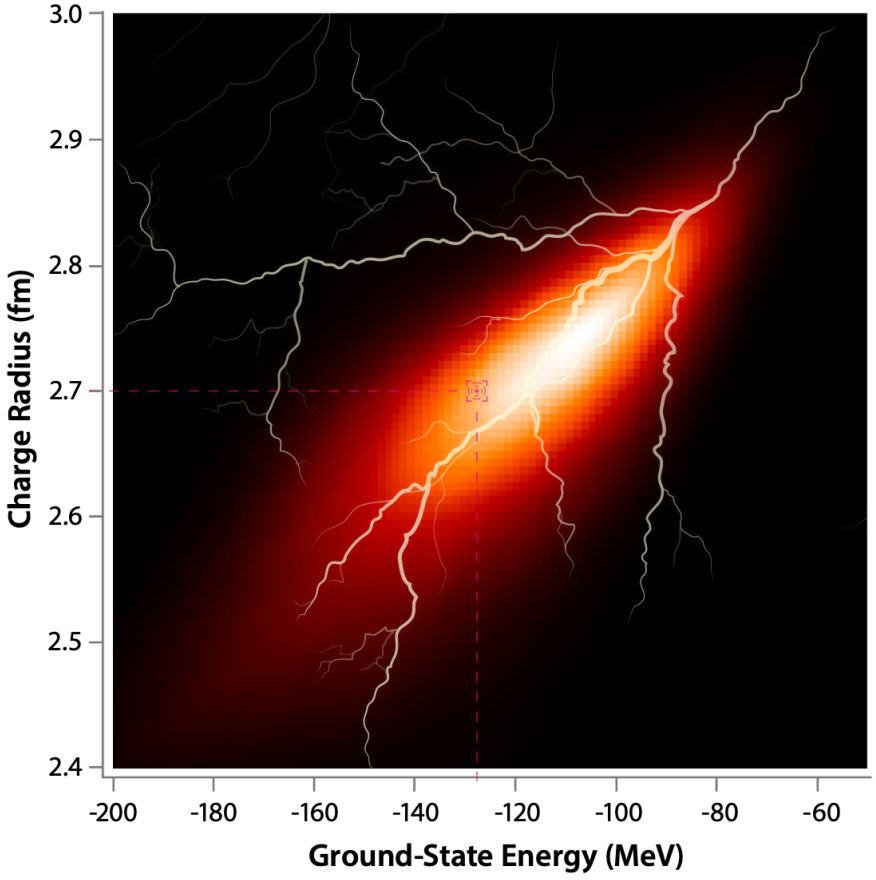
U.S. DEPARTMENT OF ENERGY | Office of Science

Computing nuclei at lightning speed

NUCLEI Nuclear Computational Low-Energy Initiative

Objectives

- Develop a method that accurately emulates exact coupled-cluster calculations of nuclei
- Perform a global sensitivity analysis of the radius and binding energy of ^{16}O



Impact

- This method allows for the computation of atomic nuclei for a million different models of the nuclear interaction on a standard laptop once the emulator is constructed
- The results elucidate the complicated nature of describing the radius and binding energy of nuclei
- This speedup enables statistical computing of the nuclear interaction, and entirely new ways to use experimental data across the nuclear chart to generate new knowledge about the strong nuclear interaction

Accomplishments

- Publication: Andreas Ekström and Gaute Hagen Phys. Rev. Lett. **123**, 252501 (2019)
- DOE Office of Science highlight

Plot of 100,000 predictions of the radius & energy of the atomic nucleus of oxygen-16 for different of models of the nuclear interaction. The new method generated the results on a laptop in just a few minutes. Dashed lines show experimental data.