Nuclear Spectroscopy Beyond the Proton-Drip Line

hat the science is

Spectroscopy information mostly unknown for nuclei near or beyond ne line of particle stability. Such nformation can enrich our nderstanding of nuclear structure t extreme conditions.

ow we do it

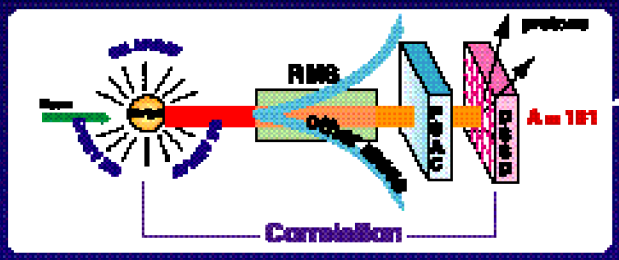
Use a novel technique called the "Recoil Decay Tagging" (RDT), which can select a signal that is s weak as 1/10000, which is otherwise impossible to detect.

hat we have done

Proton emitters ^{151}Lu (shown on ne right), ^{113}Cs and ^{109}I.

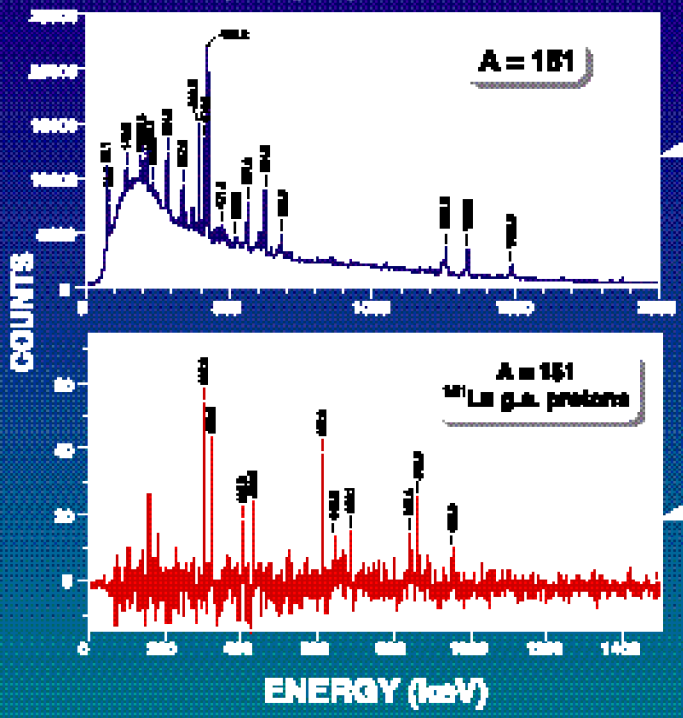
uture plans

Study some of the least bound uclei in nature, e.g. ^{145}Tm.



The RDT Tec
Use the pr
radioactivity a
RMS focal pla
a tag to selec
at target posit

