Low–Lying Nuclear Structure of Even Zirconium Isotopes

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The aim of the talk is to discuss the low–lying shell structure properties of even zirconium isotopes studies by large scale shell model calculations.

We use an iterative matrix diagonalization algorithm for solving the eigenvalue problem in the m – scheme complemented by an importance sampling for an effective truncation of the shell model space [1].

We study the properties of the first few isotopes of the zirconium chain. Their low–lying spectra have been object of intensive experimental studies, [2, 3] to mention just two of them, which raised a series of questions, like the evolution of the shell structure and the nature of the mixed symmetry states.

The reliability of our results is assured by a sufficiently large model space spanned over the $(1f_{5/2}, 2p_{1/2}, 2p_{3/2}, 1g_{9/2})$ levels for protons and $(2d_{5/2}, 3s_{1/2}, 2d_{3/2}, 1g_{7/2}, 1g_{9/2}, 1h_{11/2})$ for neutrons. In this case a rigorous procedure for truncation the configuration space for heavier isotopes is required and we implement the importance sampling mentioned above. The effective nucleon–nucleon interaction within the chosen configuration space is generated by the code of M. Hjorth-Jensen [4] based on the "N3Lo" nucleon-nucleon potential.

We report excitation energies, occupation numbers of the single–particle levels and transition probabilities which revile the structure of the low–lying nuclear spectrum.

References

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