

Nuclear Lunch Questions: January 31, 2023

Paper: “*Neutrinoless double- β decay: Combining quantum Monte Carlo and the nuclear shell model with the generalized contact formalism,*” Ronen Weiss, Pablo Soriano, Alessandro Lovato, Javier Menendez, and R. B. Wiringa, *Phys. Rev. C* **106**, 065501

Questions:

1. What exactly is neutrinoless double-beta decay? What is the Feynman diagram? What are Majorana and Dirac particles? [Joseph Derkin]
2. What are recent and/or upcoming experimental campaigns to search for neutrinoless double-beta decay? Why are they challenging? [Sijan Regmi]
3. What would be the implications if we measured neutrinoless double-beta decay? What are the challenges for nuclear theory for predicting neutrinoless double-beta decay? [Bikash Chauhan]
4. What are the novelties and key achievements presented in the paper? [Shyam Bahadur Chauhan]
5. What is the tool of choice for carrying out high-dimensional integrals and why? What is the so-called “curse of dimensionality?” [Chirag Rathi]
6. How does Variational Monte Carlo work in a nutshell? What are its limitations? [Bradley McClung]
7. What are the “Metropolis-Hastings Monte Carlo techniques” mentioned in the paper, and how do they work? [Michael Jeswald]
8. What are the nuclear interactions used for in the paper? What type of interaction(s) do they describe? What are Illinois and Urbana potentials? [Nisha Singh]
9. What is Green’s Function Monte Carlo? How does it work? Does it belong to the family of Quantum Monte Carlo methods? [Justin Bryan]
10. How is the trial wave function for the Variational Monte Carlo calculations constructed? What are the components? What is a Jastrow function? [Pramita Tiwari]
11. What is a transition density? And what role do transition densities play in the paper? [Yenuel Jones-Alberty]
12. What is the computational scaling of Variational Monte Carlo? See also Eq. (15). [Joseph Foy]
13. What are short-range correlations, and how are they treated in the paper? [Andrius Burnelis]
14. What is Model Order Reduction? Can we use it to extend *ab initio* calculations of light nuclei to heavier masses? [Alexandra Semposki]