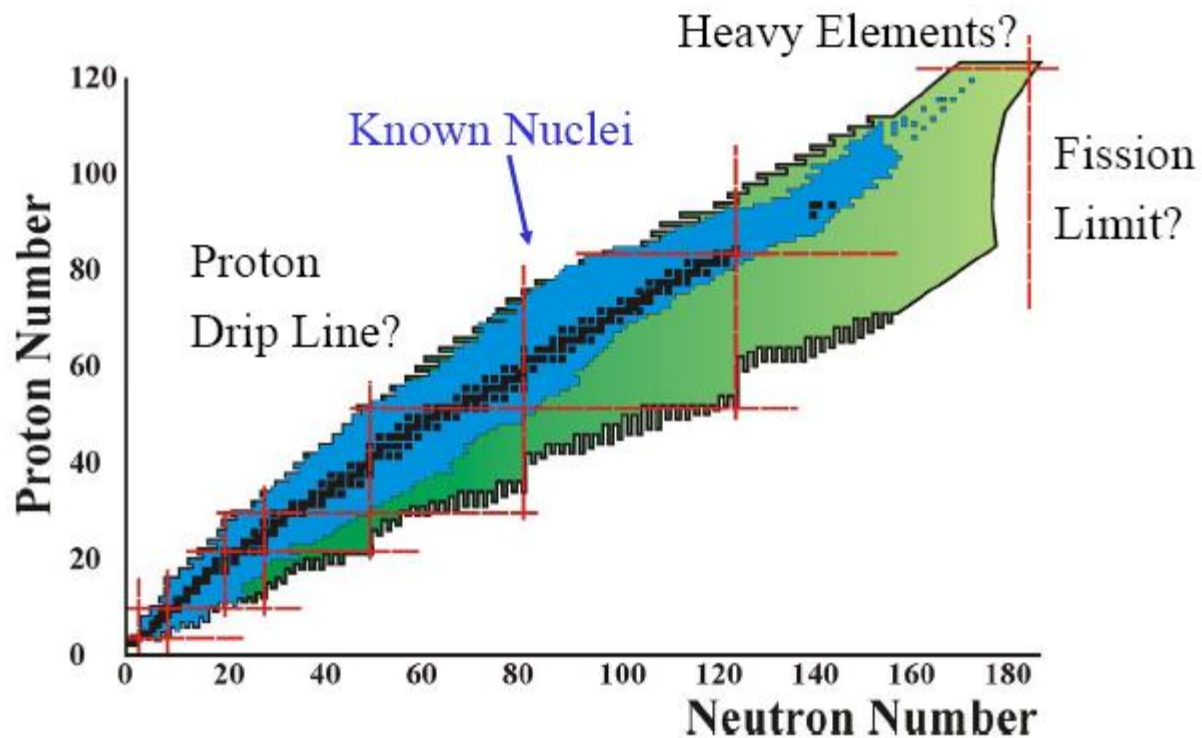


In-beam and decay spectroscopy of ^{251}Md

Chris Morse

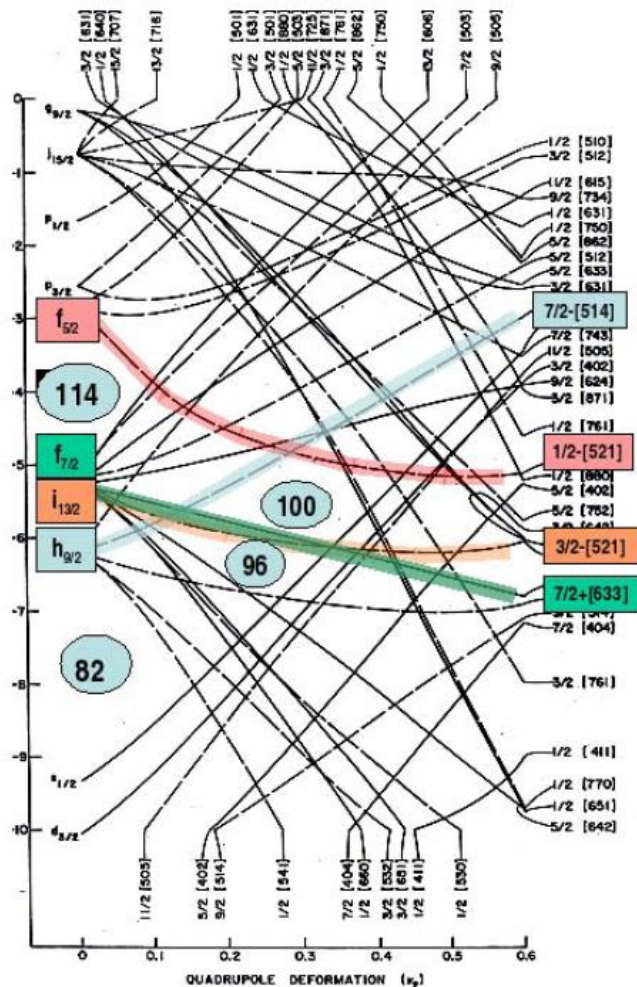
June 13, 2022

Introduction



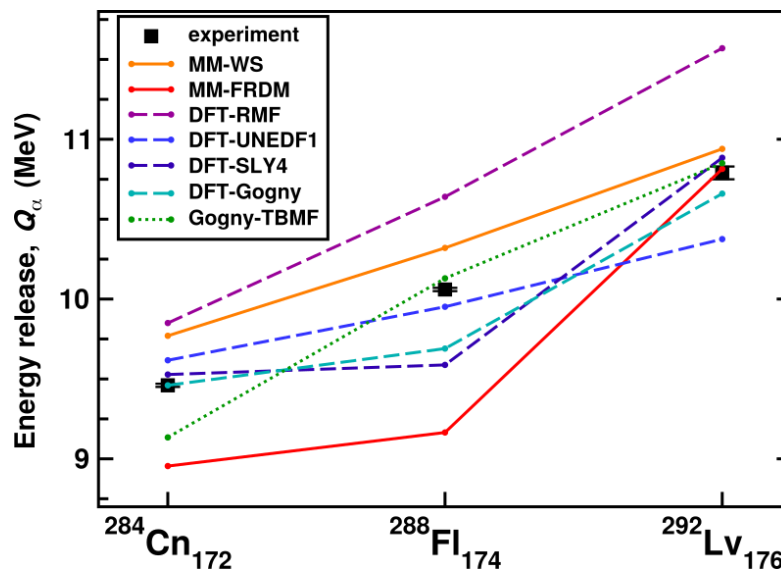
How can we learn about the properties of the heaviest nuclei?

Properties of superheavies



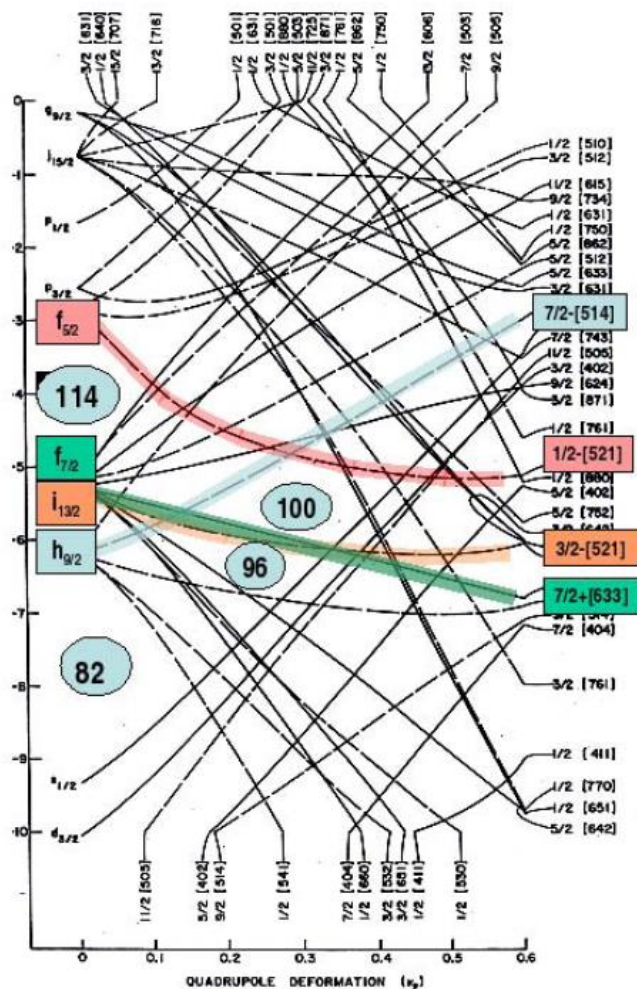
R. R. Chasman et al., Rev. Mod. Phys. 49, 833 (1977)

Calculations offer one way to gain detailed insights into the structure of superheavy nuclei, although experiments are making inroads.



