HK 25: Structure and Dynamics of Nuclei 5

Time: Tuesday 14:30–16:15 Location: T/HS2

Group Report HK 25.1 Tue 14:30 T/HS2

Magnetic dipole strength in ^{128}Xe and ^{134}Xe in the spin-flip resonance region — R. Massarczyk[1,2], G. Rusev[2], •R. Schwengner[1], F. Dönau[1], C. Bathia[3], M.E. Gooden[4,5], J.H. Kelley[4,5], A.P. Tonchev[6], and W. Tornow[4,7] — [1]Helmholtz-Zentrum Dresden-Rossendorf, 01328 Dresden, Germany — [2]Los Alamos National Laboratory, Los Alamos, NM 87545, USA — [3]McMaster University, Hamilton, Ontario L8S4L8, Canada — [4]Triangle Universities Nuclear Laboratory, Durham, NC 27708, USA — [5]North Carolina State University, Raleigh, NC 27695, USA — [6]Lawrence Livermore National Laboratory, Livermore, CA 94550, USA — [7]Duke University, Durham, NC 27708, USA

The magnetic dipole strength in the energy region of the spin-flip resonance is investigated in ^{128}Xe and ^{134}Xe using quasimonoenergetic and linearly polarized γ-ray beams at the High-Intensity γ-Ray Source facility in Durham, North Carolina, USA. Absorption cross sections were deduced for the magnetic and electric and dipole strength distributions separately for various intervals of excitation energy, including the strength of states in the unresolved quasicontinuum. The magnetic dipole strength distributions show structures resembling a resonance in the spin-flip region around an excitation energy of 8 MeV. The electric dipole strength distributions obtained from the present experiments are in agreement with the ones deduced from an earlier experiment using broad-band bremsstrahlung instead of a quasimonoenergetic beam. The experimental magnetic and electric dipole strength distributions are compared with model predictions.

HK 25.2 Tue 15:00 T/HS2

Dipole polarizability of neutron rich nuclei and the symmetry energy — •Andrea Horvat[1], Thomas Aumann[1,2], Konstanze Boretzky[2], Jacob Johansen[1], Kenjiro Miki[1], Fabia Schindler[1], and Philipp Schrock[1] for the R3B-Collaboration — [1]IKP, TU Darmstadt, Germany — [2]GSI, Darmstadt, Germany

As a part of a systematic investigation of the dipole response of stable up to very neutron rich tin isotopes, nuclear and electromagnetic excitation of ^{124}Sn - ^{134}Sn has been investigated at relativistic energies in inverse kinematics induced by carbon and lead targets at the LAND-R3B setup at GSI in Darmstadt. The electric dipole response and the nuclear reaction cross section, total and charge-changing, will be obtained from the kinematically complete determination of momenta of all particles on an event by event basis. The dipole polarizability will be extracted from the Coulomb excitation interaction channel, in order to make use of relevant correlations of this observable with nuclear matter properties such as the symmetry energy at saturation density (J) and it's slope (L). The systematics of the low-lying "pygmy" dipole strength, the giant dipole resonance (GDR) and the neutron skin thickness will be determined with respect to increasing isospin asymmetry. This talk will also discuss the correlations and sensitivities of these variables and observables obtained within the framework of nuclear energy density functional theory.

This work is supported by HIC for FAIR, GSI-TU Darmstadt cooperation, NAVI and the BMBF project 05P12RDFN8.

HK 25.3 Tue 15:15 T/HS2

Dipole strength distribution of ^{50}Ti * — •Udo Gayer, Tobias Beck, Jacob Beller, Laura Mertes, Haridas Pai, Norbert Pietralla, Philipp Ries, Christopher Romig, Volker Werner, and Markus Zweidinger — Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt

A first nuclear resonance fluorescence (NRF) experiment with a 68% isotopically enriched ^{50}Ti target has been performed at the superconducting Darmstadt electron linear accelerator S-DALINAC to investigate particle-bound dipole excitations in this nucleus. The target was irradiated with an unpolarized bremsstrahlung photon beam at endpoint energies of 7.5 MeV and 9.7 MeV. The observed excited states are analyzed with respect to their excitation energies, spin quantum numbers and transition strengths. A complementary NRF experiment with polarized photons will be conducted at the High Intensity gamma-ray Source in Durham, NC, USA to determine the polarity of the dipole transitions. Data will be analyzed with regard to the Pygmy Dipole Resonance, a weakly-collective electric dipole excitation which starts to form in nuclei of this mass region. The measured transition strengths will be compared to microscopic calculations in the quasiparticle-phonon model. The investigation of the magnetic dipole strength distribution will focus on strong spin-flip transitions between the p,f spin-orbit partners expected in the nuclear shell model. First results of the measurements and the evaluation will be presented and discussed.

