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Generalised Pandya relations for the neutron-proton interaction

The Pandya relation connects the interaction between two particles (or two holes) with the interaction between a particle and a hole [1], and follows from the action of the particle-hole conjugation operator in the context of the shell model [2]. The relation has been used extensively to correlate spectra of pairs of nuclei, for example ^{40}K and ^{38}Cl [3]. Many other examples are known [4,5].

Another useful symmetry of the shell model is seniority, which refers to the number of nucleons that are not in pairs coupled to angular momentum zero [6]. In semi-magic nuclei seniority is an approximate symmetry of the eigenstates of the nuclear Hamiltonian but, more generally, it is a quantum number that can be used to label basis states.

In this talk it is shown that generic expressions of the neutron-proton interaction in a seniority basis reveal a connection with particle-hole conjugation, leading to generalised Pandya relations in terms of $3nj$ symbols of angular-momentum recoupling coefficients. Examples of its application in nuclei are presented.

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