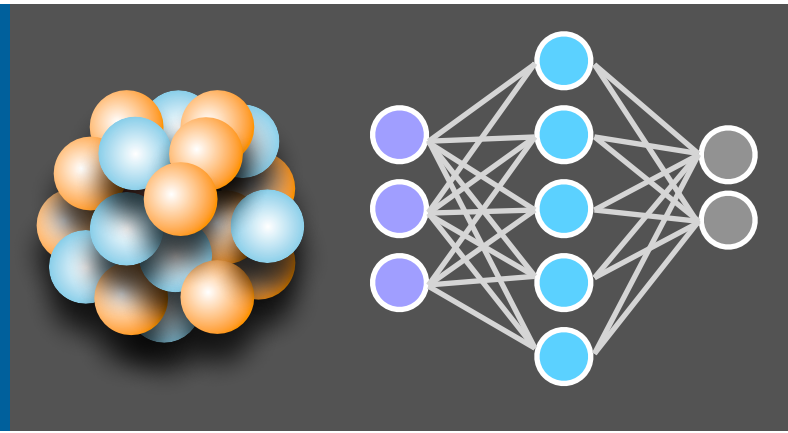
VARIATIONAL LEARNING NUCLEAR MATTER



ALESSANDRO LOVATO

IFIC Newcomers Fest 2025

December 12, 2025

CAREER RECAP

2006: *Bachelor in Physics from "Sapienza" University (Rome, Italy)*

2008: *Master in Particle Physics from "Sapienza" University (Rome, Italy)*

2012: *PhD in Astro-Particle Physics from "SISSA" (Trieste, Italy)*

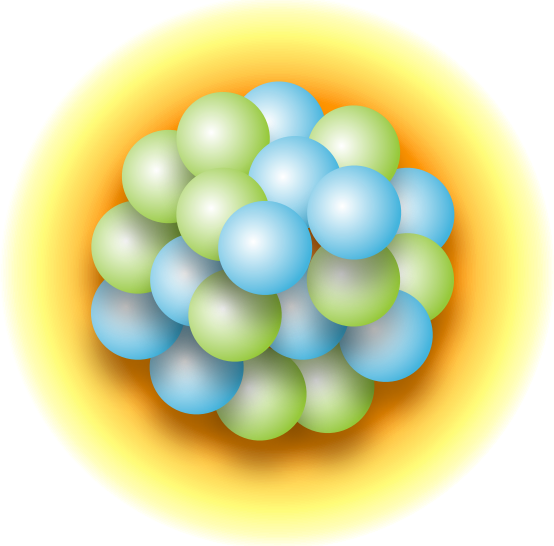
2012 - 2014: *Postdoc in the ALCF Division at Argonne*

