NNDC Experimental Activities

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BROOKHAVEN NATIONAL LABORATORY

a passion for discovery

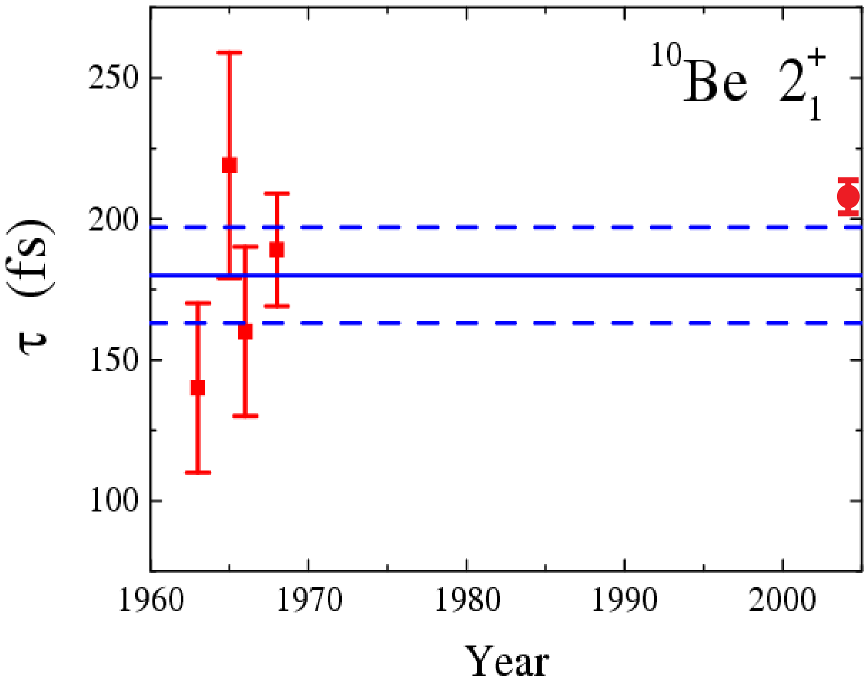
U.S. DEPARTMENT OF ENERGY | Office of Science

A Potpourri

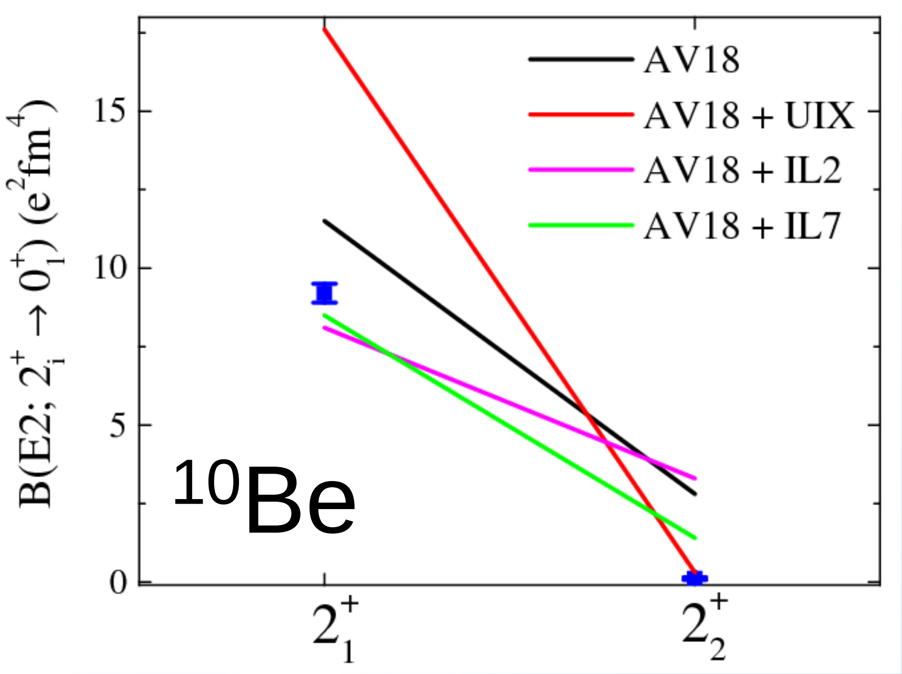
- Data for shaping new theories
- Data history – exotic decay
- Data directly linked to evaluation
- Data for applications

