INTERACTION BETWEEN COLLECTIVE AND GENERALIZED NEUTRON P-H STATES IN THE DOUBLY-EVEN N=82 NUCLEI

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Inelastic proton scattering through isobaric analogue resonances (IAR) gives information that cannot be obtained with other spectroscopic means of study. This has been pointed out in (p,p´) reactions on doubly-even N=82 target nuclei where one is led to the existence of rather pure states, built from coupling neutron hole states to low-lying levels in the N=83 nuclei |1|.

Experiments on ^{142}Nd have shown that inelastic proton scattering through the $7/2^-_1$ IAR feeds more levels than can be accounted for within the simple GNP-H picture by coupling the $2d^{-1}_{3/2}$ and $3s^{-1}_{1/2}$ neutron holes to the $J^\pi = 7/2^-$ ground state of ^{143}Nd.

Other types of negative parity levels can occur in the relevant region of excitation energy corresponding to the unperturbed GNP-H multiplets ($E_x \cong 3.5$ MeV) (see fig. 1)

i) collective levels formed by coupling the one-quadrupole (2^+) and one-octupole (3^-) phonon states to the quintuplet $|2^+ \otimes 3^-|$; IM

ii) proton two-quasi particle excitations of the type $|1g_{7/2}1h_{11/2};IM\rangle$ and $|2d_{5/2}1h_{11/2};IM\rangle$.

Coupling levels of both type with the GNP-H basis states results in diagonalizing the residual interaction

$$H_{res} = \sum_{i=1}^{2} \sum_{\lambda} V_\lambda^{(i)}(r)\ \tilde{Y}_\lambda \cdot \tilde{Q}_\lambda^{(i)} + \sum_{\alpha,\beta,\gamma,\delta} \tilde{V}_{\alpha\beta\gamma\delta}\ N(a^+_\alpha a^+_\beta a_\delta a_\gamma)$$

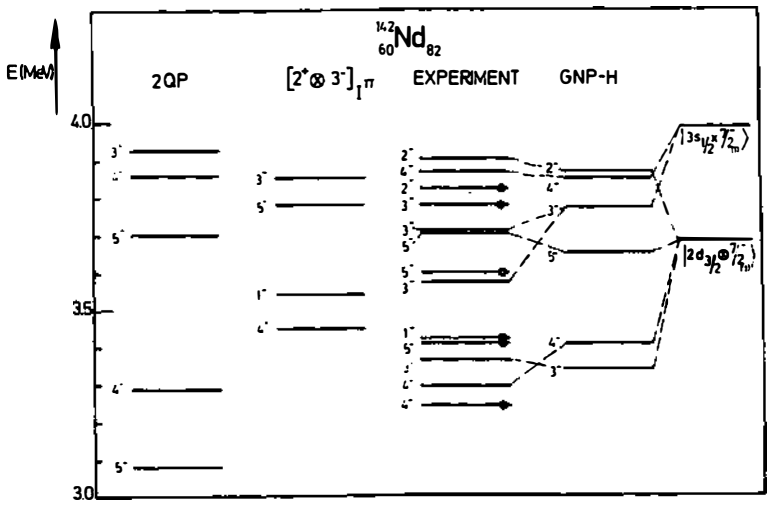

Fig. 1

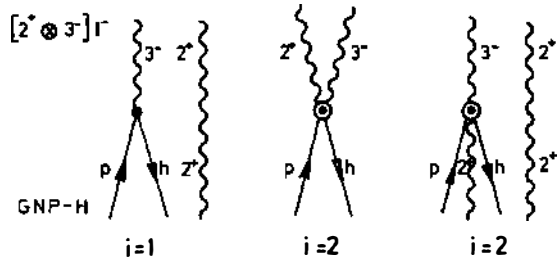

Fig. 2

with $V_\lambda^{(i)}(r)$, $\tilde{O}_\lambda^{(i)}$ as given in ref. |2|, and $\tilde{v}_{\alpha\beta\gamma\delta}$ describing the proton-neutron interaction.

The first part of H_{res} connects the GNP-H states to the collective $|2^+ \otimes 3^-|I^-$ levels (interaction vertices are indicated in fig. 2; there the i=1 and i=2 diagrams describe first and second order terms of the particle-core coupling), whereas the second part describes the

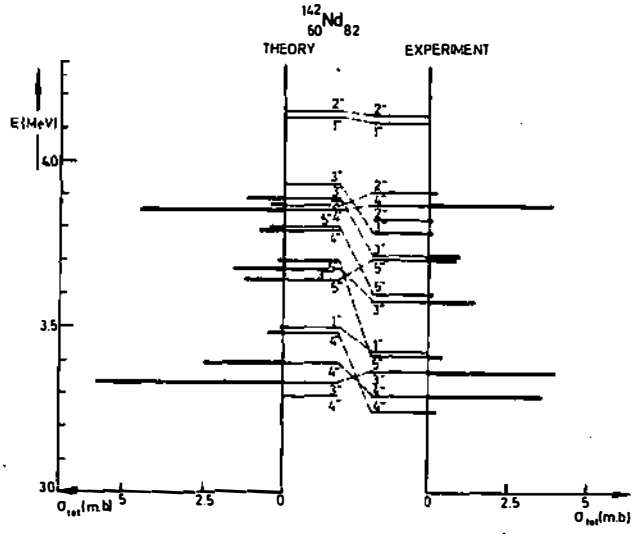

Fig. 3

interaction between proton 2-quasi particle and GNP-H configurations.

The coupling strengths are calculated explicitly using a Woods-Saxon potential and the weight functions $V_\lambda^{(i)}(r)$. Proton-neutron matrix elements are obtained using the Sussex matrix elements.

As a result, the coupling of GNP-H states, mainly with the collective degrees of freedom, results in an energy spectrum in good agreement with experimental data. Also, a description of the total cross section for proton inelastic scattering through the $7/2_1^-$ IAR is studied (fig. 3) and compared with the experimental results.

REFERENCES

|1| K. Heyde, M. Waroquier and H. Vincx, Generalized neutron p-h states in a unified-model description, contribution to this Conference.

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