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Investigation of the dipole response of 64Ni in real-photon scattering experiments

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One of the two main nucleosynthesis processes for explaining the formation and abundances of the neutron-rich nuclei in our universe is the slow neutron-capture process (s process). It takes place in environments with neutron densities in the range of 10^6–10^{12} cm^{-3}. Due to these relatively small neutron densities, the β- decay rate usually dominates over the neutron-capture rate and, hence, the s-process reaction path follows the valley of stability. At a so-called branching-point nucleus, the aforementioned reaction rates become competing and the reaction path branches. One of these branching-point nuclei is ^{63}Ni. Its radiative neutron-capture cross section is crucial for determining the corresponding branching ratio. Therefore, ^{63}Ni(n,γ) experiments have been performed [1,2]. But, the determined cross sections take only radiative-neutron captures on ^{63}Ni nuclei in the ground state into account and neglect that a certain amount is excited in stellar environments [3]. Hence, theoretical corrections have to be applied using, e.g., Statistical Hauser-Feshbach calculations [4]. For these, the Photon Strength Function (PSF) is one input parameter which is closely related to the photoabsorption cross section which can be deduced from real-photon scattering experiments.
Furthermore, systematic studies of the photoabsorption cross section can be utilized to investigate the properties of dipole excitation modes. For instance, in many nuclei an accumulation of electric dipole strength below and around the neutron separation threshold has been observed which is commonly denoted as Pygmy Dipole Resonance (PDR) [5]. During the last two decades, experimental and theoretical effort was put into the investigation of the PDR. Nevertheless, there are still some open questions concerning this excitation mode and systematic studies are crucial. Due to the wide range of N/Z ratios of stable, even-even nuclei, the nickel isotopic chain is well suited for this purpose. Real-photon scattering experiments have already been performed on ^{58,60,62}Ni [6-8] and the dipole responses of the unstable isotopes ^{68,70}Ni have been measured using relativistic Coulomb excitation in inverse kinematics [9-11]. Therefore, the missing link for completing this systematic investigation is ^{64}Ni.
Two complementary real-photon scattering experiments on ^{64}Ni were performed using a continuous bremsstrahlung and a quasi-monoenergetic photon beam to obtain the total and absolute photoabsorption cross section in a model-independent way. In this contribution, the corresponding experiments and preliminary results will be presented.
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[1] C. Lederer et al., Phys. Rev. Lett. 110, 022501 (2013)
[2] C. Lederer et al., Phys. Rev. C 89, 025810 (2014)
[3] T. Rauscher, Astrophys. J. Lett. 755, L10 (2012)
[4] W. Hauser and H. Feshbach, Phys. Rev. A 87, 366 (1952)
[5] D. Savran et al., Phys. Rev. C 84, 024326 (2011)
[6] F. Bauwens et al., Phys. Rev. C 62, 024302 (2000)
[7] M. Scheck et al., Phys. Rev. C 87, 051304(R) (2013)
[8] M. Scheck et al., Phys. Rev. C 88, 044304 (2013)
[9] O. Wieland et al., Phys. Rev. Lett. 102, 092502 (2009)
[10] D.M. Rossi et al., Phys. Rev. Lett. 111, 242503 (2013)
[11] O. Wieland et al., Phys. Rev. C 98, 064313 (2018)

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