Precision Measurements to Test Ab Initio Theories

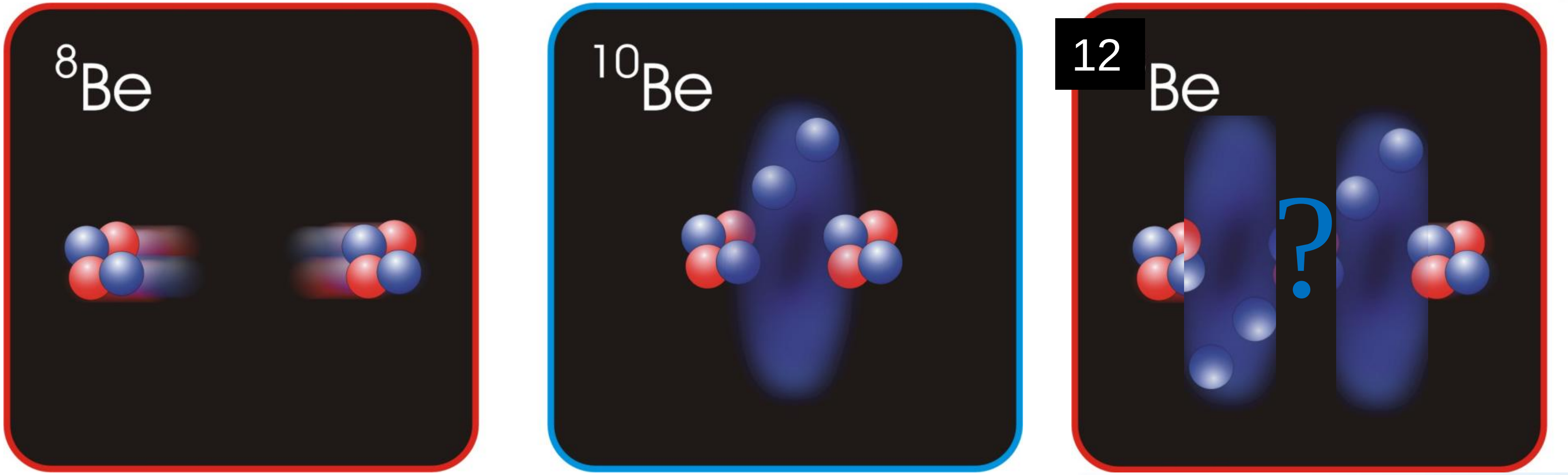
History of 2+ lifetime measurements in ^{10}Be



Green's function Monte Carlo NN + 3 body forces



What do the extra neutrons do?



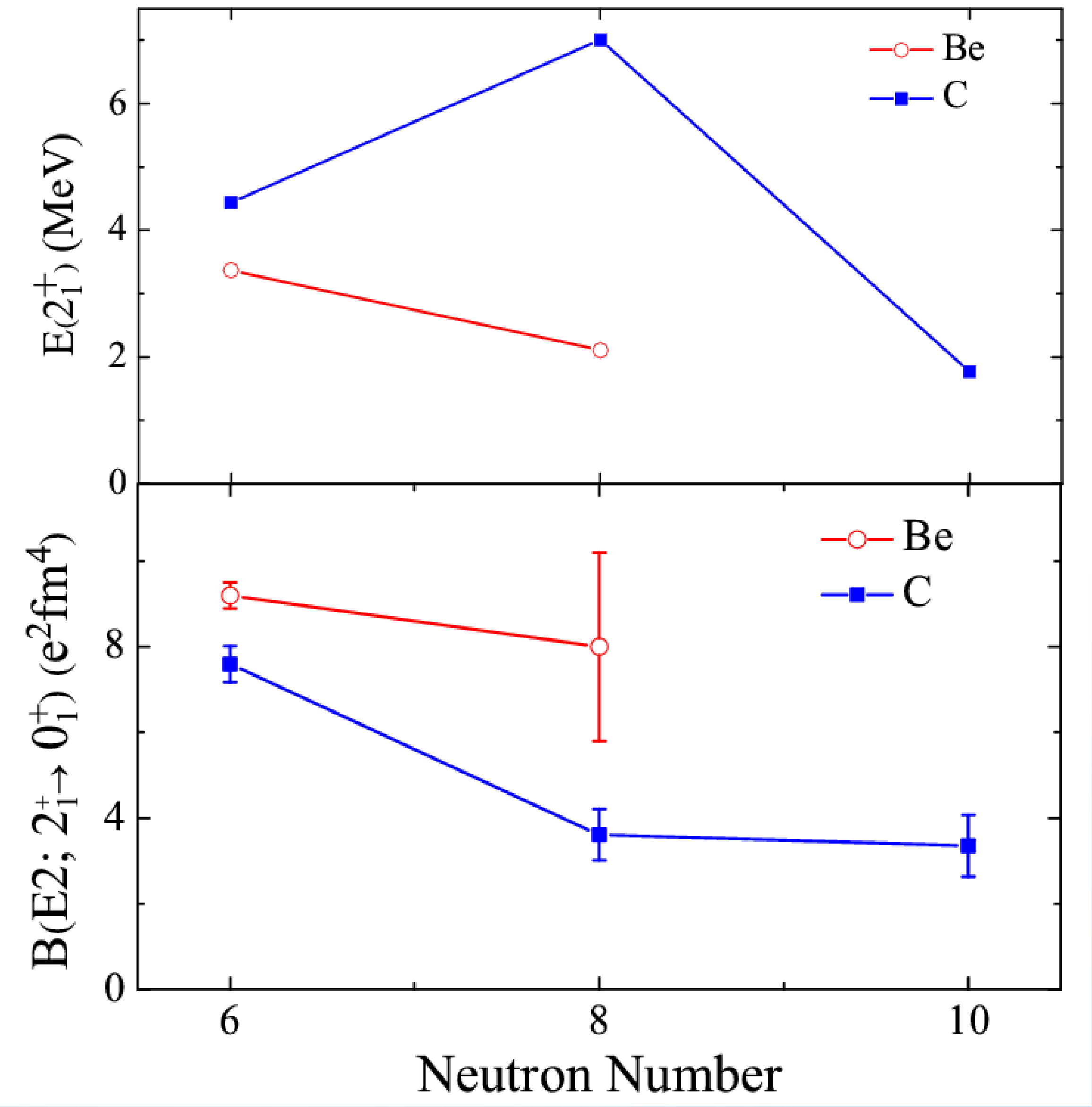
Make a “Nuclear Molecule”?