* Supported by the DFG under contract No. SFB 634

HK 25.4 Tue 15:30 T/HS2

Dipolstärkeverteilung von ^{54}Cr bei Energien unterhalb von 9,7 MeV* — •Philipp Ries, Tobias Beck, Jacob Beller, Udo Gayer, Laura Mertes, Haridas Pai, Norbert Pietralla, Christopher Romig, Volker Werner und Markus Zweidinger — Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt

In den letzten Jahren genossen elektrische und magnetische Dipolstärken ($E1$ und $M1$) unterhalb der Neutronenseparationsschwelle, insbesondere die Anregung der Pygmy Dipol Resonanz (PDR), erhebliche Aufmerksamkeit. Durch Messungen von Anregungsstärken und Paritäten von J=1 Zuständen in leichteren Kernen um A=50 soll die Systematik der PDR nun in jener Massenregion erweitert werden, in der die PDR erstmals auftritt. Mittels am supraleitenden Darmstädter Elektronenlinearbeschleuniger S-DALINAC erzeugter Bremsstrahlung mit Photonenenergien von bis zu 9,7 MeV wurde der Kern ^{54}Cr zum ersten Mal mit der Methode der Kernresonanzfluoreszenz untersucht. Dabei wurden zahlreiche Zustände, die meisten zum ersten Mal, beobachtet. Die Paritäten dieser Zustände werden an der High Intensity Gamma-ray Source des Triangle Universities Nuclear Laboratory in Durham, NC, USA, bestimmt werden. Die Ergebnisse werden vorgestellt und im Vergleich mit Experimenten, die auf gleiche Weise an Kernen rund um den N=28 Schalenabschluss (^{50}Cr, ^{52}Cr [1] und ^{50}Ti) durchgeführt wurden, diskutiert.

*Unterstützt von der DFG im Rahmen des SFB 634.

[1] H. Pai *et al.*, Phys. Rev. C **88**, 054316 (2013)

HK 25.5 Tue 15:45 T/HS2

Pygmy Dipol Resonanz in instabilen Sn Isotopen — •Joachim Tscheuschner for the DALI-LaBr RIBF-Collaboration — TU Darmstadt

Um die Pygmy Dipol Resonanz (PDR) in den instabilen Isotopen Sn-128 und Sn-132 zu untersuchen, wurden am RIKEN (Japan) alpha-Streuexperimente durchgefuehrt. Die Photonen aus dem Zerfall der angeregten Zustände wurden mit einem Detektor hoher Effizient bestehend aus NaJ Kristallen (DALI2) sowie in Vorwärtsrichtung großvolumigen LaBr Kristallen (HECTOR) nachgewiesen.

In der alpha-Streuung werden hauptsaechlich isoskalare Moden angeregt, was durch Vergleich mit Ergebnissen aus der Coulomb Anregung eine Aussage über die isoskalaren und isovektoriellen Anteile der PDR erlaubt. Ziel der Experimente ist, die Entwicklung der PDR als Funktion des Neutronenüberschusses zu untersuchen. In diesem Beitrag werden die alpha-Streuexperimente und Ergebnisse aus ersten Analyseschritten vorgestellt.

Dieser Beitrag ist unterstuetzt durch HIC for FAIR, GSI-TU Darmstadt Kooperation, und BMBF project 05P12RDFN8.

HK 25.6 Tue 16:00 T/HS2

Low-lying dipole strengths of ^{50}Cr* — •H. Pai, T. Beck, J. Beller, U. Gayer, L. Mertes, N. Pietralla, P. Ries, C. Romig, V. Werner, and M. Zweidinger — Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt

Low-lying electric and magnetic dipole strengths ($E1$ and $M1$, respectively), particularly Pygmy Dipole Resonance (PDR) and Spin-flip $M1$ excitations, of atomic nuclei have drawn considerable attention in the last decade. The low-lying dipole strengths of ^{50}Cr were studied with the method of nuclear resonance fluorescence up to 9.7 MeV, using bremsstrahlung provided by the superconducting Darmstadt electron linear accelerator S-DALINAC. Twenty-four spin-1 states were observed between 3.0 and 9.7 MeV excitation energy, 17 of those for the first time. The excited states' parities will be determined through polarized photon scattering at the High Intensity gamma ray Source (HIγS), Triangle Universities Nuclear Laboratory (TUNL) in Durham,

NC, USA. Microscopic calculations within the quasiparticle-phonon nuclear model will be performed to interpret the dipole strength distribution of ^{50}Cr. The experimental results of ^{50}Cr will be compared to data on its closed-shell N = 28 isotone ^{52}Cr [1] and may provide information on the onset of the PDR in atomic nuclei.

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[1] H. Pai *et al.*, Phys. Rev. C **88**, 054316 (2013).