IL NUOVO CIMENTO **47 C** (2024) 35
DOI 10.1393/ncc/i2024-24035-x

Colloquia: COMEX7

Systematic investigation of the Pygmy Dipole Resonance near the magic $N = 82$ shell closure

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received 31 October 2023

Summary. — The Pygmy Dipole Resonance is part of the electric dipole response of an atomic nucleus. There are still several open questions concerning, *e.g.*, its structure. Systematic studies are crucial to improve the knowledge of this excitation mode. Such systematic studies have already been performed along the magic $N = 82$ isotonic chain using the Nuclear Resonance Fluorescence (NRF) technique, hinting to a trend of increasing strength with increasing N/Z ratio. Comparing these results to those from further NRF experiments on neighbouring non-magic isotopes and on ^{142}Ce, a more fragmented strength distribution seems to occur.

1. – Introduction

The Pygmy Dipole Resonance (PDR) occurs as a concentration of electric dipole strength around and below the neutron-separation energy S_n and has been a research topic of great interest in theory and experiments for the last decades [1-3]. However, there are still several open questions concerning the PDR and its underlying structure. Systematic studies with the same probe are therefore crucial to improve the knowledge of this excitation mode.

Due to the small angular-momentum transfer of photons, the Nuclear Resonance Fluorescence technique is well suited for investigating the PDR [4]. Such NRF experiments have been performed using bremsstrahlung along the magic $N = 82$ isotonic chain. In these experiments, a general trend of increasing $E1$ strength with an increasing N/Z ratio has been observed [5, 6]. The question arised, how the PDR evolves if the magic neutron shell is crossed. For the Nd isotopic chain, theoretical calculations are available predicting an increasing strength with increasing neutron number [7]. Thus, NRF experiments on the neighbouring even-even isotopes ^{144,146}Nd and on ^{142}Ce have been performed.

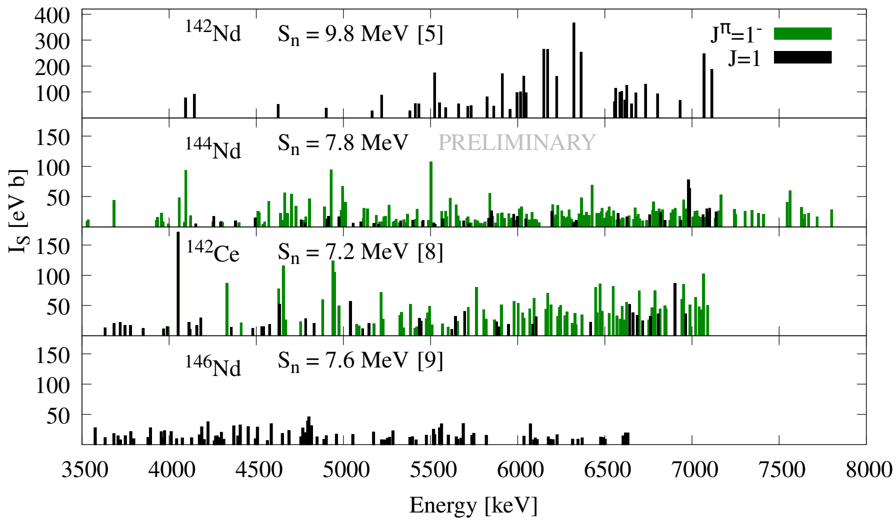

Fig. 1. – Comparison of the energy-integrated cross sections extracted in NRF experiments on ^{142,144,146}Nd and on ^{142}Ce. The green bars represent 1^- states, whereas the black bars are states where only the spin $J = 1$ could be determined.

2. – First Results

Comparing the energy-integrated cross sections extracted in NRF experiments on ^{142,144,146}Nd and on ^{142}Ce (cf. fig. 1), the $E1$ strength below S_n seems to be more fragmented with an increasing N/Z ratio. However, due to the rather high level density in these nuclei, a more meaningful comparison could be achieved by determining average quantities like the total photo-absorption cross section. This would take into account the entire electric dipole response of the nuclei, including unresolved strength and so-called inelastic decay channels, *i.e.*, decays that do not lead directly to the ground state but decay through lower-lying but still excited levels. This quantity can be obtained in a model-independent way in NRF experiments and has already been determined for ^{142}Ce [8] and will be done for ^{144}Nd.

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This work is partly supported by the BMBF (05P21PKEN9).

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