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Nuclear shell model in a quantum computer

Quantum computing has the potential to provide new algorithms to solve problems that are otherwise untractable classically. Among these problems, one can employ quantum computers to solve quantum many-body problem. In this talk, I will review two different algorithms to attempt and solve the nuclear shell model in quantum computers. One approach is based on variational quantum eigensolvers, a well-known approach for which we have quantified the required resources for nuclear physics applications [1,2,3]. The other approach looks into quantum annealers as many-body solvers, which have surprisingly good scaling properties in mid-shell isotopes [4].

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[2] A. Pérez-Obiol, S. Masot-Lima, A. M. Romero, J. Menéndez, A. Rios, A. García-Sáez and B. Juliá-Díaz, Quantum entanglement patterns in the structure of atomic nuclei within the nuclear shell model, *Eur. Phys. J. A* 59, 240 (2023), arXiv:2307.05197.

[3] A. Pérez-Obiol, S. Masot-Lima, A. M. Romero, J. Menéndez, A. Rios, A. García-Sáez and B. Juliá-Díaz, Entropy-driven entanglement forging, arXiv:2409.04510.

[4] E. Costa, A. Pérez-Obiol, J. Menéndez, A. Rios, A. García-Sáez, and B. Juliá-Díaz, A Quantum Annealing Protocol to Solve the Nuclear Shell Model, arXiv:2411.06954.

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