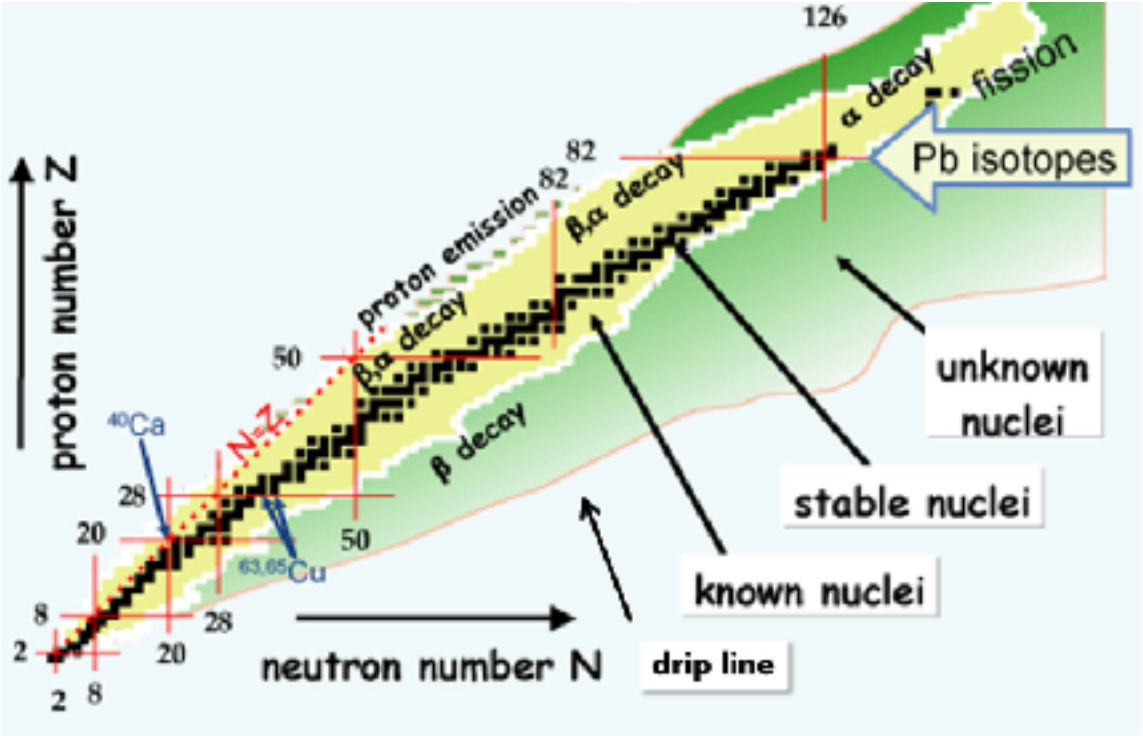
2014 - present: *(on leave) Staff Scientist in the Physics Division at Argonne*

