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Quarteting in N=Z nuclei

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The phenomenon of quarteting in even-even $N = Z$ nuclei has a
long history in nuclear structure [1]. In spite of that, several unexplored and yet interesting aspects of this phenomenon have come to light only in recent years. In Ref. [2], we have evidenced on analytic grounds the key role played by the isovector pairing in the phenomenon of nuclear quarteting. We have indeed shown that α-like quartets, i.e., correlated four-body structures made by two protons and two neutrons, do represent the distinctive feature of the exact eigenstates of this Hamiltonian in $N = Z$ even-even systems. But how do quartets evolve in the presence of a general Hamiltonian?
I will provide a description of deformed $N = Z$ nuclei in the
sd and pf shells in a formalism of α-like quartets.
I will show how these quartets can be built by resorting to
the use of proper intrinsic states and I will perform configuration-interaction calculations in spaces built with these quartets.[3]
As a peculiarity of this approach, which improves a technique
employed in previous works [4,5], it will be shown
that the spectra of these nuclei can be organized in bands
associated with the various intrinsic states built in terms of
quartets. It will also be shown that the same bands simply
result from the angular momentum projection of these intrinsic states.
Comparisons with experiment and shell model results will be provided.

[1] A. Arima, V. Gillet, and J. Ginocchio, Phys. Rev. Lett. 25 (1970) 1043.
[2] M. Sambataro and N. Sandulescu, J. Phys. G.: Nucl. Part. Phys. 47 (2020) 045112.
[3] M. Sambataro and N. Sandulescu, Phys. Lett. B 827 (2022) 136987.
[4] M. Sambataro and N. Sandulescu, Phys. Rev. Lett. 115 (2015) 112501.
[5] M. Sambataro and N. Sandulescu, Phys. Rev. C 91 (2015) 064318.

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