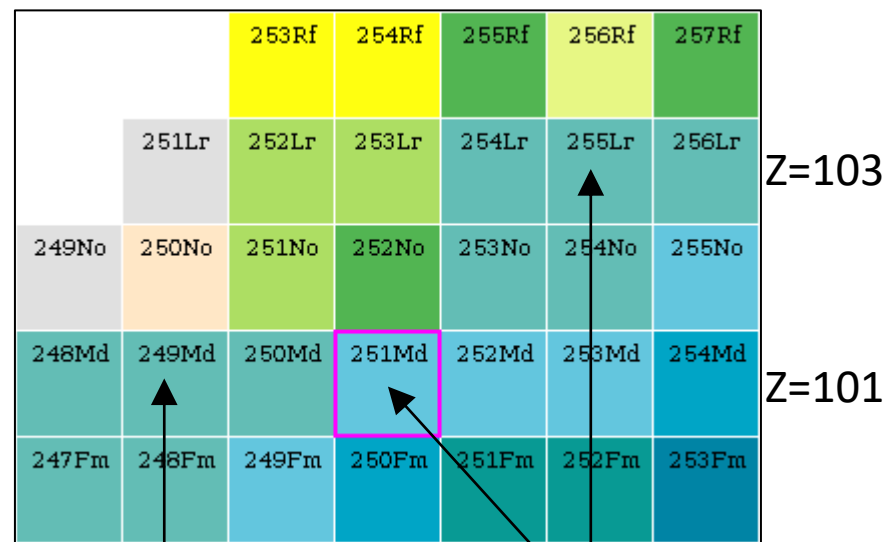
A. Sămark-Roth et al., PRL 126, 032503 (2021)

Properties of superheavies



R. R. Chasman et al., Rev. Mod. Phys. 49 833 (1977)

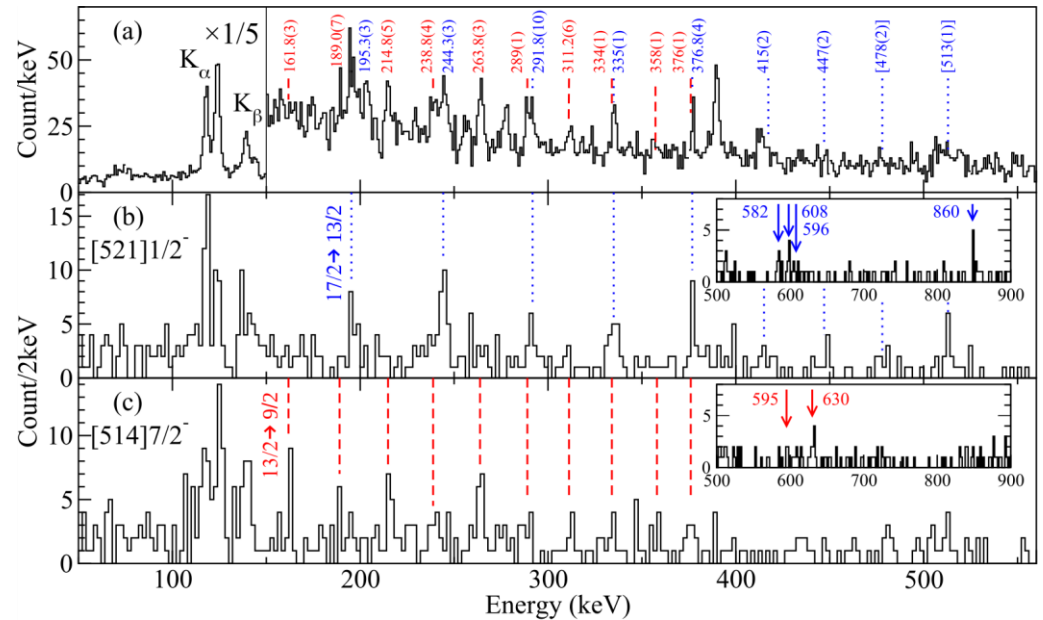
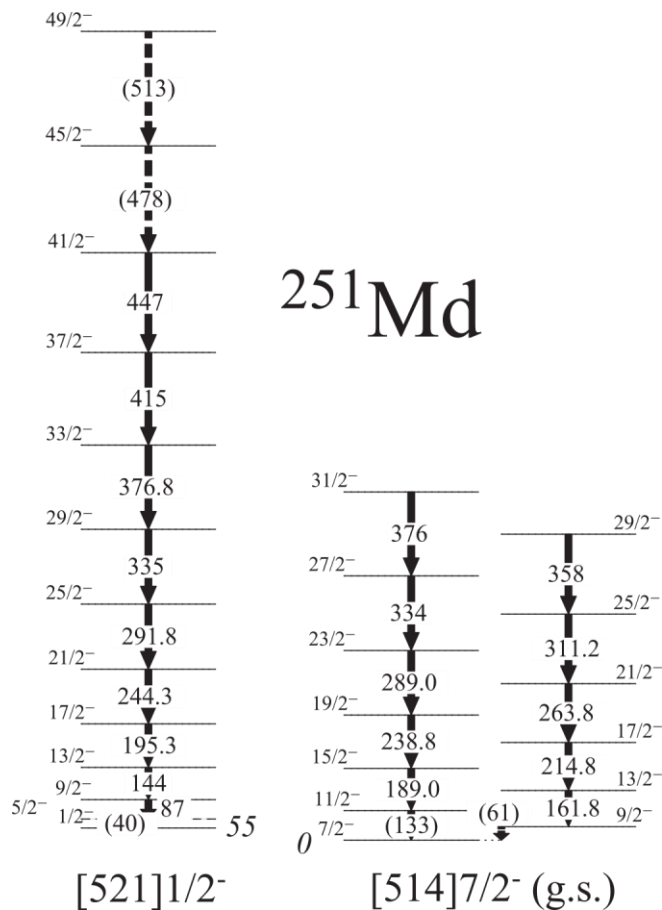
Detailed studies of transfermium nuclei are possible and allow properties of superheavies to be inferred.



ANL-approved experiment

Detailed in-beam spectroscopy has been shown to be possible

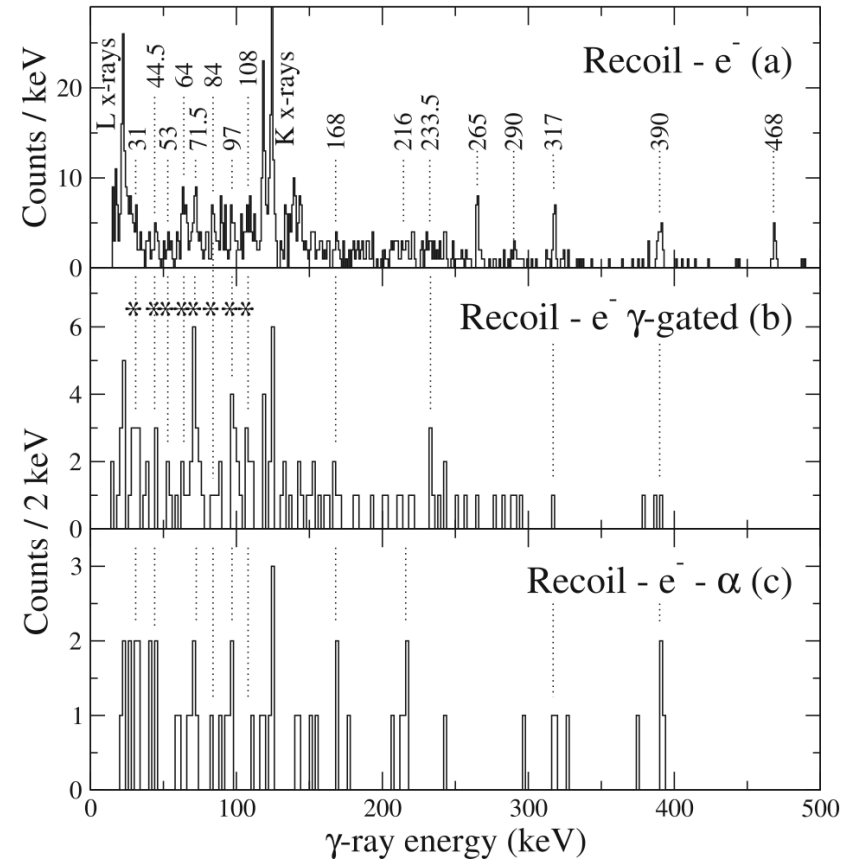
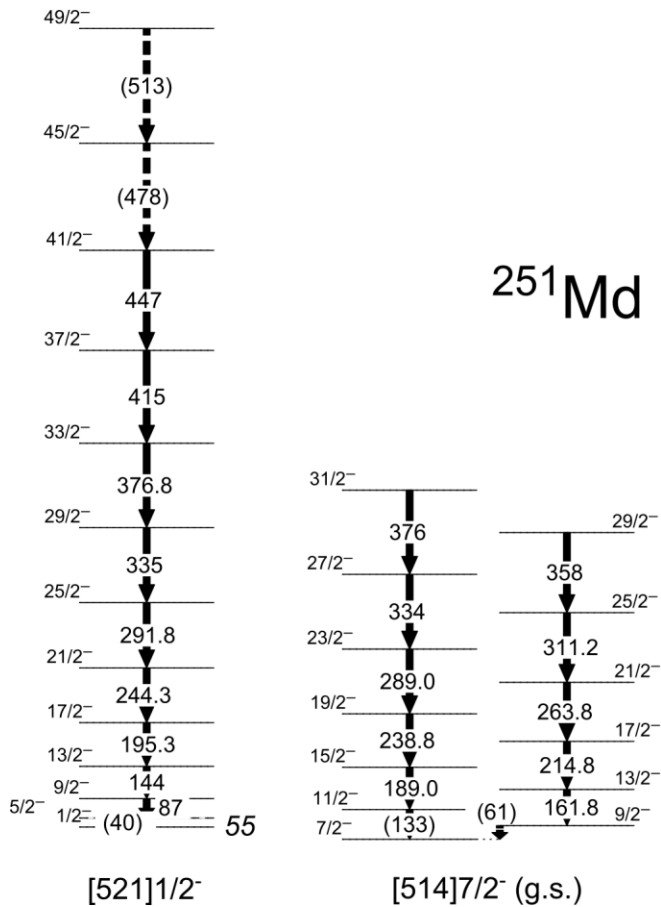
^{251}Md – previous data



