HK 61: Nukleare Astrophysik

Zeit: Freitag 14:00–15:45 Raum: HZ 4

Gruppenbericht HK 61.1 Fr 14:00 HZ 4

Triaxiality as essential feature for electromagnetic strength, level density and neutron capture cross sections in heavy nuclei — •Eckart Grosse[2], Arnd R. Junghans[1], and Ralph Massarczyk[1,2] — [1]Institut für Strahlenphysik, Helmholtz Zentrum DD-Rossendorf, 01328 Dresden — [2]Institut für Kern- und Teilchenphysik, TU Dresden, 01069 Dresden

Reliable predictions for compound nuclear processes leading to nuclides outside the valley of stability are of importance for nuclear astrophysics as well as for the transmutation of nuclear waste. Assuming triaxiality in nearly all nuclei with A>70 a combined parameterization is presented for level density and photon strength. For the strength functions a fit to IVGDR shapes by the sum of three Lorentzians adding up to the TRK sum rule is used. Only two global fit-parameters are needed and a third one suffices to also describe level densities sufficiently well, if the significant collective enhancement due to the loss of axial symmetry is accounted for. Predicted level distances for the small spins reached by capture at the neutron threshold agree well to observations for more than 100 spin-0 target nuclei. Simultaneously derived neutron capture cross sections in the range of unresolved resonances are in accord to experimental findings as well as to Maxwellian averages (kT=30 keV) of neutron capture cross sections compiled recently for simulations of nuclear reactions in AGB-stars.

HK 61.2 Fr 14:30 HZ 4

Measurement of the ^{20}N(γ,n)^{19}N cross section by Coulomb dissociation — •Marko Röder[1,2], Daniel Bemmerer[1], Thomas E. Cowan[1,2], Zoltán Elekes[1,3], Tobias Reinhardt[2,1], Andreas Wagner[1], and Kai Zuber[2] for the R3B-Collaboration — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR) — [2]Institut für Kern- und Teilchenphysik, Technische Universität Dresden — [3]MTA Atomki, Debrecen, Hungary

In the astrophysical r-process, many neutron-rich nuclei are involved. The reactions on these exotic nuclei can only be studied with radioactive ion beams. One example is the ^{19}N(n,γ)^{20}N reaction that is included in a neutrino-driven wind scenario. Using ^{20}N as a beam, this reaction was studied at the GSI Fragment Separator (FRS) in inverse kinematics via Coulomb dissociation in the S393-experiment. The relativistic neutrons were observed by the LAND-detector. I will give final results of the analysis, including the cross section of the ^{20}N(γ,n)^{19}N reaction, the γ-ray spectrum of excited ^{19}N from this reaction, and also some data on the ^{21}N(γ,n)^{20}N reaction.

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HK 61.3 Fr 14:45 HZ 4

Untersuchung der Reaktion ^{90}Zr(p,γ) mit In-beam Gammaspektroskopie — •Philipp Erbacher[1], Jan Glorius[1], Lars Netterdon[2], Anne Sauerwein[1], Kerstin Sonnabend[1], Benedikt Thomas[1] und Andreas Zilges[2] — [1]Institut für Angewandte Physik, Goethe Universität Frankfurt am Main — [2]Institut für Kernphysik - Universität zu Köln

Nach dem aktuellen Stand der Forschung wird der p-Kern ^{92}Mo zum größten Teil durch Photodesintegrationsreaktionen in Typ II Supernovae produziert. Netzwerkrechnungen zeigen jedoch, dass dieses Produktionszenario alleine nicht ausreicht, um die solare Häufigkeit von ^{92}Mo zu erklären. Als zusätzliches Produktionsszenario wurden daher Protoneneinfangreaktionen während Typ Ia Supernovae vorgeschlagen. Um diese Annahme zu überprüfen, ist eine genaue Kenntnis der relevanten Wirkungsquerschnitte notwendig. Aus diesem Grund wurde ein zu 97.65 % angereichertes ^{90}Zr-Target mit Protonen mit Energien von 2.5 MeV bis 5.1 MeV bestrahlt, um die Wirkungsquerschnitte der Reaktion in den Grundzustand und das Isomer von ^{91}Nb zu bestimmen. Die Messungen wurden am Horus-Spektrometer an der Universität zu Köln durchgeführt. In diesem Vortrag werden die vorläufigen Ergebnisse des Experiments vorgestellt.

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HK 61.4 Fr 15:00 HZ 4

Response functions of cold neutron matter: density, spin and current fluctuations — •Jochen Keller and Armen Sedrakian — Institut für Theoretische Physik, Goethe-Universität, Frankfurt am Main

We study the response of a single-component pair-correlated baryonic Fermi-liquid to density, spin, and their current perturbations. A complete set of response functions is calculated in the low-temperature regime. We derive the spectral functions of collective excitations associated with the density, density-current, spin, and spin-current perturbations. The dispersion relations of density and spin fluctuations are determined and it is shown that the density fluctuations lead to exciton-like undamped bound states, whereas the spin excitations correspond to diffusive modes above the pair-breaking threshold. The contribution of the collective pair-breaking modes to the specific heat of neutron matter at subnuclear densities is computed and is shown to be comparable to that of the degenerate electron gas at not too low temperatures.

HK 61.5 Fr 15:15 HZ 4

Nucleosynthesis of Molybdenum in neutrino-driven winds — •Julia Bliss[1] and Almudena Arcones[1,2] — [1]Institut für Kernphysik, TU Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH

Neutrino-driven winds that follow core-collapse supernovae are an exciting astrophysical site for the production of heavy elements. For a long time it has been thought that the neutrino-driven winds could be the host for the r-process, but recent hydrodynamical simulations show that the conditions are not sufficient neutron rich. Nonetheless, lighter heavy elements between Sr and Ag can be produced in neutrino-driven winds. Among these elements, Mo has raised attention since various astrophysical scenarios failed to reproduce the solar abundance ratio of $Y(^{92}\mathrm{Mo})/Y(^{94}\mathrm{Mo})$. Moreover, available data of SiC X-grains present different isotopic ratios than in the solar system. We have done a systematic nucleosynthesis study to identify the necessary conditions to reproduce the observed Mo isotopic ratios based on neutrino-driven winds.

HK 61.6 Fr 15:30 HZ 4

Proton-induced reactions on naturally composed zirconium — •Anne Sauerwein[1], Philipp Erbacher[1], Jan Glorius[1], Joachim Görres[1], Kerstin Sonnabend[1], Edward Stech[2], and Michael Wiescher[2] — [1]Institut für Angewandte Physik, Goethe Universität Frankfurt am Main, Germany — [2]Institute for Structure and Nuclear Astrophysics (ISNAP), University of Notre Dame, Indiana, USA and Joint Institute of Nuclear Astrophysics

Most reaction rates for the so-called p process, which produces the p nuclei, are adopted from Hauser-Feshbach-model (HFM) calculations. In order to improve the accuracy of theoretically predicted reaction rates, an improvement of its nuclear physics input is required. For this reason naturally composed zirconium was bombarded with protons at energies between 2 MeV and 10 MeV in order to determine cross sections of seven (p,γ) and (p,n) reactions using the activation technique. The irradiations and the γ-ray spectroscopy took place at the ISNAP of the University of Notre Dame, USA. These measurements allow systematic investigations of the proton-optical model potentials, an important input of the HFM, from the neutron closed-shell isotope ^{90}Zr to the double subshell-closed isotope ^{96}Zr. In this contribution we present our preliminary results.

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