the internal experiment PISA up to $6 \times 10^{34} cm^{-2} s^{-1}$. The goal of the experiment was to improve nuclear data evaluated files and models which involves sensitivity analysis and validation of simulation tools, nuclear data libraries evaluation at low and medium energies, and high energy (≥200 MeV) experiments and modeling. In the present contibution the focus is on high energy experiments and modeling and will cover the investigation of: i) pA (spallation-fragmentation) reactions in the GeV regime ii) data measured from exclusive experiments for testing, validating and developing theoretical models iii) double differential cross sections (DDXS) of light charged particles (LCP=p,d,t,3He,4He,...) and intermediate mass fragments (IMFs, $Z \leq 16$) in spallation and fragmentation p-induced reactions (C to Au), and iv) reaction mechanism of pN reactions, origin of pre-equilibrium, evaporation and fragmentation processes.