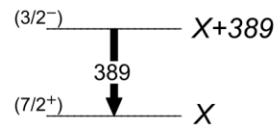
- Band based on [514]7/2⁻ configuration
 - Confirmed through e^- spectroscopy
- Also observe band based on [521]1/2⁻
 - First observed by A. Chatillon et al., PRL 98, 132503 (2007)

R. Briselet et al. PRC 102, 014307 (2020)

^{251}Md – previous data



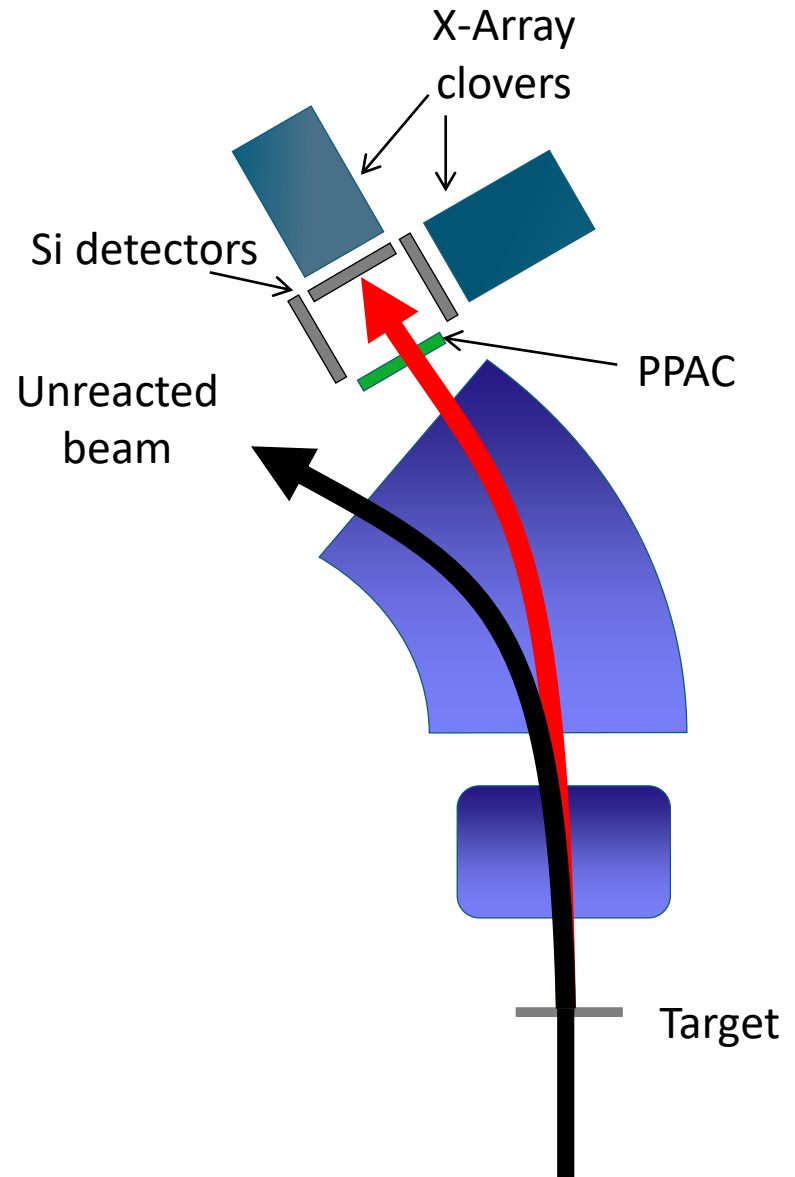
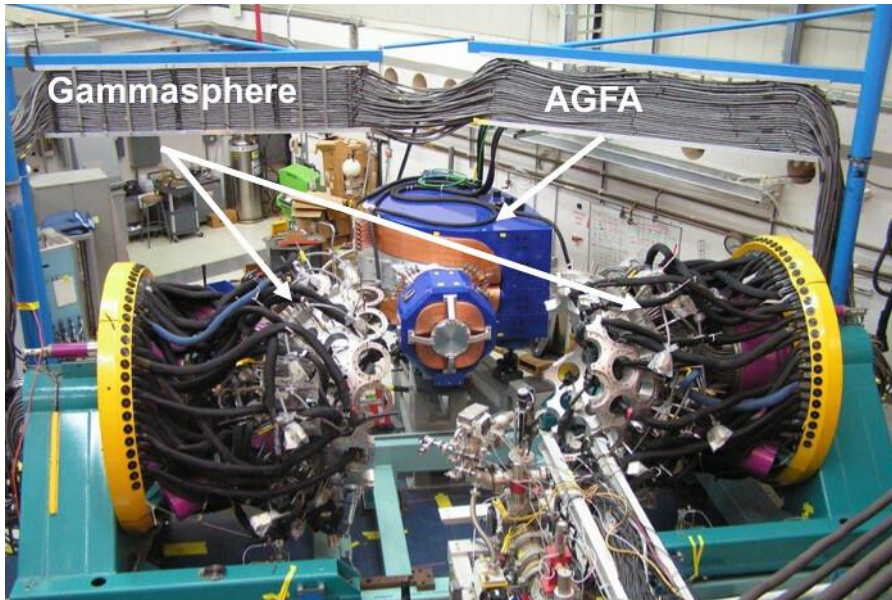
(23/2⁺) ———— ≥844
1.4(3) s



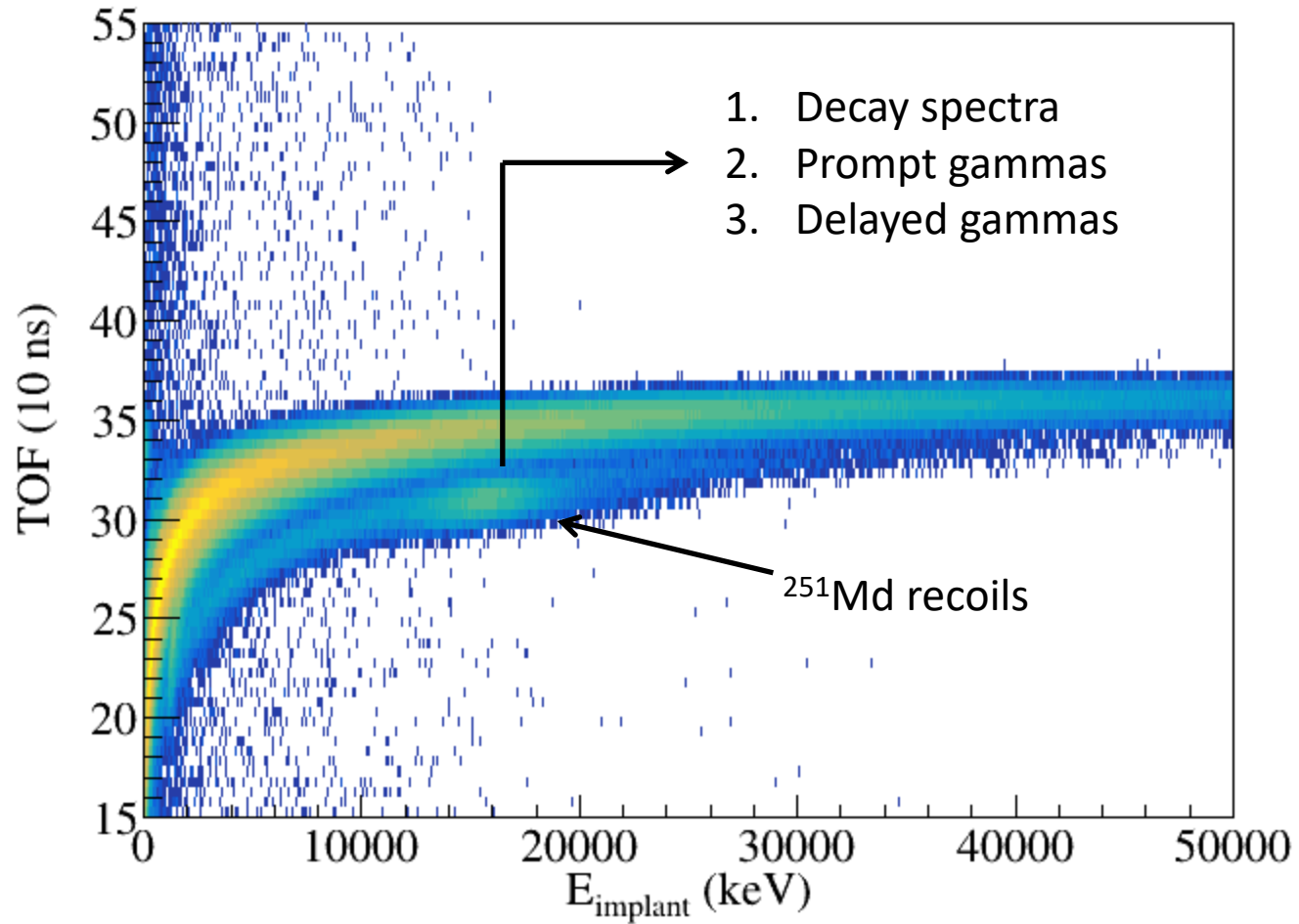
Recently evidence of an isomer was published along with delayed gamma spectroscopy