2018 - present: *(on leave) Researcher at INFN-TIFPA (Trento, Italy)*

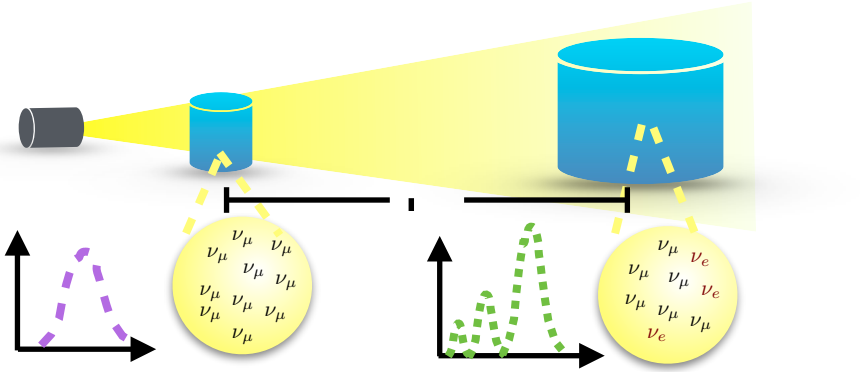
2025 - present: *Visiting the IFIC*

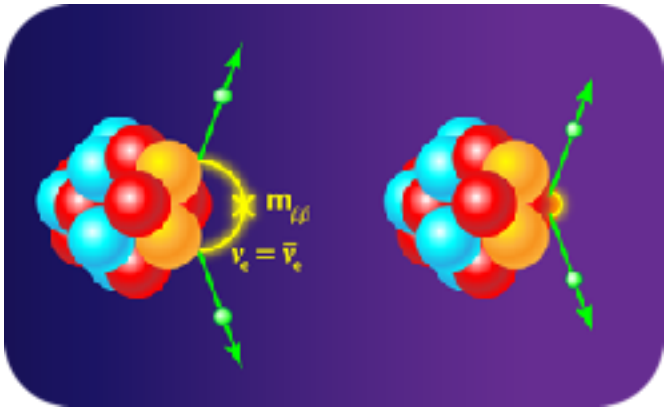
NUCLEAR PHYSICS OVERVIEW

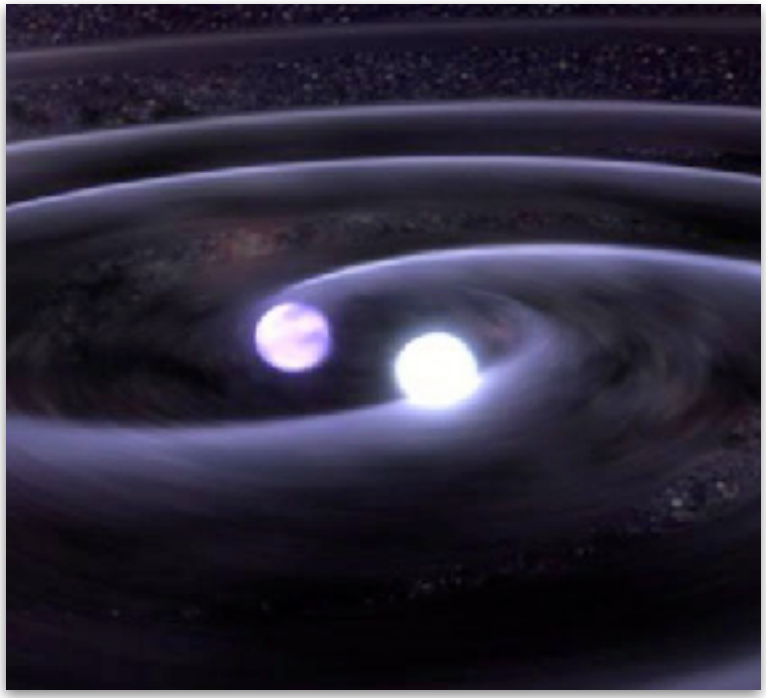