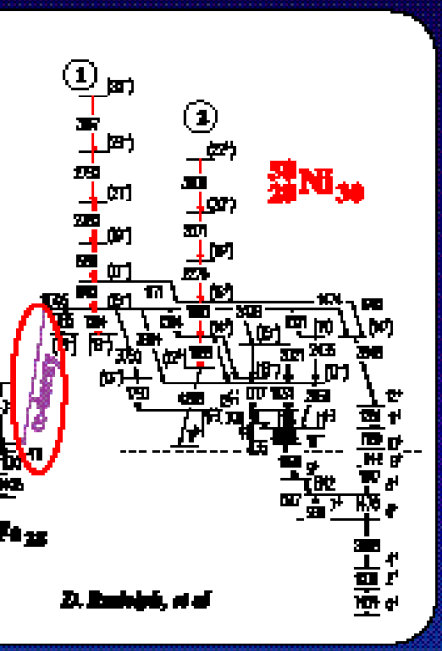
^{96}Ru(^{58}Ni,p2n)^{151}Lu @265 MeV

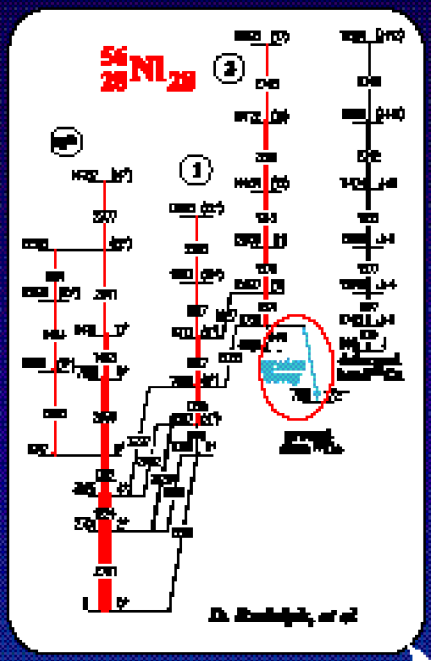


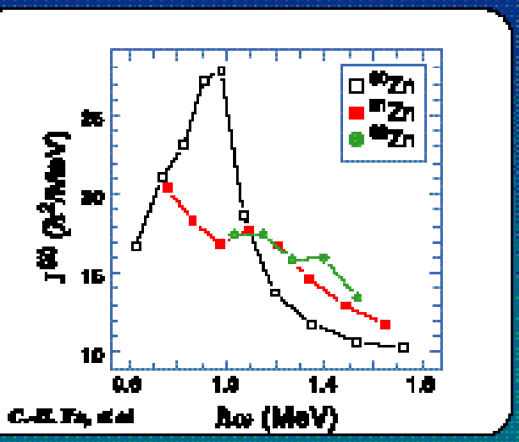
γ rays associ
with A=151.
^{151}Lu γ rays
too small to
seen.

γ rays associ
with A=151 a
known ^{151}Lu
decays. All γ r
belong to ^{151}L

uperdeformation in A ~ 40, 60 Regi







The science:

These are some of the lightes nuclei found to be superdefor Their proximity to the N=Z line also unique, making it possibl examine isospin properties in superdeformed nucleus.

Highlights of the stud

- About 30 bands found in more than 15 nuclei (from Cl to Zn).
- Superdeformation established in doubly magic N=Z ^{56}Ni.
- Discovered exotic proton and α particle decays from superdeformed bands.
- Established evidence for T=0 pair correlations in the N=Z ^{60}Zn.

pproaching ^{100}Sn

hy ^{100}Sn?

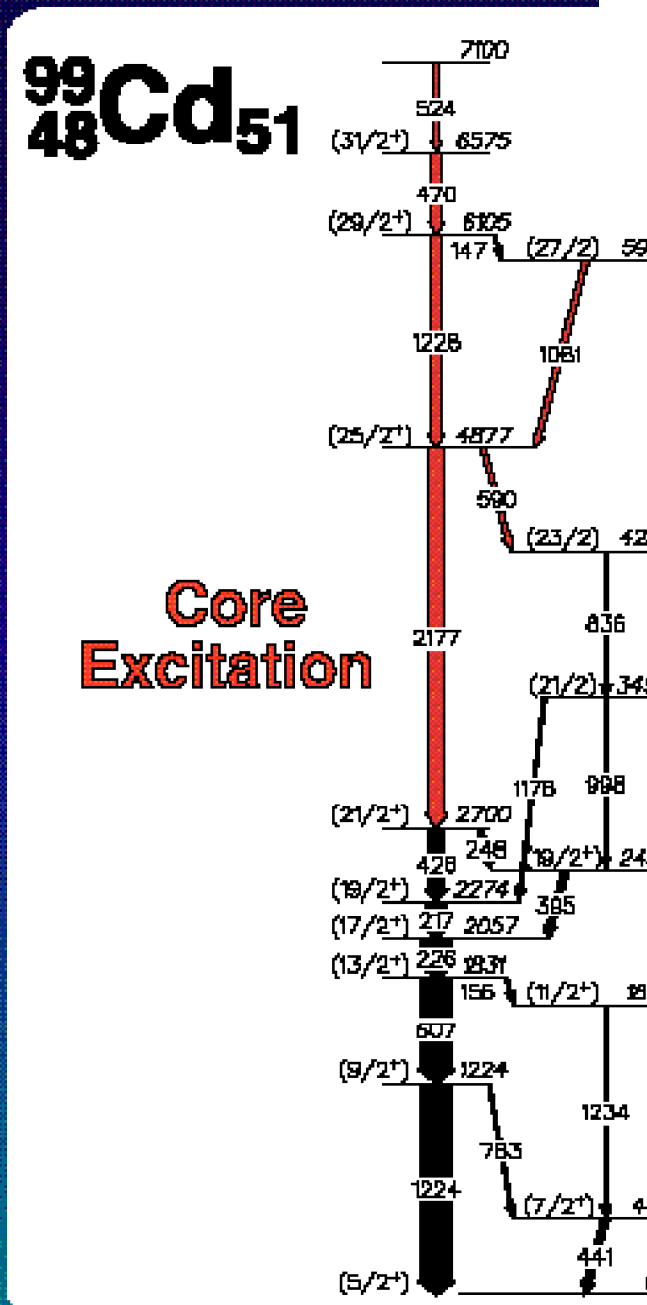
- Heaviest particle-stable, doubly-magic, N=Z nucleus.
- Provides single-particle energies and two-body matrix elements for determination of effective interactions.
- Testing ground for shell model calculations.

ow to get there?

^{100}Sn is presently very difficult to study. But studying its immediate neighbors (e.g. ^{99}Cd) can provide useful information.

hat we did

- Established high-spin states in ^{99}Cd and ^{101}In.
- Identified core excitations across N=Z=50 shell closure in ^{99}Cd and ^{101}In for the first time.
- These core excitations are very similar to those in ^{55}Fe and ^{57}Co, neighbors of doubly magic ^{56}Ni.
- These similarities indicate possible 2+ excitation energy in ^{100}Sn to be ~ 3MeV.



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