Experiment

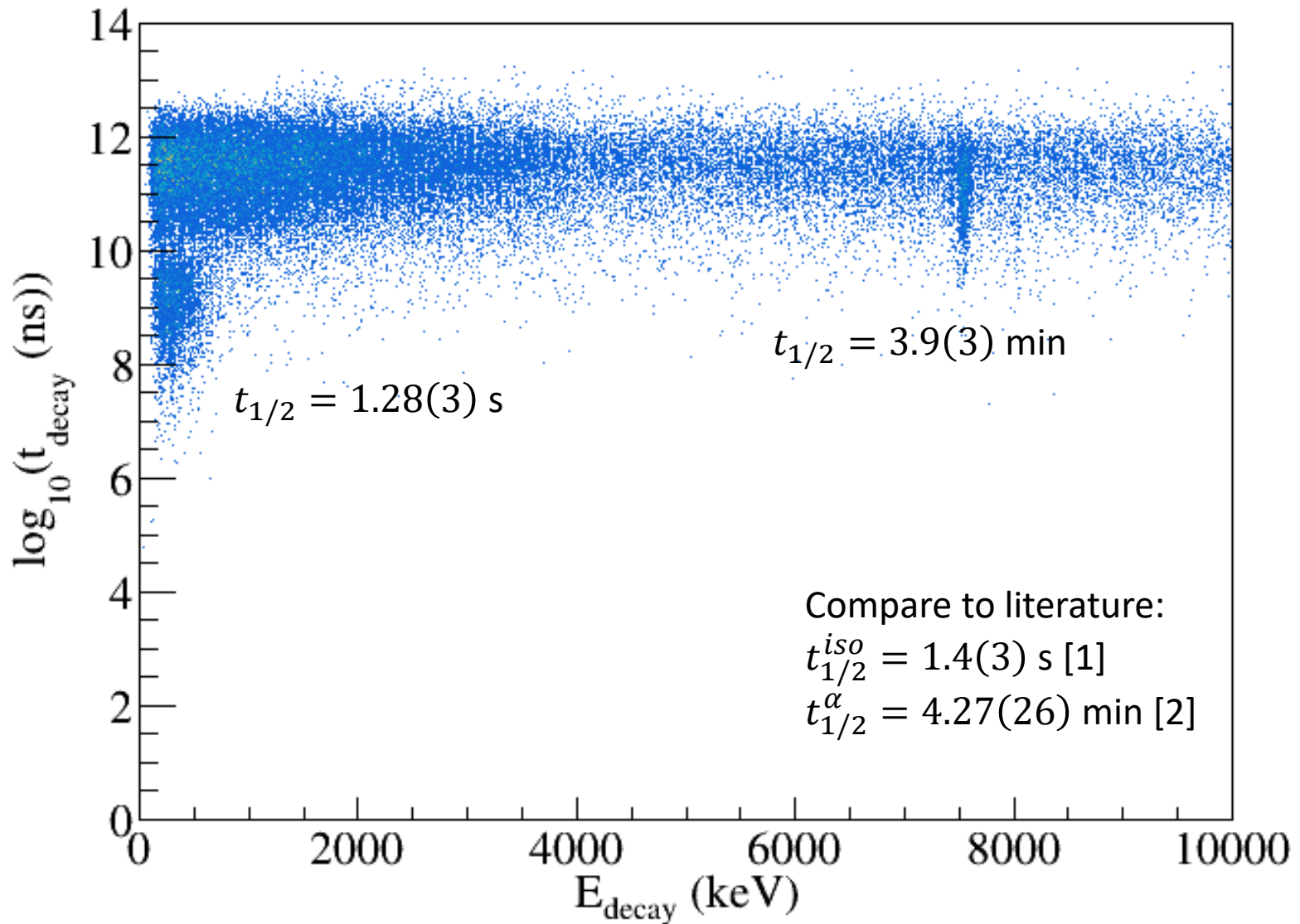
Experiment run at Argonne Nat'l Lab
AGFA + Gammasphere + X-Array
Reaction: $^{205}\text{Tl}(^{48}\text{Ca}, 2n)^{251}\text{Md}$
Beam energy: 214 MeV, target center