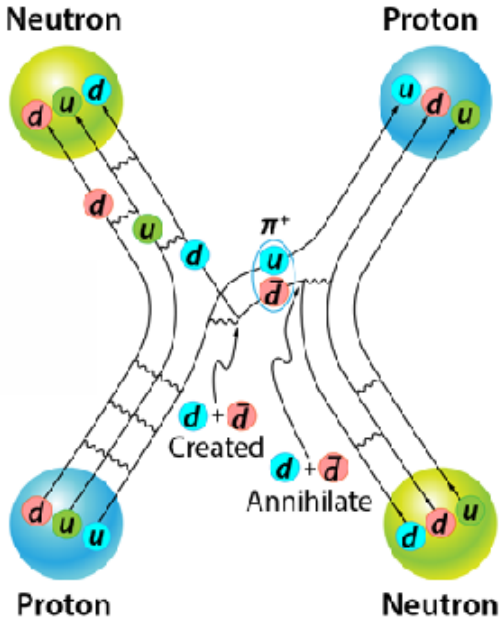
BROADER IMPACT

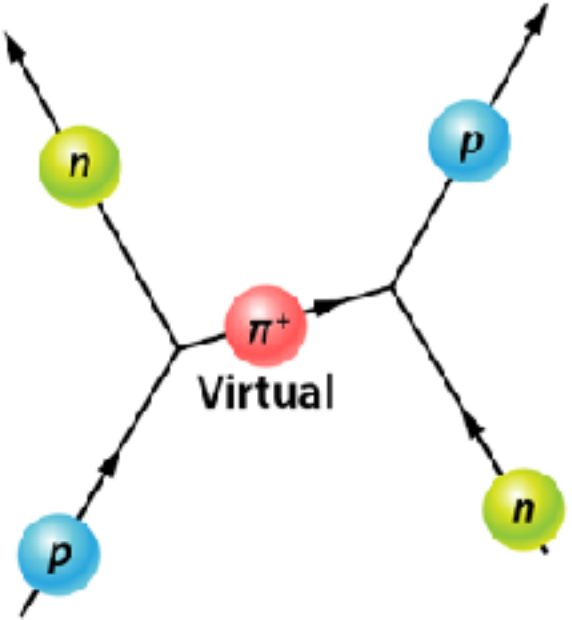






“AB-INITIO” NUCLEAR THEORY



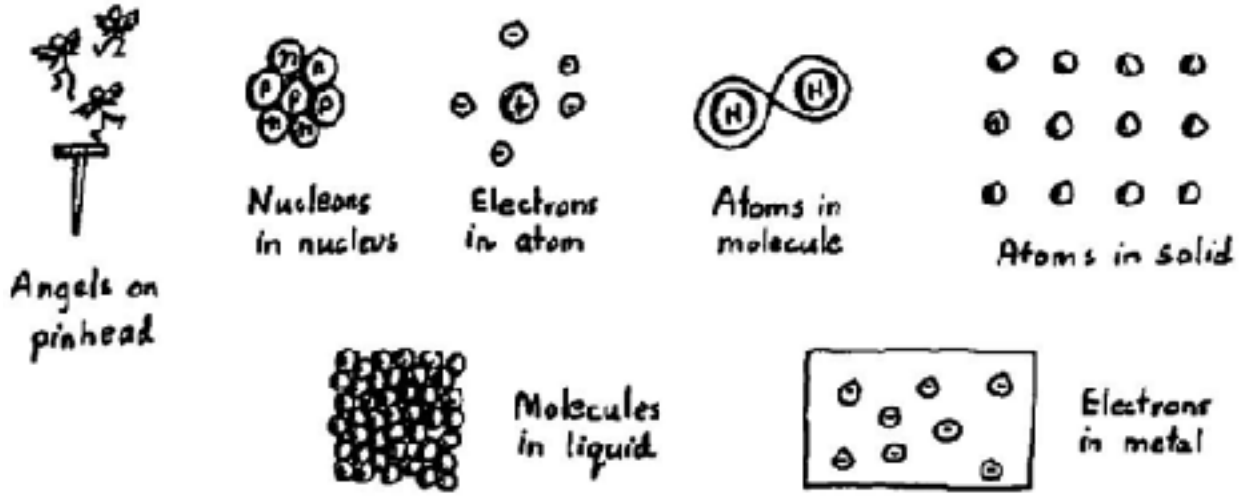


$$H = \sum_i \frac{\mathbf{p}_i^2}{2m} + \sum_{i<j} v_{ij} + \sum_{i<j<k} V_{ijk}$$