B(E2) increases

Make a “N=8” spherical cloud?

B(E2) decreases

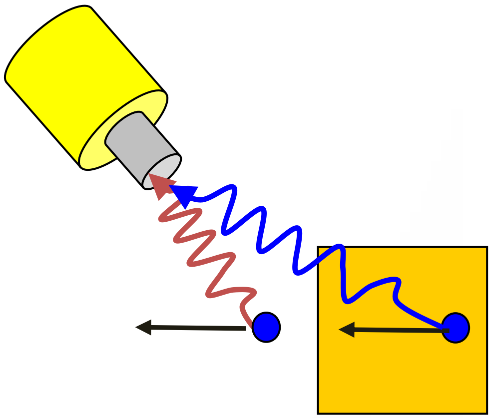
Systematics



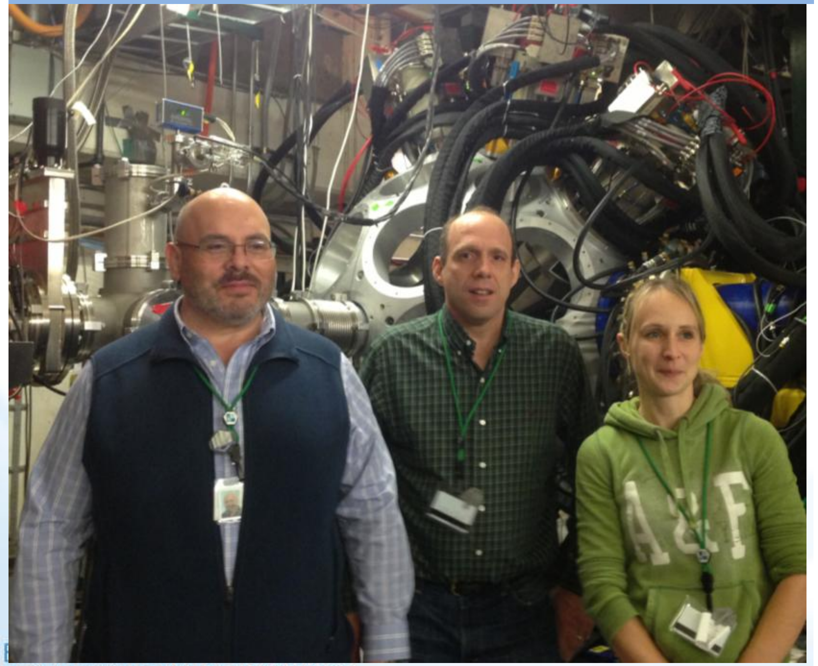
A precise measurement of the B(E2; $2^+ \rightarrow 0^+$) in ^{12}Be