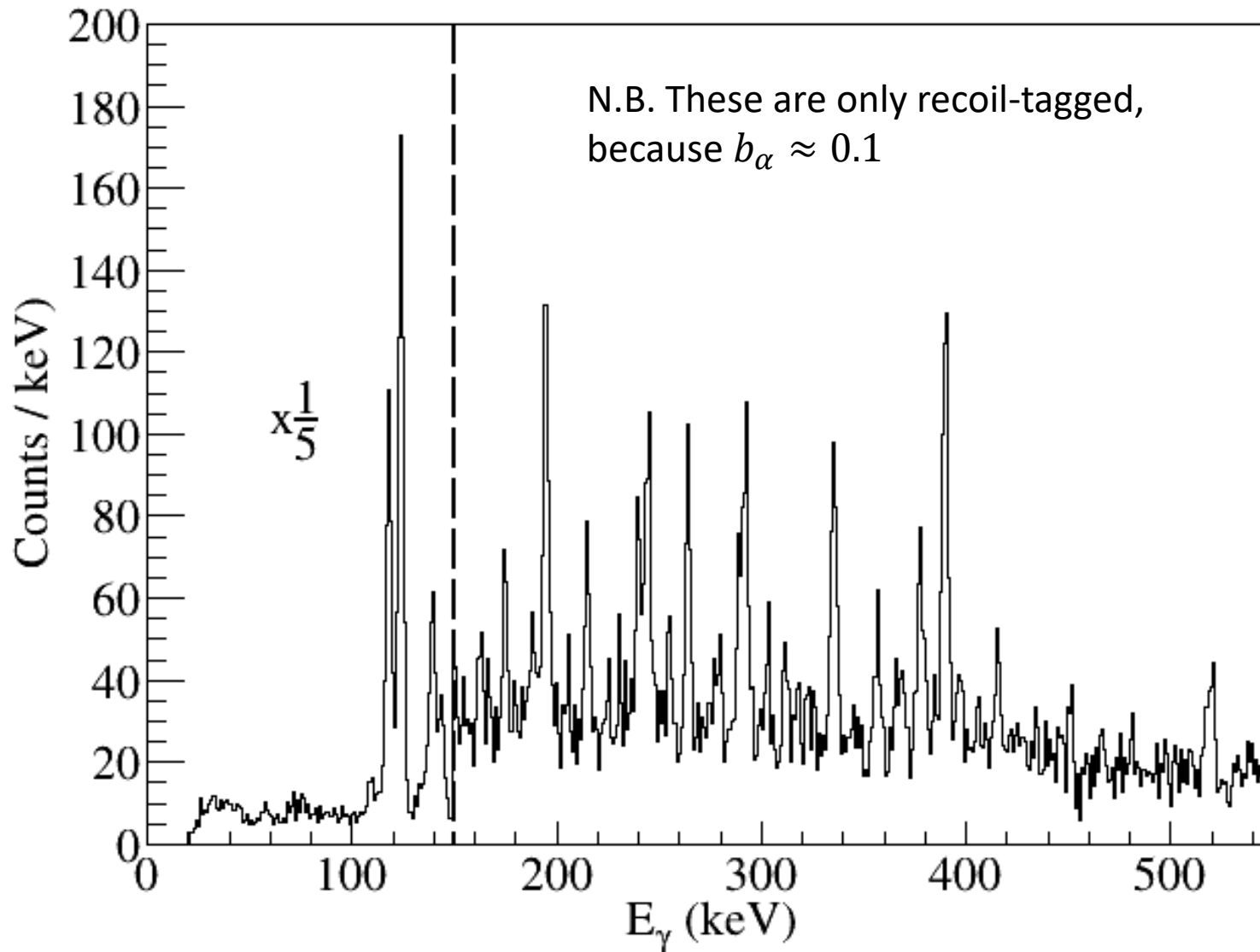
^{251}Md recoil ID



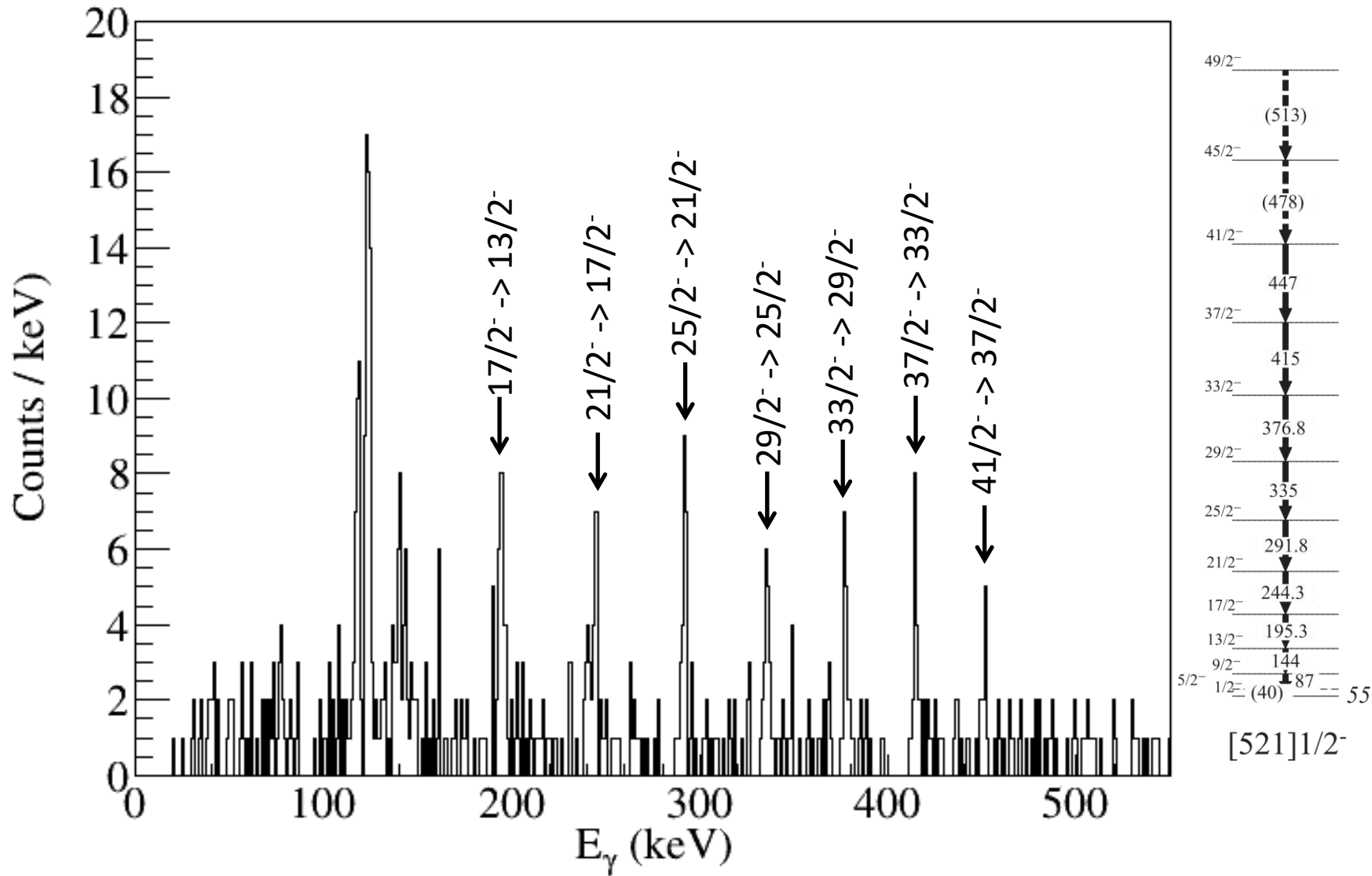
Decay spectra



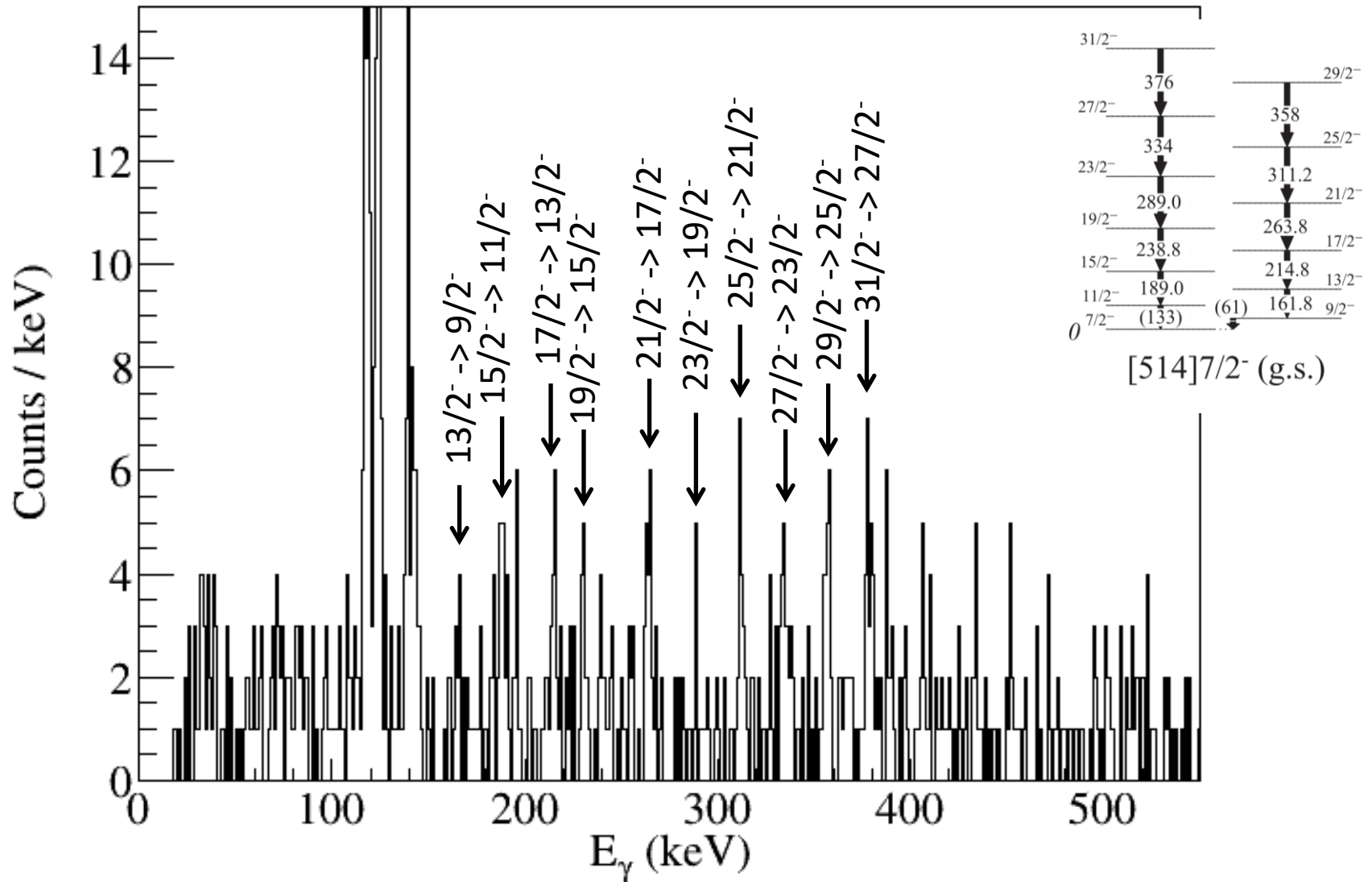
^{251}Md – prompt gammas