Illustration by APS / Alan Stonebraker

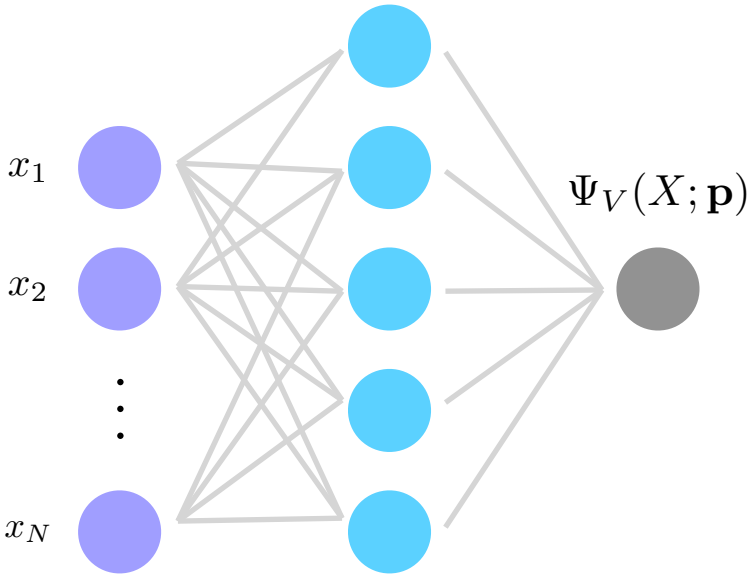
“AB-INITIO” NUCLEAR THEORY

$$H\Psi_n(x_1, \ldots, x_A) = E_n\Psi_n(x_1, \ldots, x_A)$$



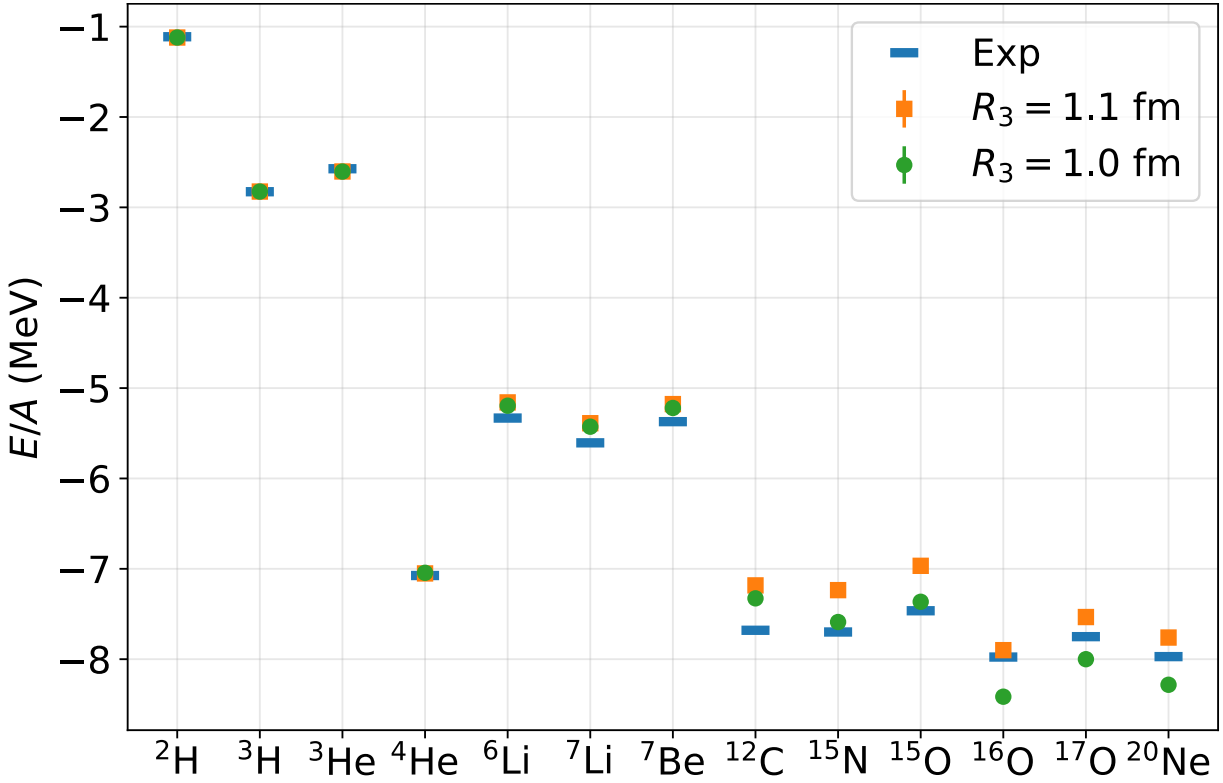
A guide to Feynman diagrams in the many-body problem