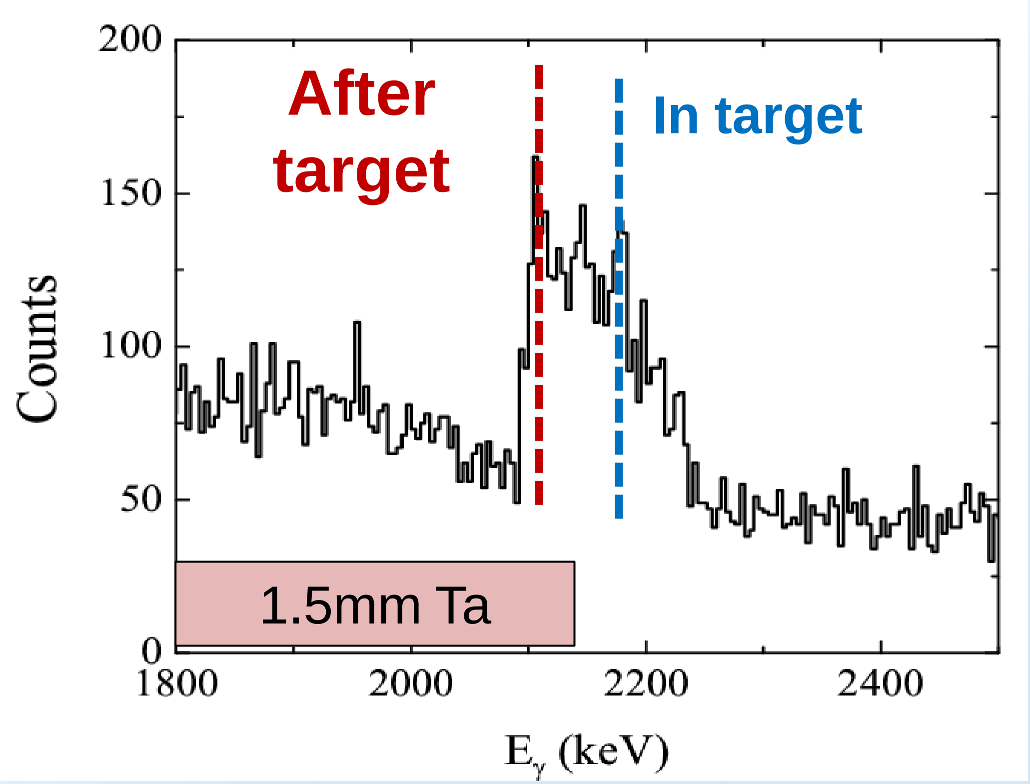
Fast, thick target DSAM

- 55 MeV/A ^{12}Be beam
- 3 different targets
- GRETINA + S800



Gretina at MSU/NSCL





2-photon decay

One of a family of second order electromagnetic processes.
They are sensitive to the initial and final state wave functions.

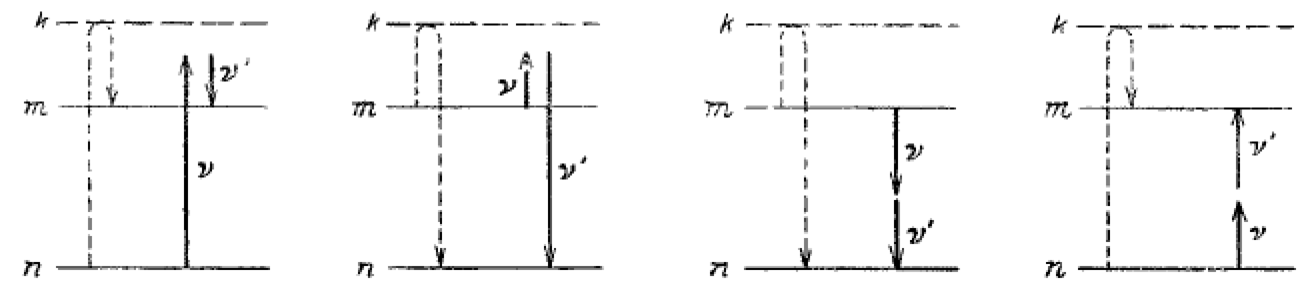


Fig. 1. Stokesscher Fall des Raman-Effekts.

Fig. 2. Antistokesscher Fall des Raman-Effekts.

Fig. 3. Doppelemission.

Fig. 4. Doppelabsorption.

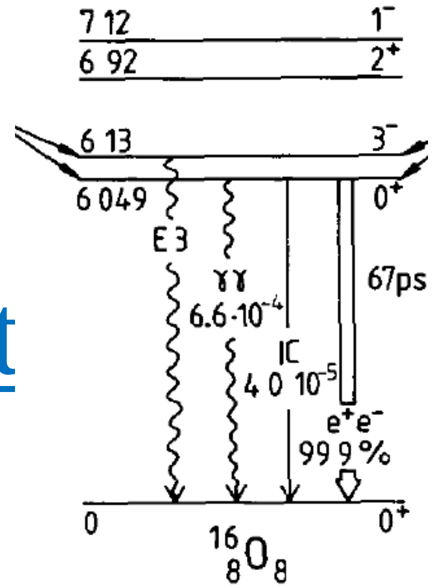
Über die Wahrscheinlichkeit des Zusammenwirkens zweier Lichtquanten in einem Elementarakt.

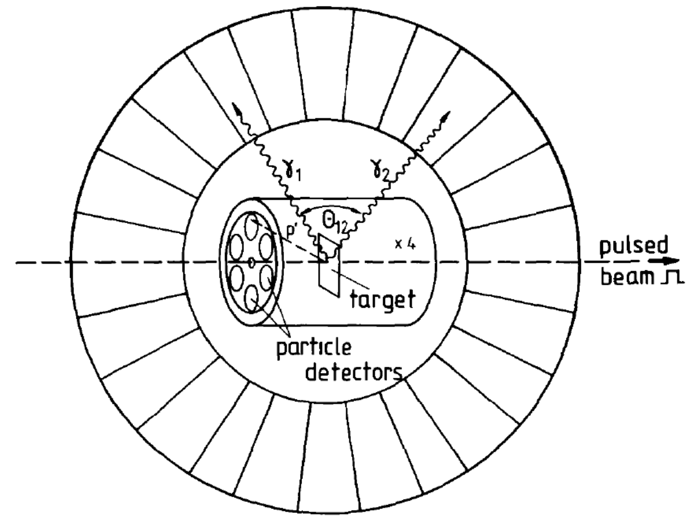
On the probability of a collaboration of two light quanta in an elementary process

