HK 26: Structure and Dynamics of Nuclei V

Time: Wednesday 14:00–16:00 Location: J-HS E

Group Report HK 26.1 Wed 14:00 J-HS E

Systematics of the Electric Dipole Response in Stable Tin Isotopes* — •Sergej Bassauer[1], Peter von Neumann-Cosel[1], and Atsushi Tamii[2] for the E422-Collaboration — [1]Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany — [2]RCNP, Osaka, Japan

The electric dipole response is an important property of heavy nuclei. Precise knowledge of the electric dipole response provides information on the dipole polarisability which in turn allows to extract important constraints on neutron-skin thickness in heavy nuclei and parameters of the symmetry energy. Another important property of nuclei which can be extracted from the electric dipole response is the gamma strength function (GSF). GSFs serve as input in calculations of cross sections in astrophysics, reactor design and waste transmutation within statistical models. Using the so called fluctuation analysis it is also possible to determine level densities in the GDR region. The tin isotope chain is particularly suited for a systematic study of the dependence of the electric dipole response on neutron excess as it provides a wide mass range of accessible isotopes with little change of the underlying structure. An inelastic proton scattering experiment under forward angles on even-even $^{112-124}$Sn was performed with a focus on the low energy strength and polarisability. In this talk results on the dipole polarisability, gamma strength function and level density extracted from these data will be presented.

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HK 26.2 Wed 14:30 J-HS E

Parametrizations of relativistic energy density functionals with tensor couplings — •Stefan Typel[1] and Diana Alvear Terrero[2] — [1]Technische Universität Darmstadt, Institut für Kernphysik, Darmstadt, Germany — [2]Uniwersytet Wrocławski, Instytut Fizyki Teoretycznej, Wrocław, Poland

Many parametrizations of relativistic energy density functionals with minimal nucleon-meson couplings have been developed in the past assuming a dependence of the couplings on the vector density. This approach is extended here by introducing tensor couplings of nucleons to ω and ρ mesons and by considering both vector and scalar density dependencies of the minimal couplings. The parameters of the new effective interactions are found by fitting to properties of finite nuclei. The uncertainties of the observables in the χ^2 function are determined self-consistently. They allow to characterize the merits and drawbacks of the various parametrizations.

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HK 26.3 Wed 14:45 J-HS E

Study of ^{116,118}Sn using the particle-γ coincidence Doppler-shift attenuation method — •Sarah Prill[1], Anna Bohn[1], Vera Everwyn[1], Michelle Färber[1], Florian Kluwig[1], Pavel Petkov[2,1], Philipp Scholz[1], Michael Weinert[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]National Institute for Physics and Nuclear Engineering, Bucharest, Romania

The tin isotopes at the nuclear shell closure $Z = 50$ present ideal candidates to study nuclear properties and their evolution with increasing number of valence neutrons. The isotopes ^{112,114}Sn [1] were already studied in Cologne with the Doppler-shift attenuation method (DSAM) using particle-γ coincidences [2]. Now, results on ^{116,118}Sn were obtained with the same method to increase the knowledge on the tin isotopic chain. For this, inelastic proton and alpha scattering experiments were performed at the SONIC@HORUS setup [3] at the 10 MV FN-Tandem accelerator of the University of Cologne, yielding particle-γ coincidence data ideally suited to extract level lifetimes in the femto- to low picosecond range. This contribution will present the newest results, including nuclear level lifetimes and transition strengths.

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[1] M. Spieker *et al.*, Phys. Rev. C **97** (2018) 054319
[2] A. Hennig *et al.*, Nucl. Instr. and Meth. A **794** (2015) 171
[3] S. G. Pickstone *et al.*, Nucl. Instr. and Meth. A **875** (2017) 104

HK 26.4 Wed 15:00 J-HS E

The γ-ray strength function of ^{87}Rb and the s-process branching-point nucleus ^{86}Rb — •Julius Wilhelmy[1], Philipp Erbacher[2], Johann Isaak[3], Bastian Löher[4], Miriam Müscher[1], Deniz Savran[4], Philipp Scholz[1], Ronald Schwengner[5], Werner Tornow[6], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]Institute for Applied Physics, Goethe University Frankfurt — [3]Institute for Nuclear Physics, TU Darmstadt — [4]GSI, Darmstadt — [5]Helmholtz-Zentrum Dresden-Rossendorf — [6]Department of Physics, Duke University

The N=50 isotone ^{87}Rb was measured in bremsstrahlung experiments at different electron energies (8.2 MeV and 13.2 MeV) at the γELBE facility at the Helmholtz-Zentrum Dresden-Rossendorf, Germany [1]. Complementary measurements with almost mono-energetic γ-ray beams at the γ^3 setup [2] at the High-Intensity Gamma-ray Source (HIγS) at TUNL, Durham, USA yield information on total photoabsorption cross sections. The radiative neutron capture of the s-process branching-point nucleus ^{86}Rb is constrained by statistical model calculations using the measured photon strength function (PSF) of ^{87}Rb, which is directly connected to the photoabsorption cross section. The results will be presented and discussed.