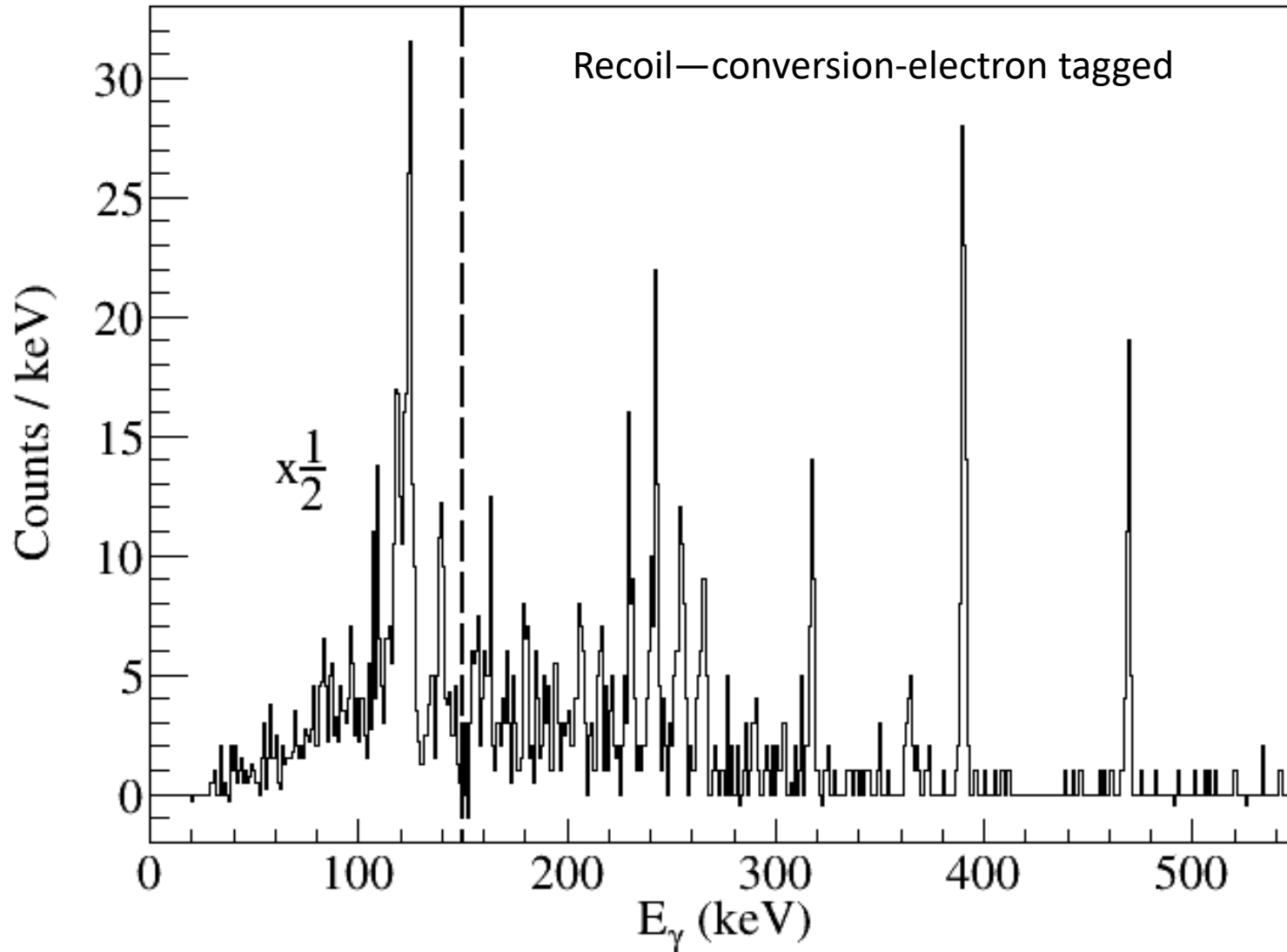
^{251}Md – prompt gamma-gamma



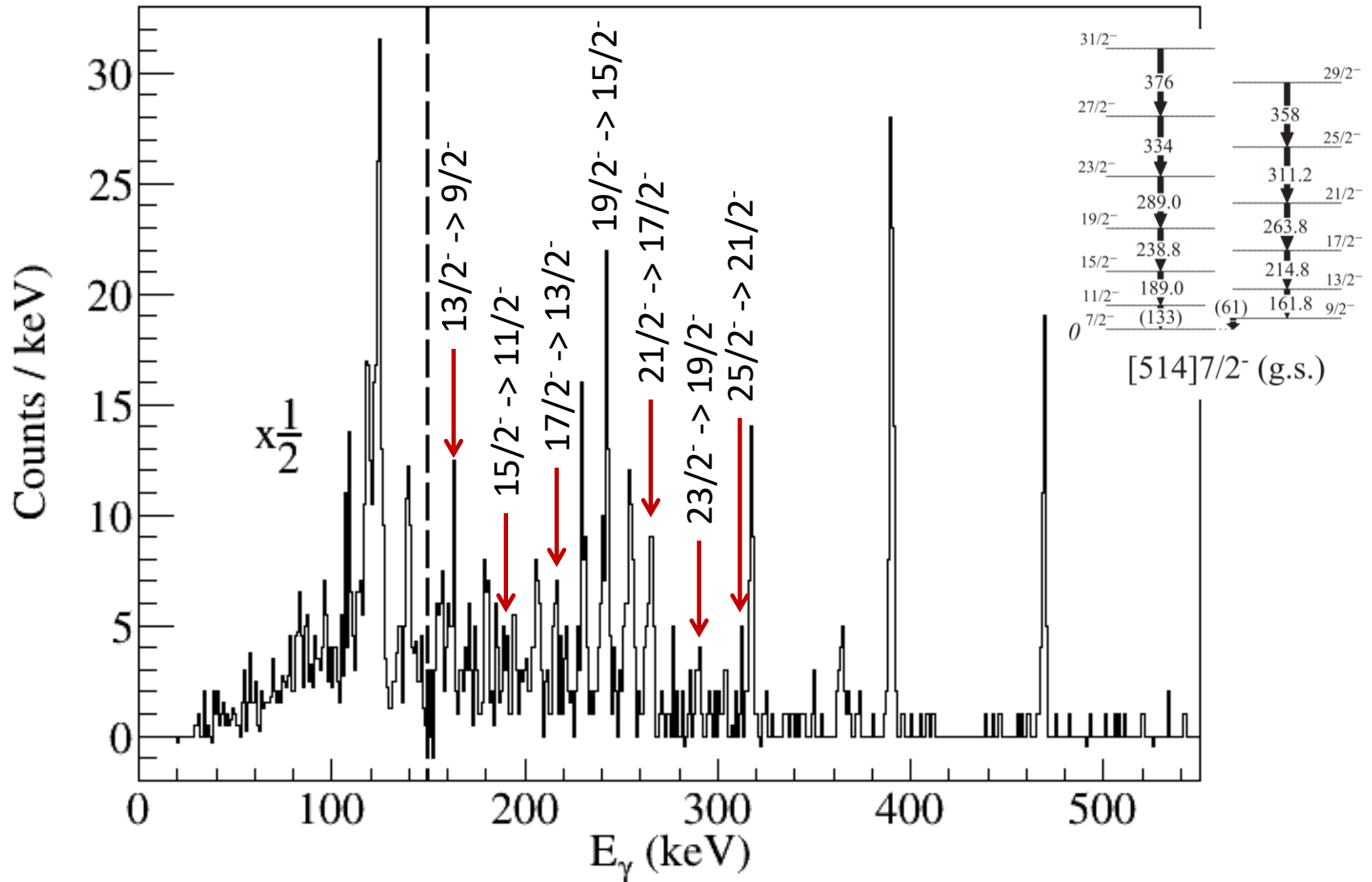
^{251}Md – prompt gamma-gamma



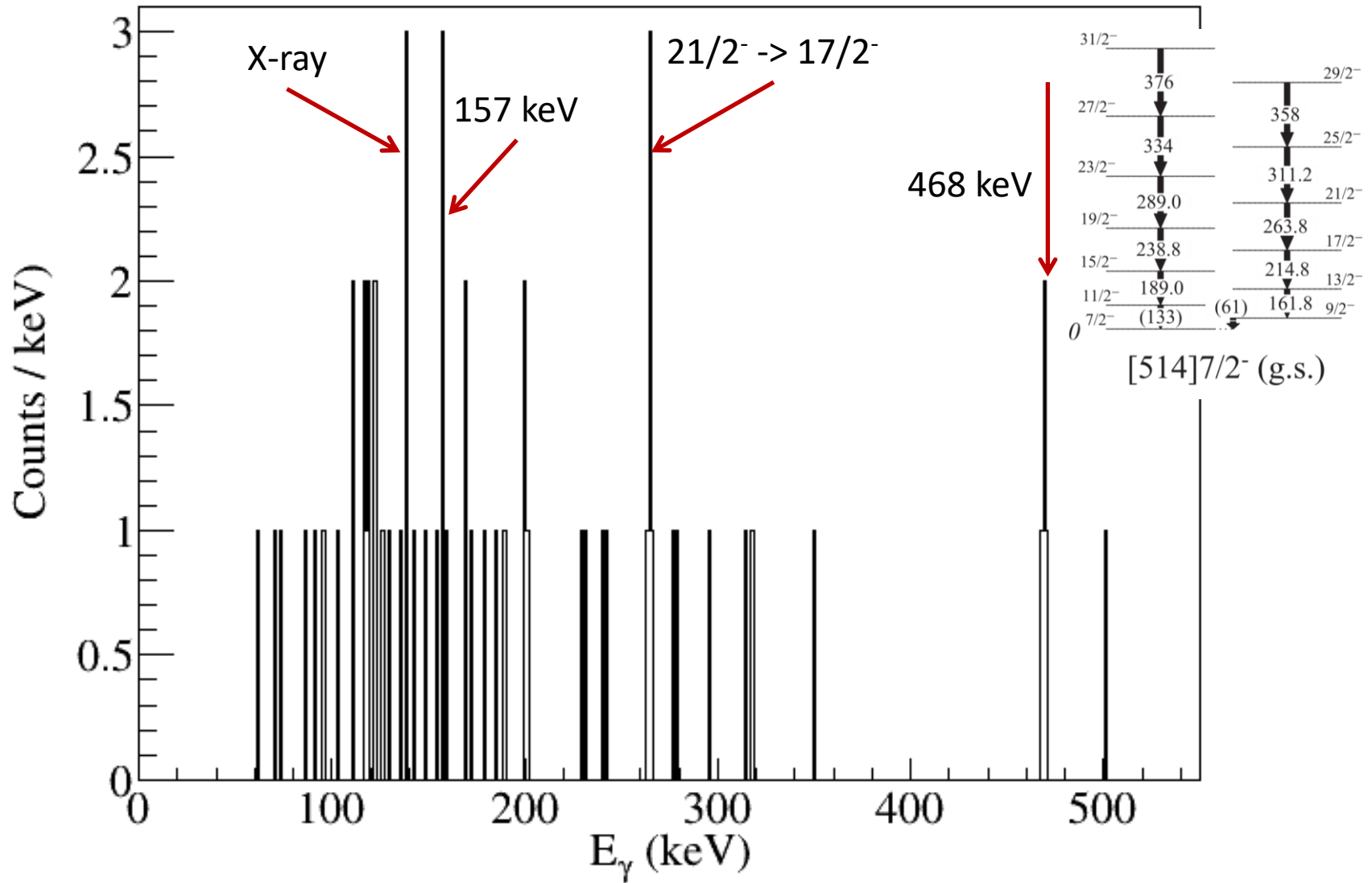
^{251}Md – delayed gammas



