THE PHYSICS COLLOQUIUM

Thursday 19 October 2023, 4:00 p.m.
Nijenborgh 4, **Room 5114.0043**

Implications of PREX-II and CREX experiments for relativistic nuclear energy density functionals

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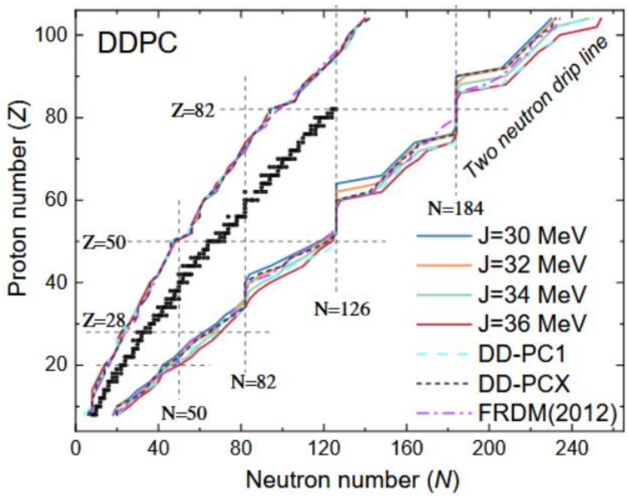
The nuclear energy density functional (NEDF) theory represents a unified approach to studying and understanding the properties of atomic nuclei along the nuclide map and the equation of state of nuclear matter. Over the past few decades, significant progress has been made in constructing NEDFs using both relativistic and non-relativistic frameworks. Until now, NEDFs have primarily been parameterized using experimental data related to the ground-state properties (e.g., masses, charge radii, spin-orbit splitting) of nuclei. However, these observables are insufficient to fully constrain the effective interaction, particularly its isovector component. It is well-known that the isovector part of the EDFs is crucial for understanding the characteristics of neutron-rich drip line nuclei and determining the density dependence of the nuclear symmetry energy.



Recently, we have constrained new NEDFs based on the relativistic density-dependent point coupling model. When optimizing these new functionals, we incorporate not only nuclear ground-state properties but also weak-charge form factors from the PREX-II [1] and CREX [2] experiments. By integrating weak-charge form factor data into the optimization procedure, we have uniquely constrained the isovector channels of the effective interactions for each functional for the first time [3]. In this presentation, I will begin by discussing the importance of the nuclear equation of state symmetry energy in nuclear physics studies, with a primary focus on the neutron-rich side of the nuclear landscape and drip lines [4]. Following that, I will delve into the contradictory findings arising from these new functionals and their implications for predictions of nuclear properties [3].

[1] D. Adhikari and PREX Collaboration, Phys. Rev. Lett. 126, 172502 (2021).
[2] D. Adhikari and CREX Collaboration, Phys. Rev. Lett. 129, 042501 (2022)
[3] E. Yüksel and N. Paar, Physics Letters B, 836, 137622, (2023).
[4] A. Ravlić, E. Yuksel, T. Nikšić, N. Paar, arXiv:2308.16533 (2023).

Join us for coffee starting 3:30 p.m. Refreshments will be served after the lecture.
For more information contact the host: Anastasia Borschevsky (a.borschevsky@rug.nl)
Website: http://www.rug.nl/research/vsi/colloquia/