# Neutron Drip Line in the Ca Region from Bayesian Model Averaging

U.S. DEPARTMENT OF ENERGY | Office of Science

NUCLEI Nuclear Computational Low-Energy Initiative

## Objectives

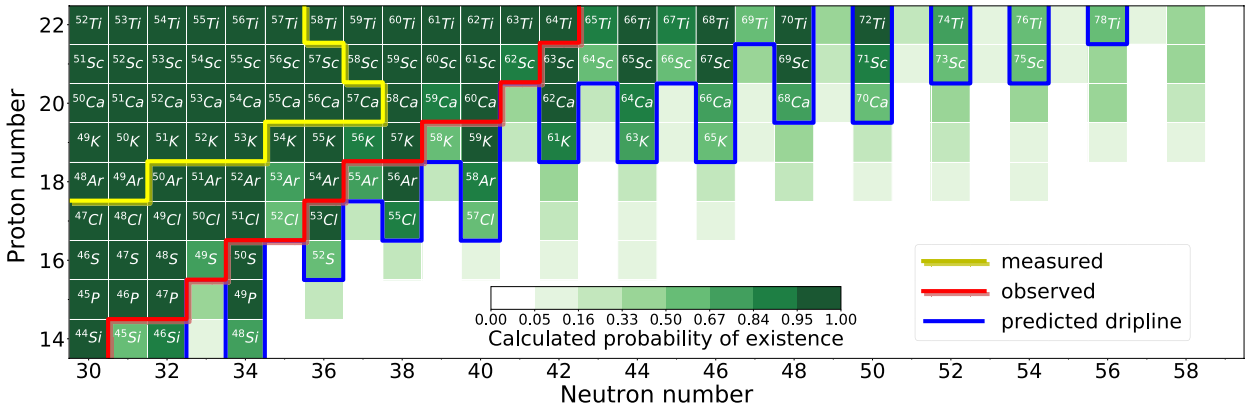
- In light of the recent discovery of eight new isotopes of the elements phosphorus, sulfur, chlorine, argon, potassium, scandium, and calcium, we estimated the boundaries of nuclear existence in the calcium region with a full quantification of uncertainties, assessing the impact of the experimental discovery on nuclear structure research.
- Using a Bayesian model averaging analysis based on Gaussian-process-based extrapolations we computed the posterior probability for each nucleus to be bound to neutron emission and make predictions, with quantified levels of certainty, for bound nuclides between silicon and titanium.

## Impact

- The increase in the predictive power of microscopic models aided by the Bayesian Model Averaging is excellent.
- The proposed supervised machine learning methodology made it possible to quantify predictions' uncertainties precisely and reliably.
- The proposed robust statistical extrapolation approach can be useful for assessing the impact of current and future experiments.

## Accomplishments

- Publication: L. Neufcourt, Y. Cao, W. Nazarewicz, E. Olsen, and F. Viens, Phys. Rev. Lett. 122, 062502 (2019).




The nuclei with experimentally-known masses lie to the left of a yellow line. Left of the red line lie nuclei that have been experimentally observed. Those awaiting discovery lie to the right of the line. The calculated limit of existence (probability >50 %) is indicated by the blue line.