M. Goppert. Natureweiss 17 932 (1929)

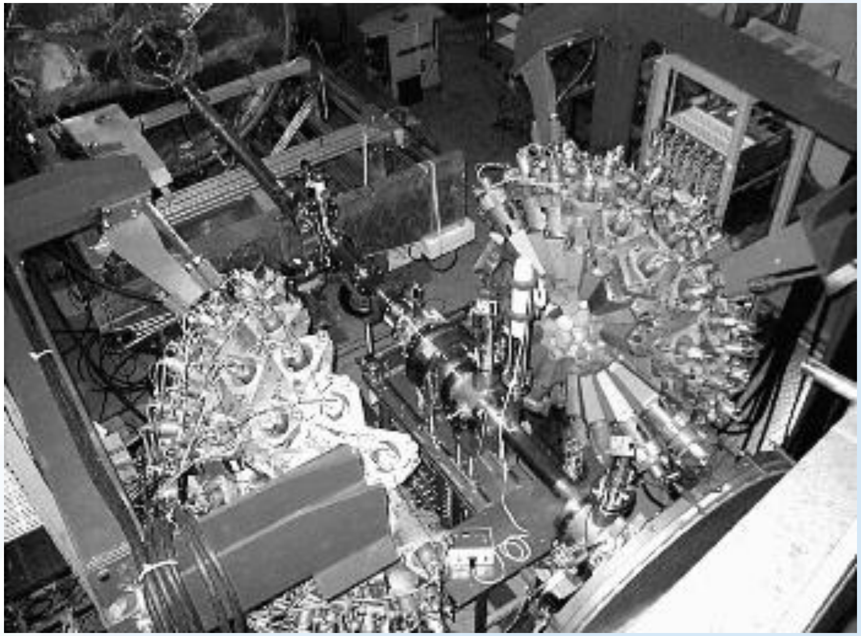
Classic Nuclear Experiment

J Kramp et al. Nucl. Phys. A474 (1987) 412

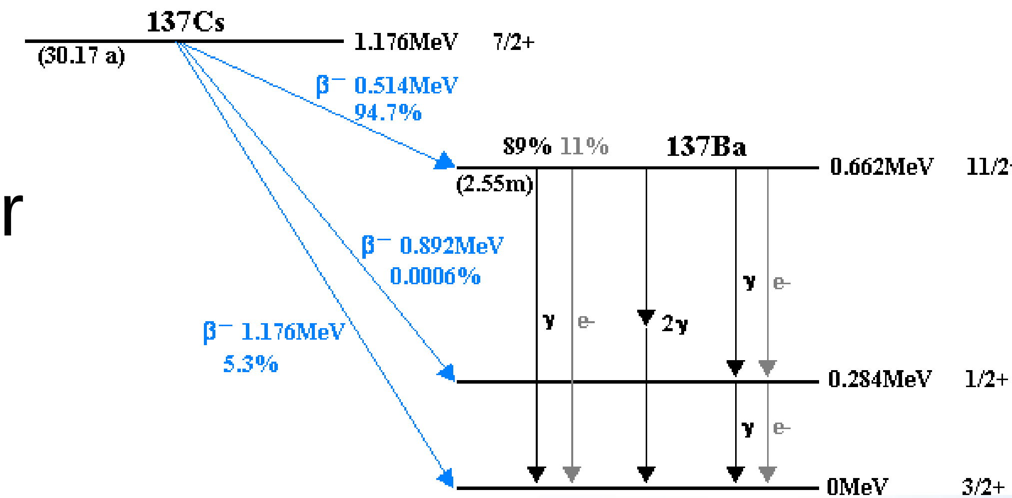




- Studied $0^+ \rightarrow 0^+$ transition in ^{16}O, ^{40}Ca, and ^{90}Zr
- Used Heidelberg-Darmstadt Crystal Ball
  - 4π gamma detector
  - 162 NaI(Tl) crystals arranged in sphere with radius of 25cm

