FORMFACTORS FOR THE PYGMY DIPOLE RESONANCE

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The presence of a new excitation mode know as the Pygmy Dipole Resonance (PDR) in nuclei with neutron excess, is well established. This mode is found at energy well below the Giant Dipole Resonance and it carries few percent of the isovector EWSR. This low lying dipole state is a mode whose isoscalar and isovector components are strongly mixed as it is clearly manifested in the corresponding transition densities. This feature allows the possibility to study these PDR states by using an isoscalar probe in addition to the conventional isovector one.

Many experiment have been done using isoscalar probes like α particles[1] or ^{17}O[2]. Structure information from the data can be extracted by comparing the experimental differential cross section with theoretical calculations. The latter relies however strongly on the model used for the construction of the radial form factors, which, in the standard codes, are produced according to some collective models prescriptions.

We use three different structure models for the PDR to calculate the transition densities. For all considered cases we use the double folding procedure to construct the corresponding form factors. In particular, we compare the transition density obtained from a RPA approach with the one extracted by a sum rule approach deduced for the high-lying isoscalar GDR (ISGDR)[3], and with the one deduced according to a simple macroscopic model for the PDR. While there is a very good agreement between the RPA result and the model for the ISGDR, in the case of the PDR state the three considered models lead to different slopes in the tails of the macroscopic and microscopic transition densities, with consequent differences in the corresponding form factors and cross sections[4].

Therefore, one has to be careful in using the proper form factor in the experimental analysis of PDR state excitations. Usually a DWBA calculation based on collective models is employed to establish the amount of B(E1) to attribute to the state as well as the percentage of EWSR to be assigned to it. Use of non-appropriate form factor has its consequence on the calculated cross section and therefore jeopardizing the extracted physical quantities. The microscopic form factor has the advantage that, by construction, it includes the important property of these states that is a strong mixing of isoscalar and isovector character.

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