NEURAL-NETWORK QUANTUM STATES



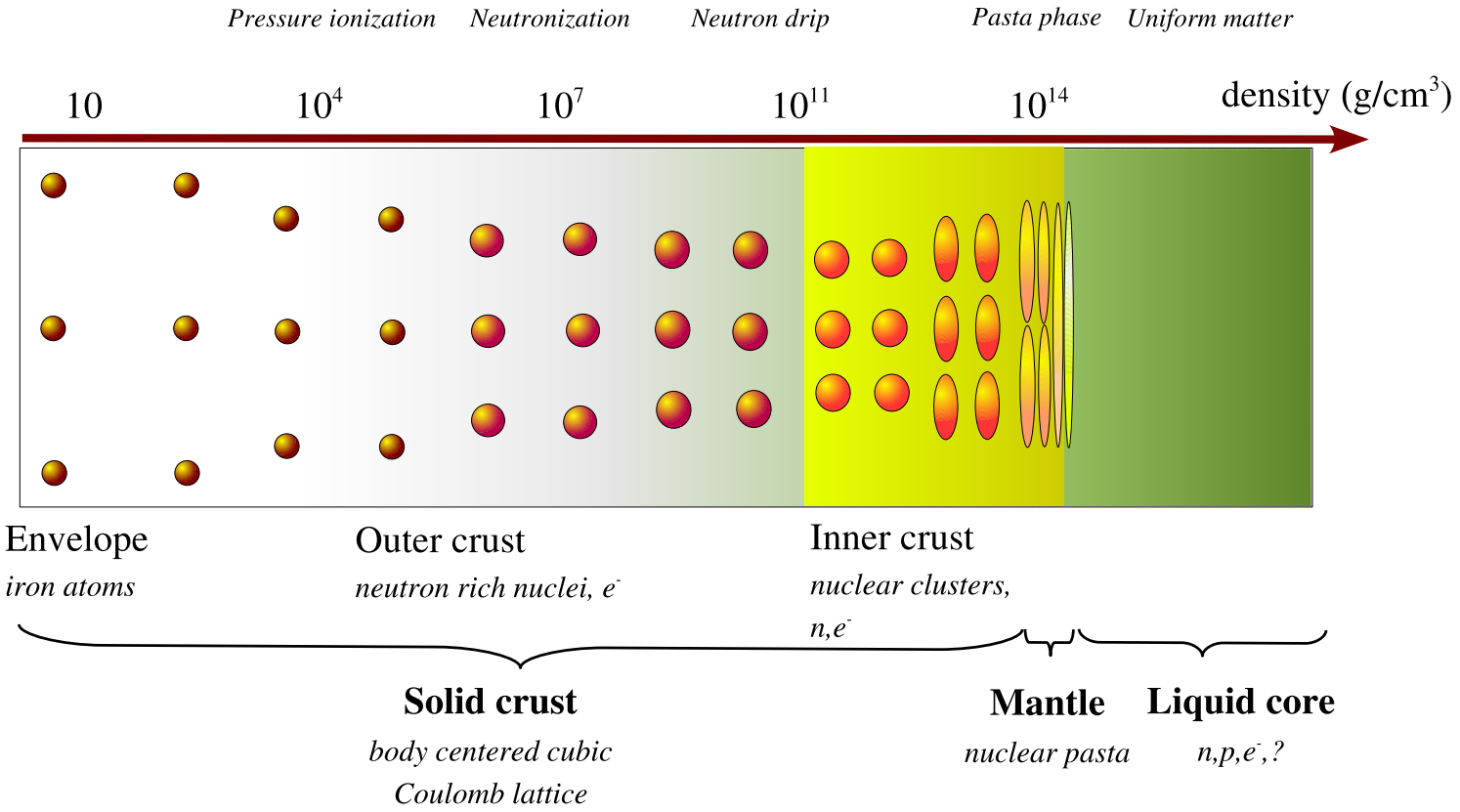
C. Adams, AL, et al., Phys. Rev. Lett. ***127*** *(2021) 2, 022502*