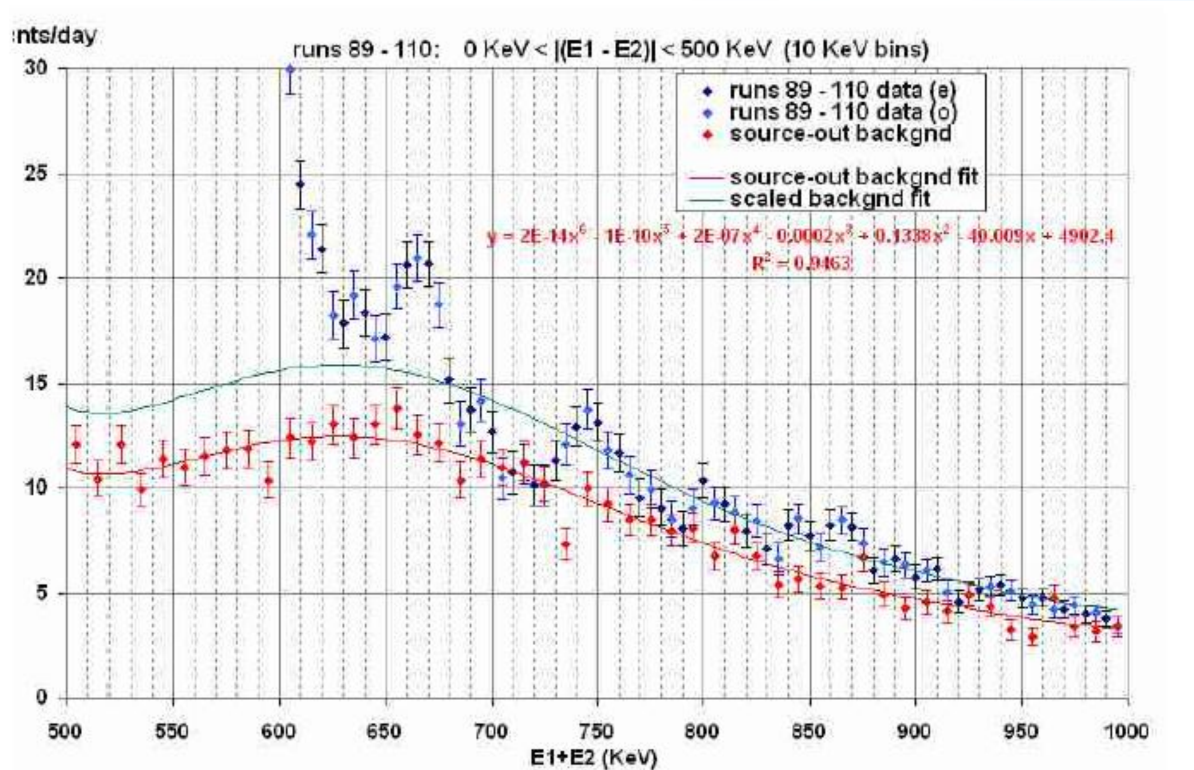


BNL experiment on ^{137}Cs

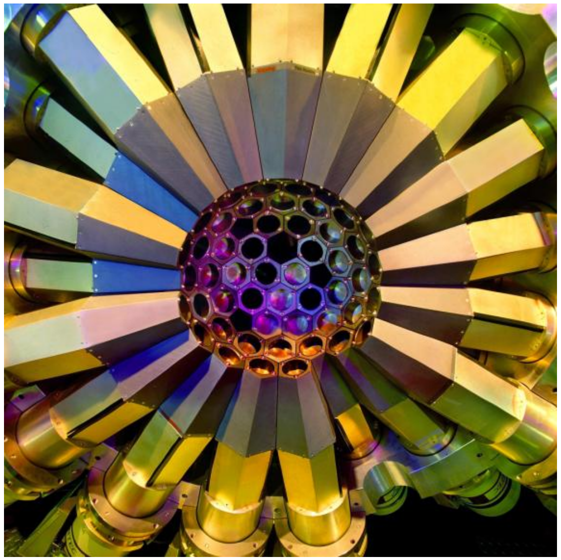


Alburger, Sutter, Millener

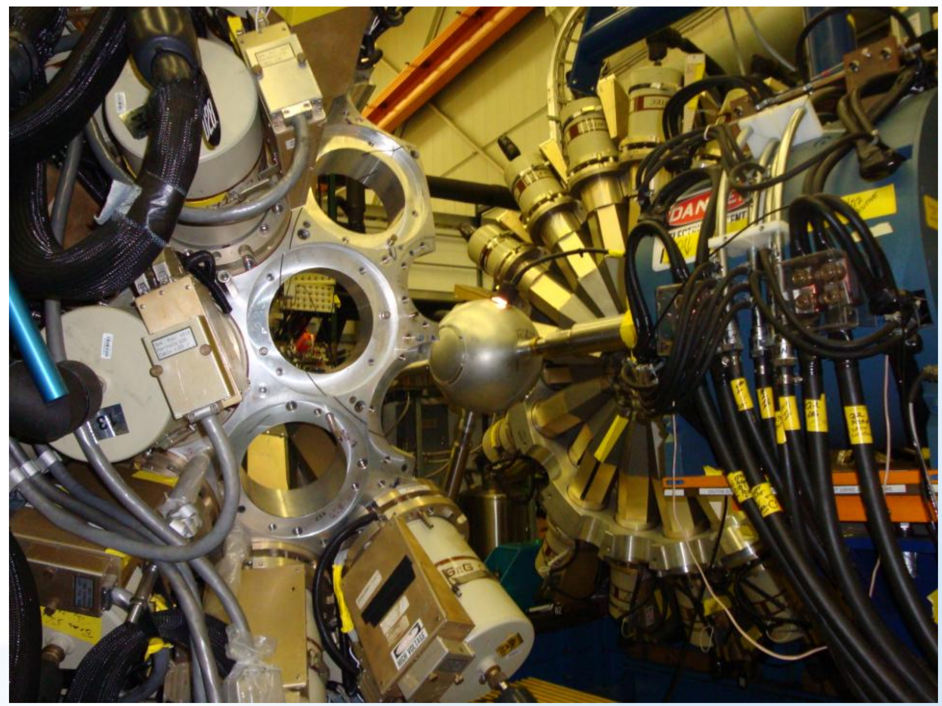
2 NaI detectors and lots of Pb shielding