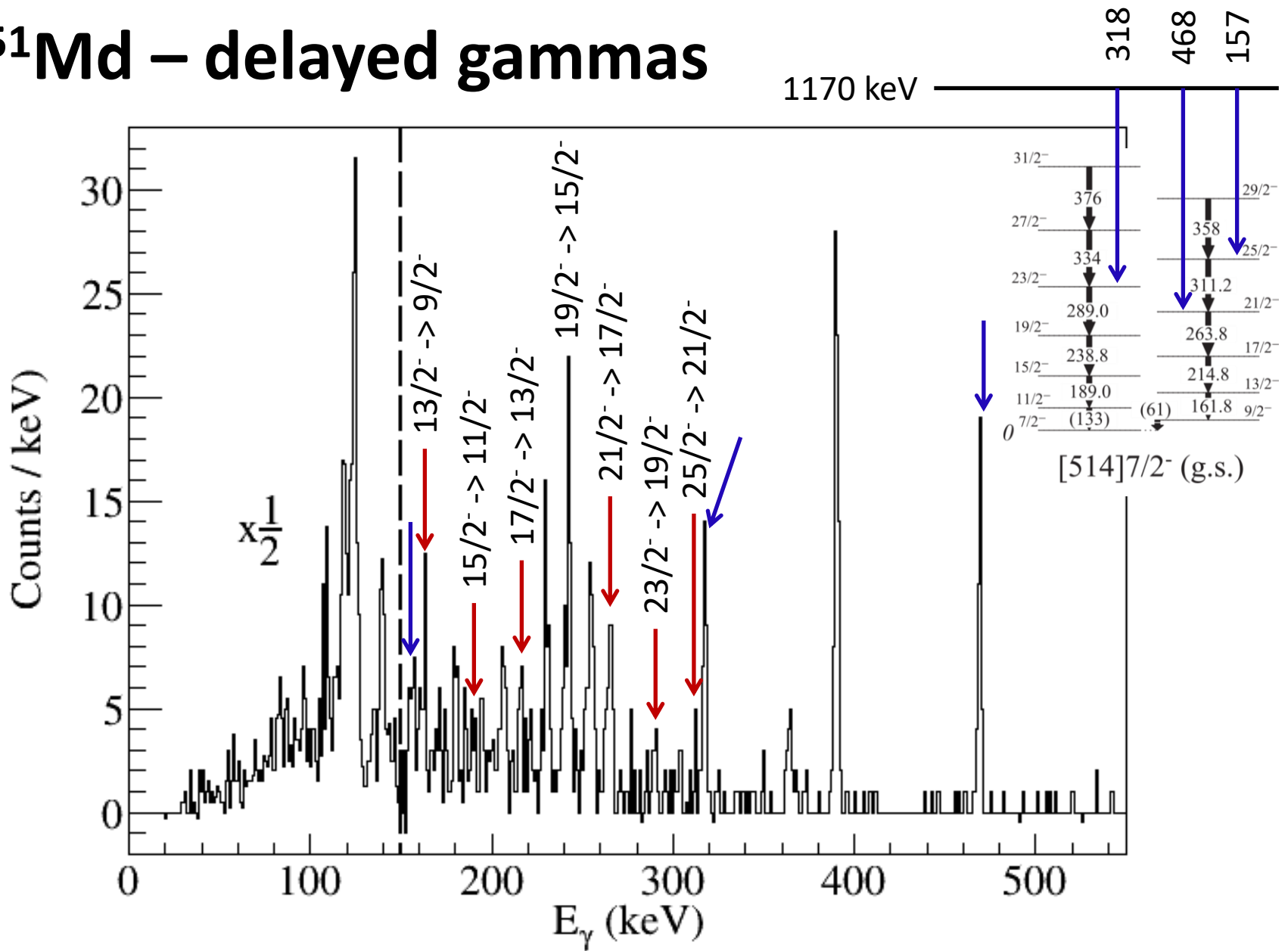
^{251}Md – delayed gammas



^{251}Md – delayed gamma-gamma



^{251}Md – delayed gammas

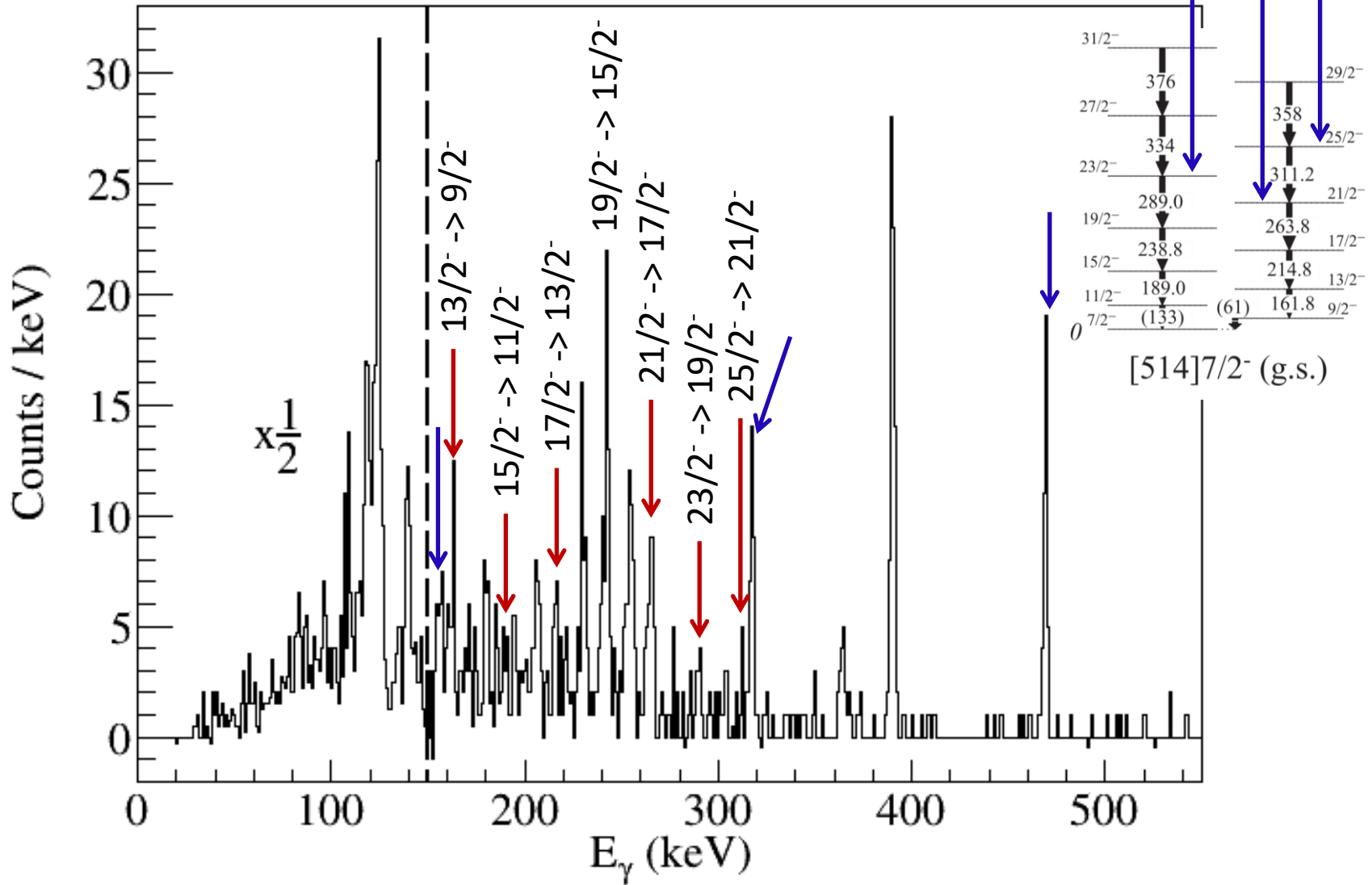


^{251}Md – delayed gammas