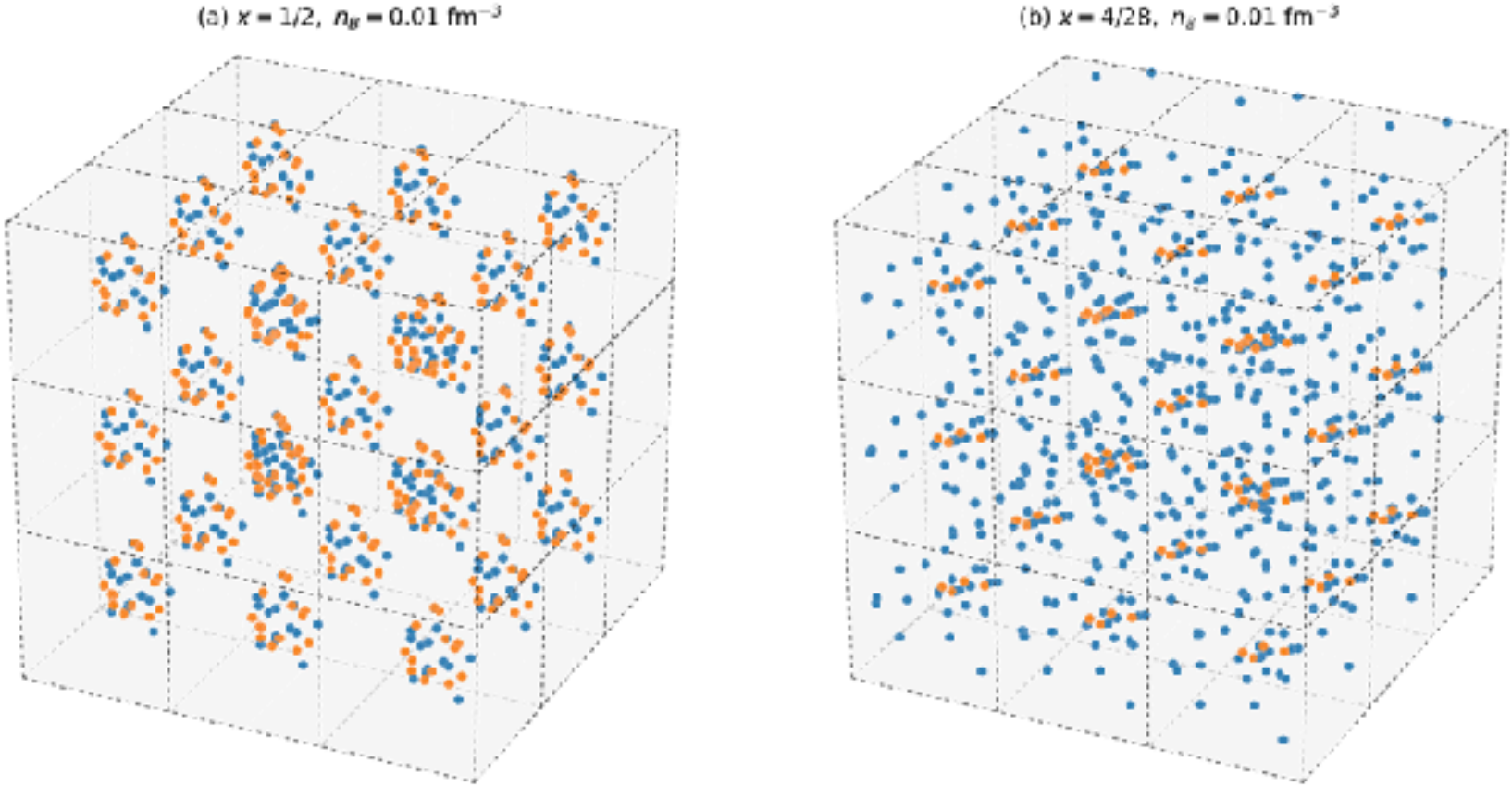
NUCLEAR STRUCTURE WITH NQS



A. Gnech, AL, Phys. Rev. Lett. 133 (2024) ***14****, 142501*

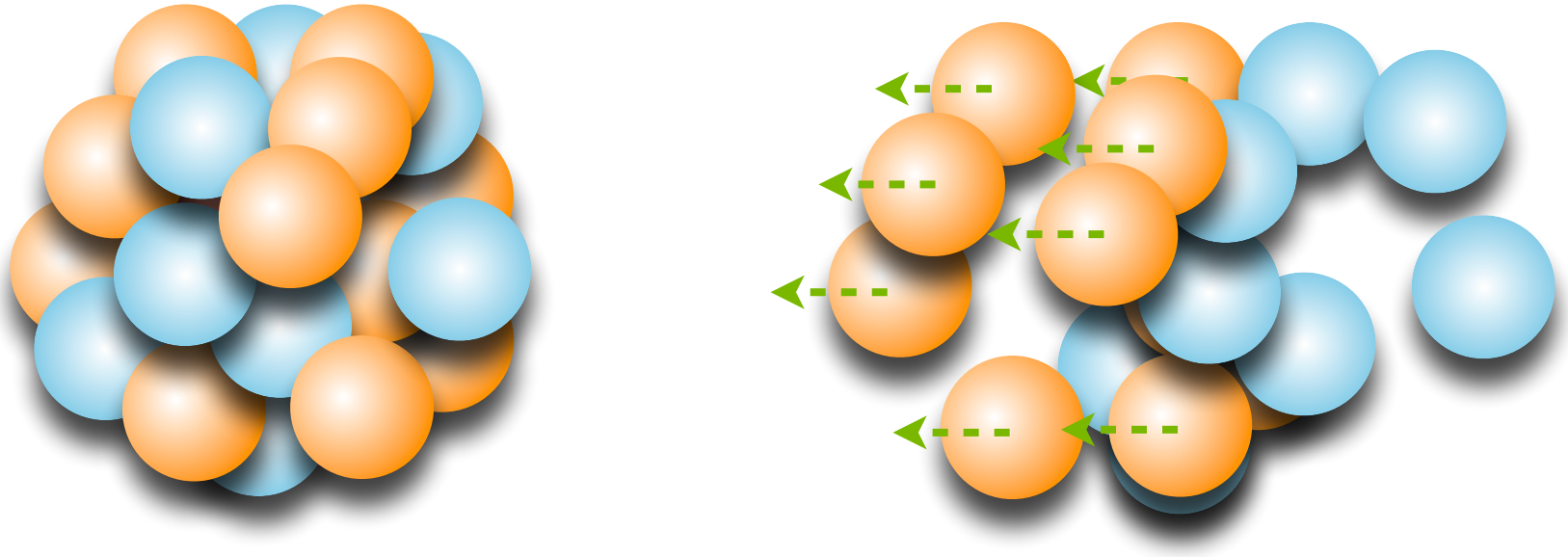
NEUTRON STARS WITH NQS