Source Experiment at ANL

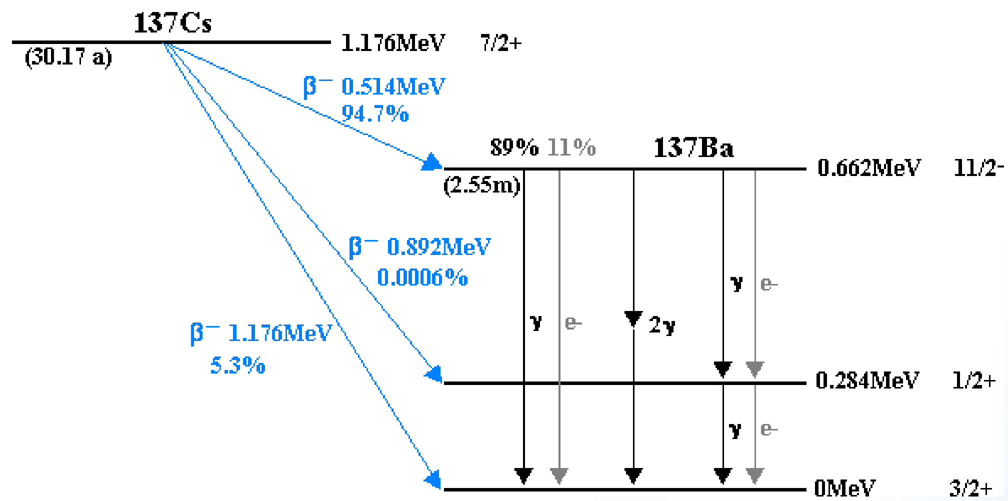


- Gammasphere Detector Array used for ^{137}Cs source experiment
- ~100 spherically arranged, Compton suppressed Ge detectors



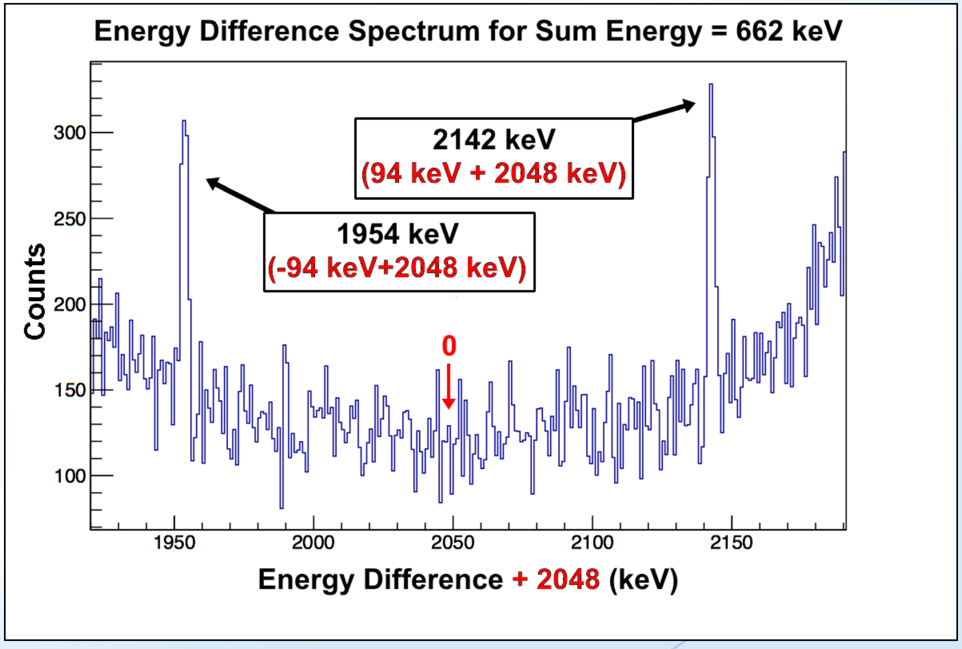
- Used Calibrated 19.67 µCi ^{137}Cs source
- Doubles trigger
- Collected data for ~10 days
- 6.42×10^{11} total decays

