

# NUCLEON CORRELATIONS AS A FUNCTION OF NUCLEON ASYMMETRY

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## ABSTRACT

A short review is given of our present understanding of the role of short- and long-range physics in determining nucleon properties near the Fermi energy for stable closed-shell nuclei<sup>1</sup>. Since proton and neutron Fermi liquids behave differently when nucleon asymmetry is increased, a theoretical method is utilized that employs data to make sensible predictions of nucleon correlations when the dripline is approached. Such a method is provided by the dispersive optical model (DOM) analysis of nucleons developed by Mahaux and Sartor<sup>2</sup>. A recent application of this method to <sup>40</sup>Ca and <sup>48</sup>Ca expands on this work to establish the nucleon asymmetry dependence of the DOM potentials<sup>3</sup>. The results imply that protons with energies near the Fermi surface experience larger correlations with increasing nucleon asymmetry. The influence of collective low-lying excitations, in particular the Gamow-Teller resonance may be responsible for this empirical observation. Based on the extracted nucleon asymmetry dependence, it is possible to predict the properties of neutron-rich calcium isotopes. Predictions for <sup>60</sup>Ca suggest that the Z=20 shell closure may disappear and protons near the Fermi energy may exhibit pairing. Extensions of this work are discussed that consider the implied consequences for neutrons<sup>4</sup>. In particular, it will be possible to predict the location of the neutron dripline for the Ca isotopes. Suitable experiments at rare isotope facilities are pointed out to further constrain the predictions towards the dripline.

## REFERENCES

- [1] Dickhoff, W.H. and Barbieri, C., *Prog. Part. Nucl. Phys.* **52**, 377 (2004).
- [2] Mahaux, C. and Sartor, R., *Adv.Nucl. Phys.*, **20**, 1 (1991).
- [3] Charity, R.J., Sobotka, L.G. and Dickhoff, W.H., *Phys. Rev. Lett.* **97**, 162503 (2006).
- [4] Charity, R.J., Sobotka, L.G., Mueller, J. and Dickhoff, W.H., *Phys. Rev C***76**, 044314 (2007).