HK 66: Struktur und Dynamik von Kernen

Zeit: Freitag 14:00–15:30 Raum: P 4

Gruppenbericht HK 66.1 Fr 14:00 P 4

The R3B experiment at FAIR — •Heiko Scheit — TU Darmstadt

The experiment Reactions with Relativistic Radioactive Beams (R^3B) at the FAIR facility will be installed at the high-energy branch of the Super-FRS. It allows for kinematically complete nuclear reaction studies with short-lived radioactive ion beams in inverse kinematics, utilizing a wide beam energy range from about 100–1000 MeV/u covering the full mass range up to uranium. Experimental programs will address fundamental questions in nuclear structure and reaction physics, as well as nuclear astrophysics.

Recently, after a long research and development phase, important milestones toward the realization of the R^3B experiment have been reached with the completion of the technical design reports for two core components of the R^3B setup: the NeuLAND high-resolution neutron time-of-flight spectrometer and the CALIFA Barrel, which serves as a γ-ray spectrometer, calorimeter and, together with the Si-tracker, as a target-recoil detector. In addition, the construction of the superconducting large-acceptance dipole magnet R^3B-GLAD, used for the magnetic rigidity analysis of beam-rapidity charged fragments, is well underway with an expected delivery at GSI in summer 2013.

First commissioning and physics experiments at GSI with R3B-GLAD and 20%-versions of NeuLAND and the CALIFA Barrel will be carried out in 2014. Until 2016 the setup will be largely completed at GSI and moved to the new high-energy cave at FAIR in 2017/8.

I will give an update on the current status of the project.

HK 66.2 Fr 14:30 P 4

Tracking am LAND/R^3B Setup an der GSI — •Ralf Plag für die R3B-Kollaboration — Goethe Universität Frankfurt am Main, Germany — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Das LAND/R^3B Setup an der GSI in Darmstadt ist eine leistungsfähige Anlage für die Durchführung von Coulomb-Aufbruch Experimenten. Damit können neben (γ,n)-Wirkungsquerschnitten unter anderem auch (γ,p)- und (γ,2p)-Wirkungsquerschnitte von radioaktiven Kernen vermessen werden, sowie mittels Zeitumkehrtheorem auch die Einfangquerschnitte für die inversen Prozesse.

Für die Messung energieabhängiger Wirkungsquerschnitte müssen allerdings alle Reaktionsprodukte identifiziert und deren Impulsvektoren mit hoher Genauigkeit bestimmt werden. Dazu wird die Ablenkung der Teilchen im Magnetfeld eines Dipols untersucht und rekonstruiert.

In diesem Vortrag wird der aktuelle Stand der Tracking-Algorithmen für die Bestimmung von Ladung, Masse und Impuls der Reaktionsprodukte anhand mehrerer Beispiele bisher durchgeführter Experimente präsentiert.

Dieses Projekt wurde vom HGF Young Investigators Project VH-NG-327 unterstützt.

HK 66.3 Fr 14:45 P 4

Beyond the neutron drip-line - superheavy oxygens — •Christoph Caesar for the R3B-Collaboration — TU Darmstadt, Institut für Kernphysik, Germany

The neutron-unbound ground state of ^{25}O was recently observed for the first time in a proton knock-out reaction from a ^{26}F beam on a beryllium target at the NSCL[1]. One single resonance was observed in the ^{24}O+n relative-energy spectrum. Shell-model calculations which describe known properties of neighboring oxygen isotopes, however, fail in reproducing the surprisingly low energy of the observed resonance.

The R3B-collaboration has studied the ^{26}F(p,2p)^{25}O reaction utilizing a kinematically complete measurement at relativistic beam energies with the R3B-LAND-setup. This measurement provides improved data in several respects. The reaction was measured fully exclusive (including γ-ray detection) and with much larger acceptance. In addition, a sufficient number of events have been recorded which populate the ^{26}O ground state in order to estimate its mass. First results on the ^{26}F(p,2p)^{25}O as well as the ^{27}F(p,2p)^{26}O channel will be presented.

This work is supported by the Hessian LOEWE initiative through HIC for FAIR.

[1] C.R. Hoffman et al. Phys.Rev.Lett 100 (2008) 152502

HK 66.4 Fr 15:00 P 4

Decay spectroscopy of neutron-rich nuclei with the CAITEN detector — •Konrad Steiger for the CAITEN-Collaboration — Physik-Department E12, Technische Universität München

An experiment in fall 2010 at the RIBF (Radioactive Ion Beam Factory at RIKEN, Japan) investigated the neutron-rich nuclei in the neighborhood of ^{30}Ne and ^{36}Mg. These nuclei were produced by relativistic projectile fragmentation of a 345 AMeV ^{48}Ca primary beam which was delivered from the superconducting ring cyclotron SRC with an average intensity of 70 pnA. The secondary cocktail beam was separated and identified with the BigRIPS fragment separator and the ZeroDegree spectrometer. The unambiguous particle identification was achieved by measuring the energy loss, time of flight and magnetic rigidity event-by-event. The identified fragments were implanted in the CAITEN detector (Cylindrical Active Implantation Target for Efficient Nuclear-decay study). The main part of this detector is a 4×10^4-fold segmented plastic scintillator with the shape of a hollow cylinder. To reduce background events the scintillator was moved continuously in axial and vertical direction (similar to a tape-transporting system). Implantations and decays were correlated in time and space. γ-rays were detected with three germanium clover detectors. For the first time β-delayed gammas were measured in the neutron-rich isotopes $^{36-38}$Si. The status of the analysis and preliminary results including new half-life values and tentative level schemes for these very exotic nuclei will be presented. Supported by BMBF (06MT9156) and DFG (EXC 153, KR2326/2-1).

HK 66.5 Fr 15:15 P 4

Quasi-Elastic Scattering of Relativistic Neutron-Deficient Carbon Isotopes — •Matthias Holl for the R3B-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Quasi-elastic scattering of relativistic ^{11}C has been recently studied in inverse kinematics during experiment S393 at the R3B-LAND setup. In this experiment, a radioactive beam coming from the fragment separator FRS was used to induce secondary reactions with a CH2 target. The incoming beam as well as the reaction products were detected in kinematically complete measurements.

The study is aimed at a quantitative understanding of absolute spectroscopic factors that appear to be quenched for deeply bound nucleons. Preliminary results will be shown and compared to results obtained for knockout reactions from these isotopes.

Supported by BMBF (06DA9040I), the State of Hesse (LOEWE Centre HIC for FAIR), and through the GSI-TU Darmstadt cooperation agreement.