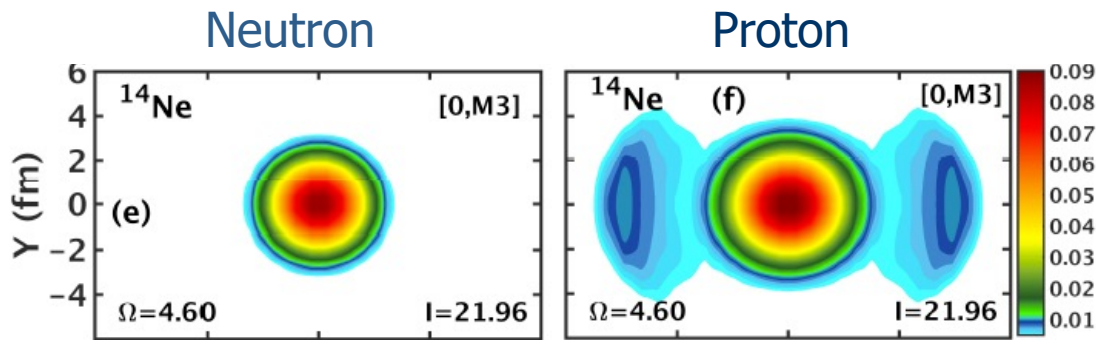# Covariant density functional theory in the FRIB era

Anatoli Afanasjev

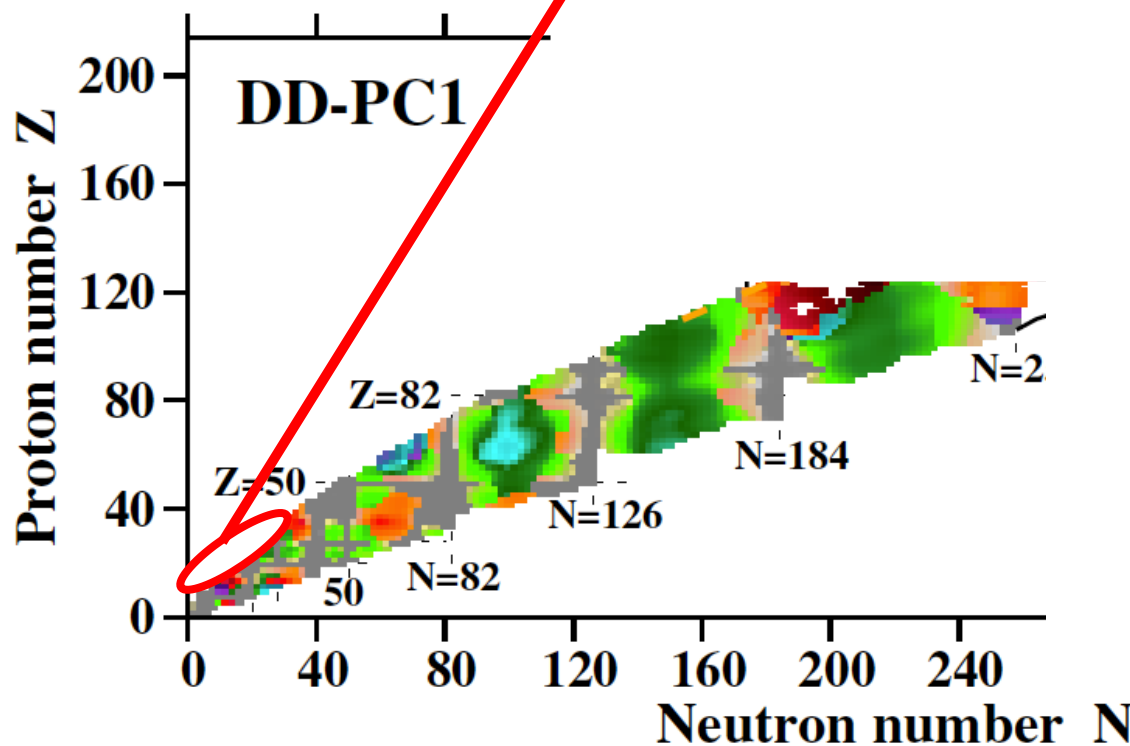Mississippi State University (MSU), USA

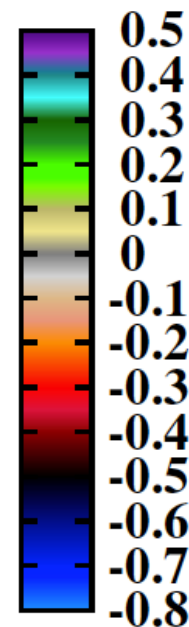Neutron   Proton

Submitted to EPJ

Extension of proton drip line for ellipsoidal shapes

Giant proton halo in rotating nuclei

Deformation

PRC 99, 034316 (2019), PLB 782, 533 (2018), PRC 103, 034323 (2021)

Recent highlights

1. New mechanism of odd-even staggering in charge radii: particle-vibration coupling affecting the energies and the wave functions of odd-N nuclei

2. Anchor-based method of global optimization of functionals (subm. PRC):
   DD-ME: from 2.5-2.8 MeV down to 1.7 MeV
   NLME: from 2.8 MeV down to 2.3 MeV
   PC: from 2.5 MeV down to 1.9 MeV

Future

1. 5-dimensional collective Hamiltonian (cranked 5DCH) in the basis of cranked states → better understanding of shape coexistence and quantum shape transitions, global calculations of masses

2. Global optimization of CEDFs
   (a) at the mean field (with rotational and vibrational corrections)
   (b) at the level of cranked 5DCH
   -- (a) → theoretical systematic uncertainties, form of the functionals. localized form of exchange terms, selection of the CEDF for step (b)

3. Beyong mean field effects on charge radii, especially, those for odd-even staggering of charge radii

4. Nuclear input (ground states, fission barriers) for r-process simulations. r-process simulations with CDFT nuclear input