Supported by the BMBF (05P18PKEN9).

[1] R. Schwengner et al., Nucl. Instr. Meth. A **555** (2005) 211
[2] B. Löher *et al.*, Nucl. Instr. and Meth. A **723** (2013) 136

HK 26.5 Wed 15:15 J-HS E

Structure of the first 2^- state in ^{88}Br — •Felix Dunkel[1], Jean-Marc Régis[1], Ulli Köster[2], Yung Hee Kim[2], Waldemar Urban[3], Jan Jolie[1], Arwin Esmaylzadeh[1], Lisa Marie Gerhard[1], Lukas Knafla[1], Mario Ley[1], and Kerstin Schomacker[1] — [1]Institut für Kernphysik der Universität zu Köln, Zülpicher Str. 77, 50937 Köln, Germany — [2]Institut Laue-Langevin, 71 Avenue des Martyrs, 38042 Grenoble, France — [3]Faculty of Physics, University of Warsaw, ul.Pasteura 5, PL-02-093 Warsaw, Poland

The structure of the first 2^- state in ^{88}Br was studied at the Institut Laue-Langevin by measuring the lifetime of this level with the gamma-gamma fast-timing technique using a setup with four $LaBr_3$(Ce) detectors. For this purpose an isomeric ^{88m}Br beam was produced by thermal-neutron induced fission of ^{235}U and mass separated using LOHENGRIN. A highly accurate lifetime result together with deduced transition strengths will be presented and discussed in the context of the shell model and possible collective effects in ^{88}Br.

HK 26.6 Wed 15:30 J-HS E

Prompt and delayed spectroscopy of ^{94}Kr with the NuBall-Spectrometer* — •Rosa-Belle Gerst, Andrey Blazhev, and Nigel Warr for the NuBall-Collaboration — Institut für Kernphysik, Universität zu Köln

The isotopic chain of krypton isotopes from the proton rich to the neutron rich side has been investigated extensively in recent years since they are home to a variety of shape phenomena. In 2018, the neutron-rich isotopes were again studied, this time with fast-neutron induced fission of ^{238}U as part of the NuBall campaign at the ALTO facility at the IPN Orsay. A fast-neutron beam was produced with the neutron source LICORNE which uses a p(^{7}Li,^{7}Be)n inverse reaction. The ^{7}Li beam was provided by the 15 MV Tandem Van de Graaff accelerator in a 400ns pulsed mode. The fast neutrons then impinged on a 100g ^{238}U target to induce fission. The gamma-rays from the excited fission fragments were measured with the NuBall-array [1], a novel hybrid gamma-spectrometer consisting of 24 HPGe clover, 10 HPGe Phase I and 20 LaBr3 detectors. The pulsed beam allows the investigation of prompt and delayed gamma-transitions separately and in coincidence. During the analysis of the data, a new short-lived isomer was discovered in 94Kr [2] extending the previously known level scheme [3].

*Supported by the DFG under Grant No. BL 1513/1-1

[1] M. Lebois *et al.*, to be published
[2] R.-B. Gerst *et al.*, in preparation
[3] T. Rzaca-Urban *et al.*, The European Physical Journal A - Hadrons and Nuclei 9, 165 (2000)

HK 26.7 Wed 15:45 J-HS E

Measuring the 2s-1s transition in Muonic atoms — •Nilesh Deokar — Johannes Gutenberg University of Mainz, Johann-

Joachim-Becher-Weg 45, 55128 Mainz, Germany

2s-1s muonic X-rays are a potential observable to study Atomic Parity Violation (APV) in muonic atoms. Muonic X-rays are produced when negative muons cascade down the different energy levels of an atom. To detect the 2s-1s X-rays, a zinc target was placed in a negative muon beam from the piE1 beamline at the Paul Scherrer Institute, Switzerland. The muons were stopped inside the zinc target which leads to the cascade. The target was surrounded by High Purity Germanium (HPGe) detectors on two sides which detected the outgoing muonic X-rays. The data taking was carried out over a period of 8 days with beam momenta ranging from 33 MeV/c to 35 MeV/c. The 2s-1s transition in zinc corresponds to the energy value of ~1640 keV. This transition is overshadowed by background transitions and also the scattered X-rays between the HPGe detectors which give rise to satellite peaks. X-ray-X-ray coincidences can help to suppress this background. The analysis of the data acquired will revolve around separating the 2s-1s transitions from the background. A clear observation of the 2s-1s transition opens up to the possibility for an APV experiment with muonic atoms.