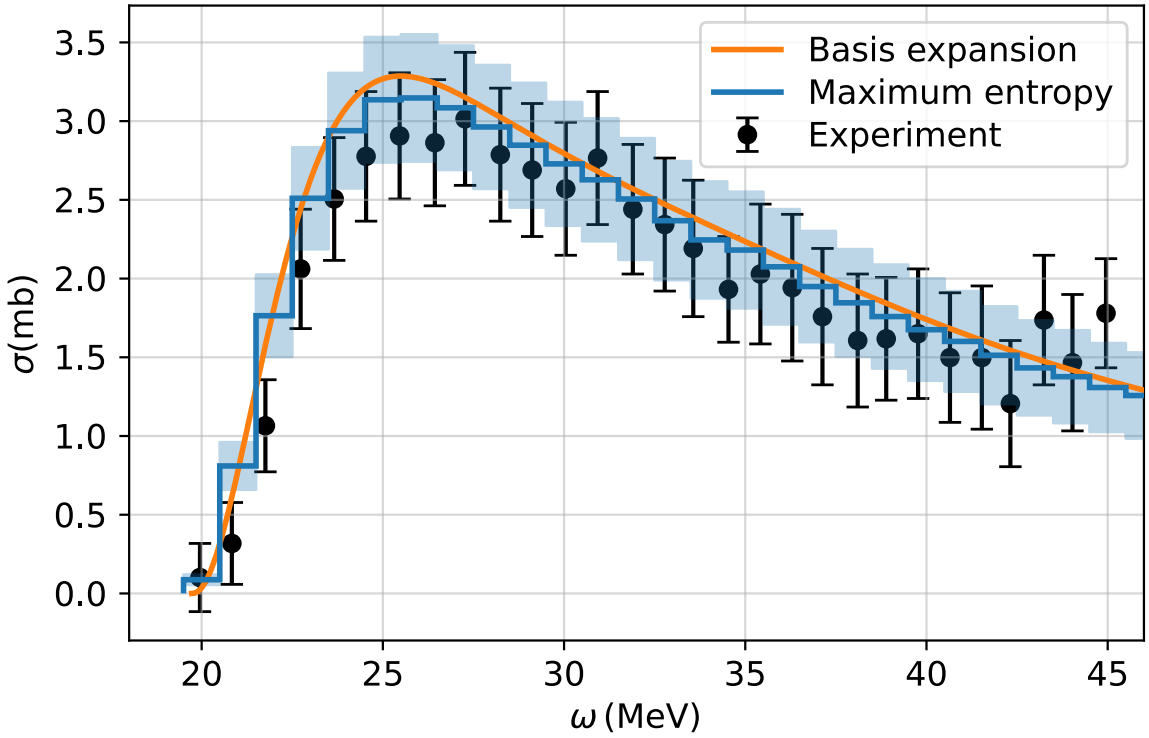


B. Fore, AL et al. Nat. Commun.Phys. 8 (2025) 1, 108

NUCLEAR DYNAMICS WITH NQS



NUCLEAR DYNAMICS WITH NQS



E. Parnes, et al., arXiv:2504.20195 [nucl-th]

THANK YOU