New E5 Transition

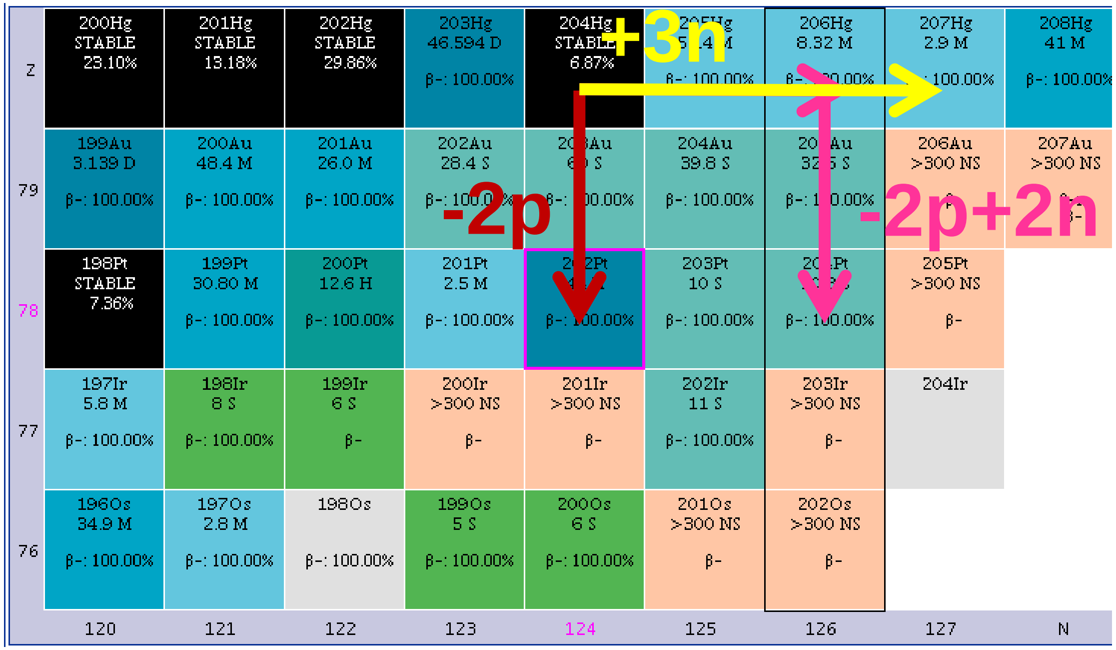


- Initially, no discernable features
- Choose detector pairs to suppress scattering
- Cascade is isotropic (no angular correlation)
- Cascade features become clear
- Values correspond to ±(378 keV-284 keV), or±94 keV

$$B(E5)_{^{137}Ba} = 0.35(4)\mathrm{W.u.}$$



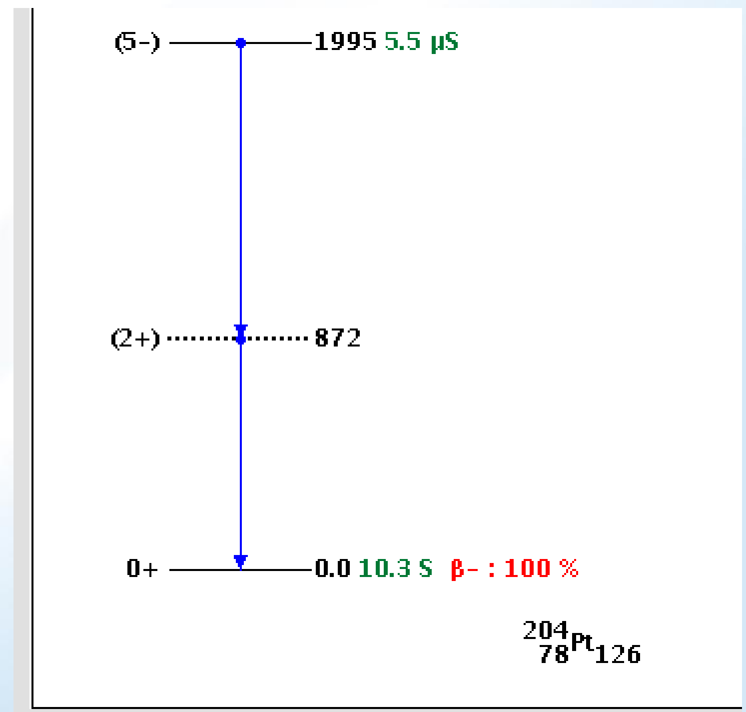
Connecting Evaluation to Measurements



Deep inelastic reaction with ^{204}Hg beam

^{207}Hg :
No excited states known !!

^{204}Pt :
First 2^+ state not definite



Data for Applications

^{104}Tc
g.s $J^{\pi}=(3^{+})$

Selected for a Viewpoint in Physi
PRL 105, 202501 (2010) PHYSICAL REVIEW LETT

Reactor Decay Heat in ^{239}Pu: Solving the γ Discrepancy i

A. Algora,[1,2,*] D. Jordan,[1] J. L. Taín,[1] B. Rubio,[1] J. Agramunt,[1] A. B. Pe
E. Nácher,[1] A. Krasznahorkay,[2] M. D. Hunyadi,[2] J. Gulyás,[2] A. Vitéz,[2] M. C
I. D. Moore,[3] T. Eronen,[3] A. Jokinen,[3] A. Nieminen,[3] J. Hakala,[3] P. Karvo
J. Rissanen,[3] T. Kessler,[3] C. Weber,[3] J. Ronkainen,[3] S. Rahaman,[3] V. Elomaa
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