DREB2022 - Direct Reactions with Exotic Beams



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Open quantum system behavior of a near threshold resonance in 11B

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A narrow near-threshold proton-emitting resonance (Ex=11.4 MeV,J π = 1/2+ and Γ p= 4.4 keV) was directly observed in ¹¹B via proton resonance scattering. This resonance was previously observed in the β -delayed proton emission of the neutron halo nucleus ¹¹Be [1]. The good agreement between both experimental results serves as a ground to confirm the existence of such exotic decay and the particular behavior of weakly bound nuclei as open quantum systems. *R*-matrix analysis and single-particle resonance show in agreement with the data that the resonance effect reaches far beyond the resonance width due to the fast increase of penetrability in this below-barrier domain. This unusual behavior can be considered as paradigm of an open quantum system. The shape of the resonance, a consequence of the interplay between the reaction mechanism and structure, clearly reveals the open quantum system nature of such narrow resonances. The resonance properties will be discussed with respect to the spectroscopic factor as obtained from *R*-matrix analysis and will be compared to arecent study of the same resonance by a transfer reaction10Be(d,n) [2].

[1] Y. Ayyad et al., Phys. Rev.Lett.123, 082501 (2019)

[2] E. Lopez Saavedra et al., in APS Division of Nuclear Physics Meeting Abstracts, Vol. 2021(2021) pp. EF-006.

Topic

Experiment

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