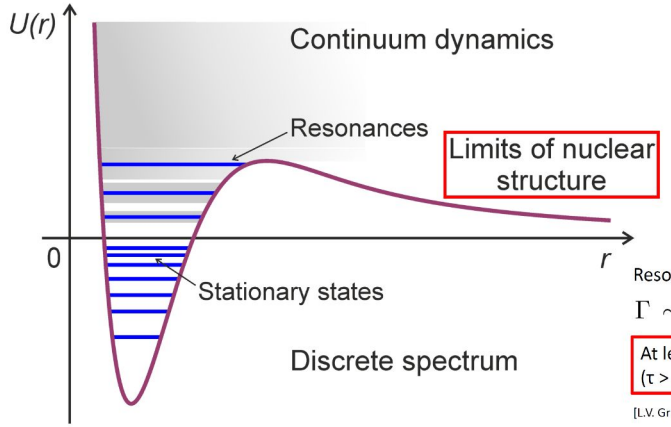
Exotic nuclei studied by their in-flight radioactivity

Ivan Mukha

How far beyond the dripline does the nuclear structure reach?



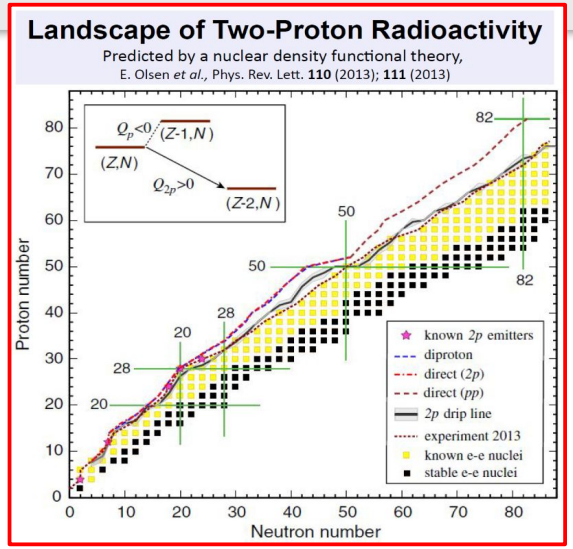
Resonances:

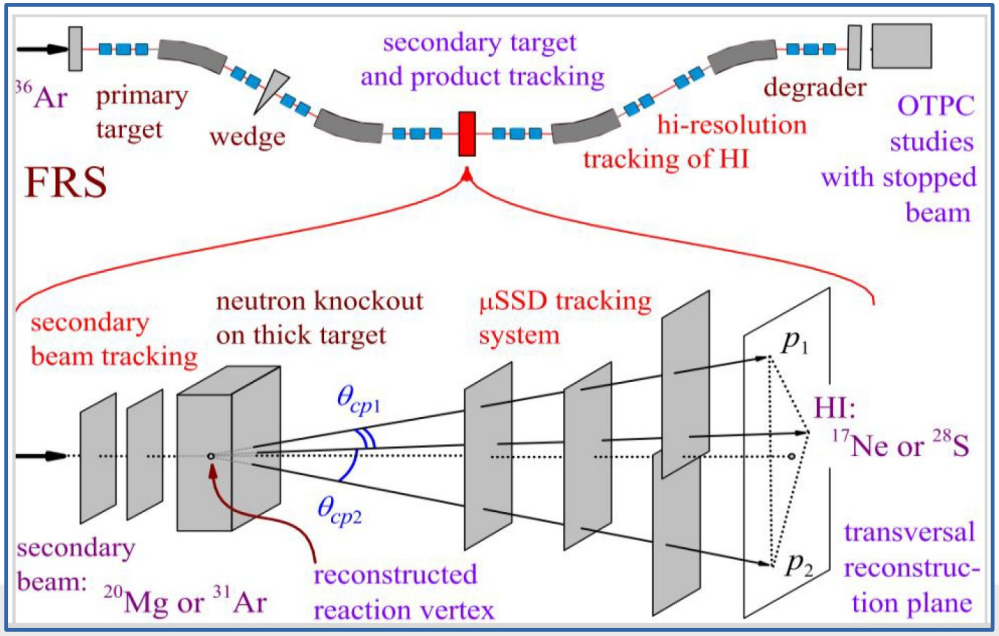
$\Gamma \sim \hbar/\tau$

At least one reflection on barrier ($\tau > \sim 10^{-22}$ s)

[L.V. Grigorenko, et al., Phys. Rev. C 98, 064309 (2018)]

Where are the limits of existence of unbound nuclear systems? What is beyond?





Layout of the fragment separator FRS with the EXPERT setup

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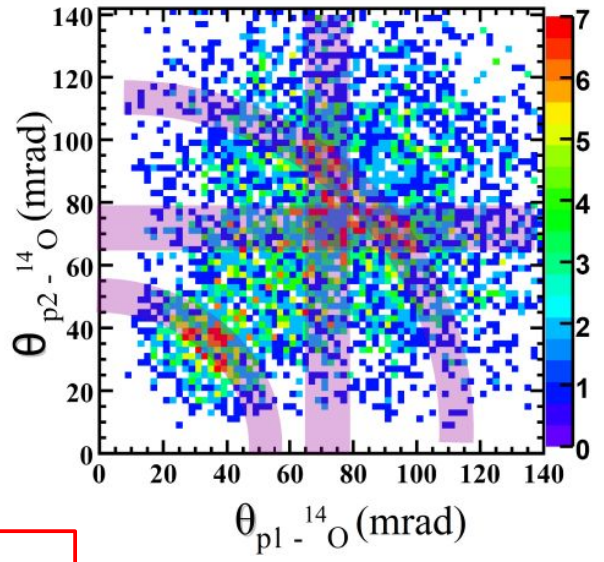
Angular correlations of nuclear decay products are like the Dalitz plot.
Then decay energy and width of the precursor can be measured, and decay mechanism established.

Example: two-proton decay $^{16}Ne \rightarrow p+p+^{14}O$



Discovery of the most-remote isotope ^{31}K

- ^{31}K is a three-proton emitter located 4 mass units beyond the proton dripline
- Spectroscopy performed
- Based on vertex reconstruction, measured half-life of ^{31}K g.s. is < 10^{-12} s

PHYSICAL REVIEW LETTERS **123,** 092502 (2019)

Towards the Limits of Existence of Nuclear Structure: Observation and First Spectroscopy of the Isotope ^{31}K by Measuring Its Three-Proton Decay

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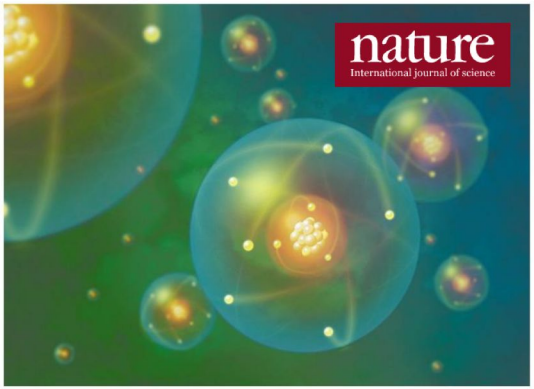

Atomic nuclei (artist's impression) contain both protons and neutrons. A newly reported isotope offers the hope of testing fundamental principles of nuclear structure. Credit: Mark Garlick/SPL

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A peculiar atom shakes up assumptions of nuclear structure

Lopsided potassium isotope survives longer than predicted by theory.