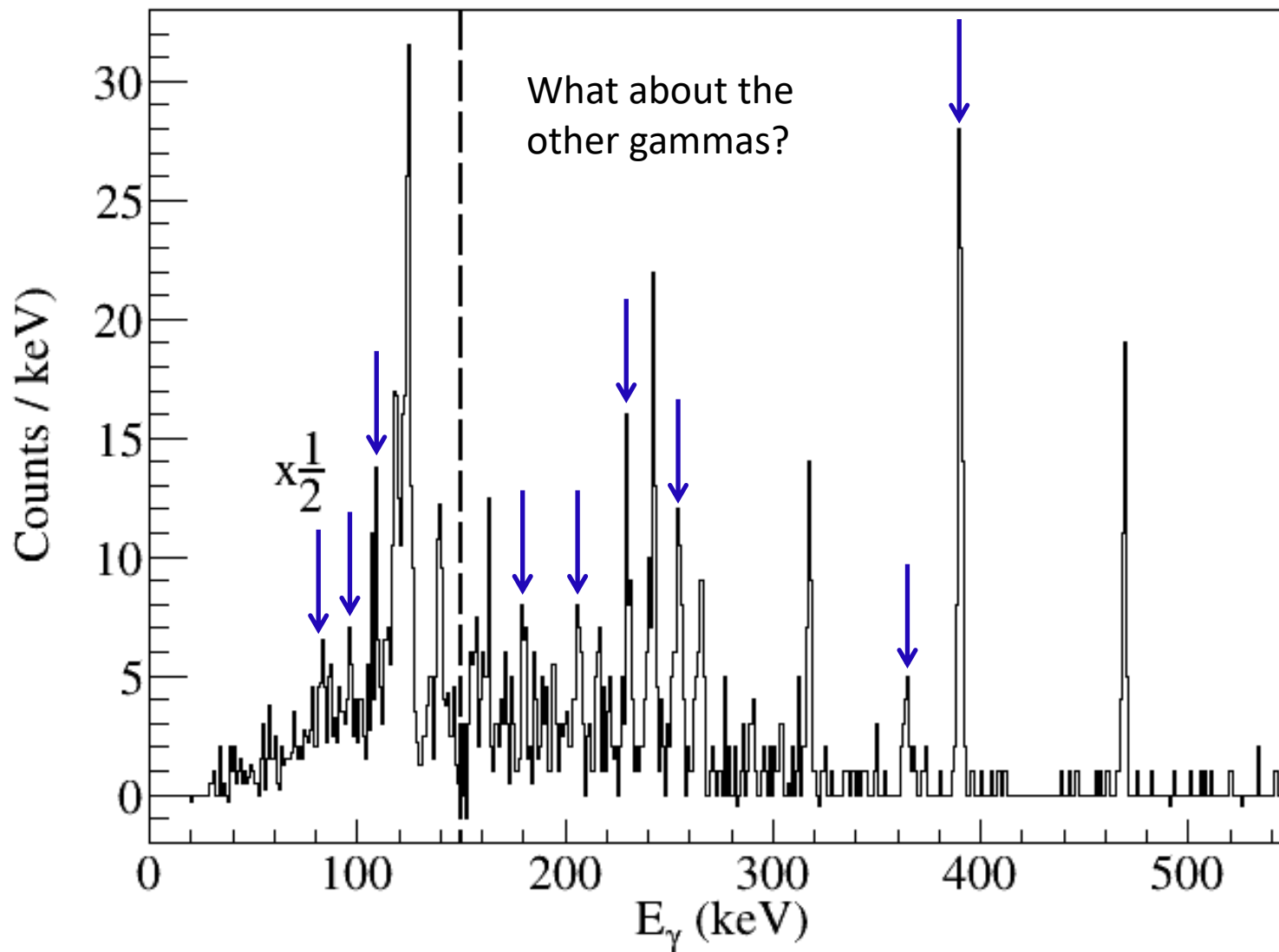
$$J^\pi = 8^- \otimes \frac{7^-}{2} = \frac{23^+}{2}$$

1170 keV

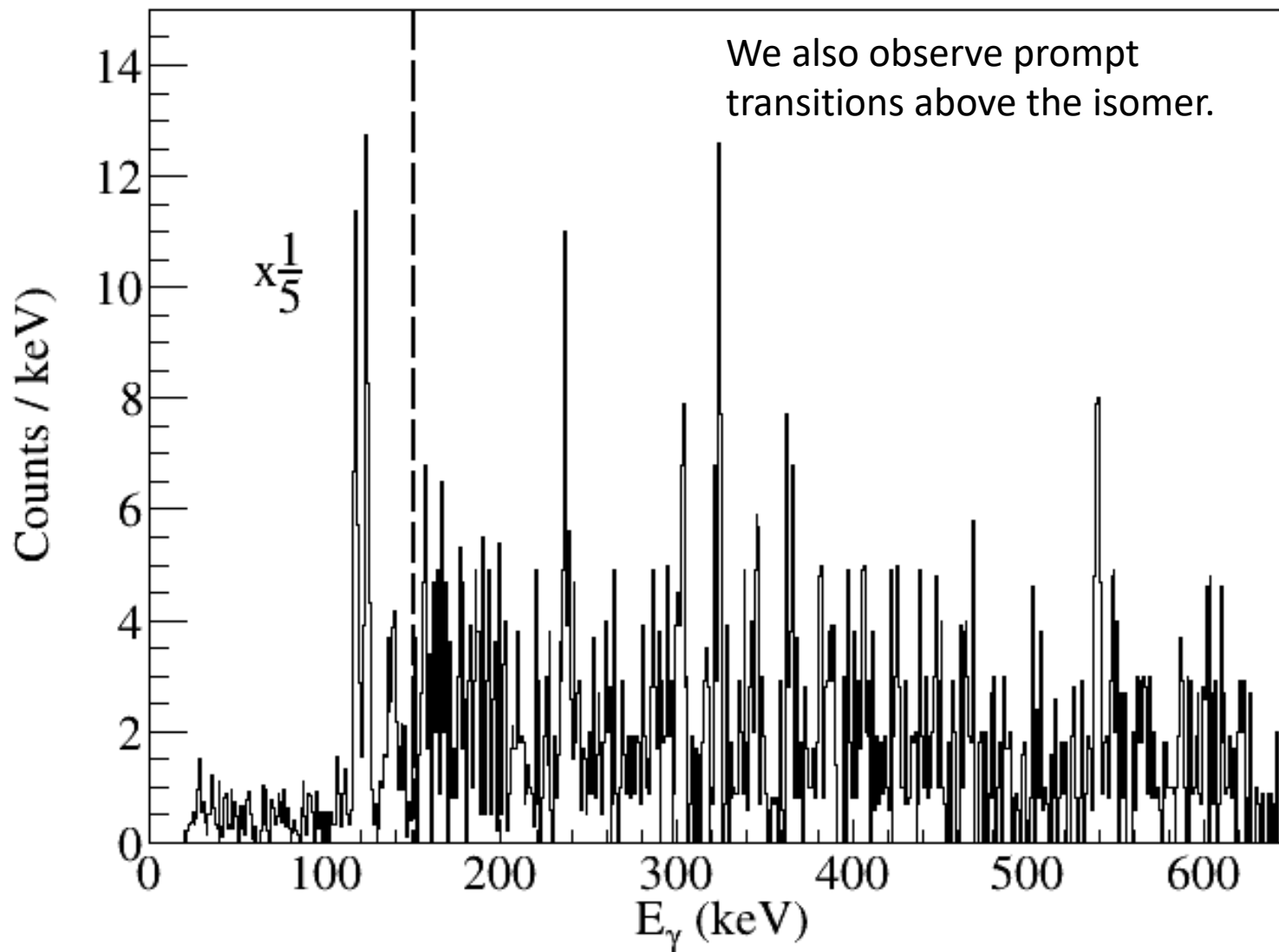
318
468
157



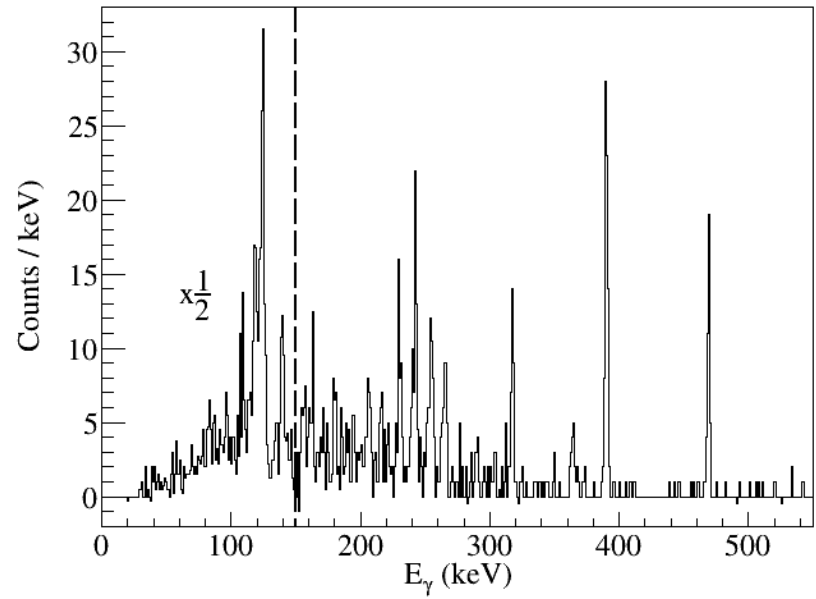
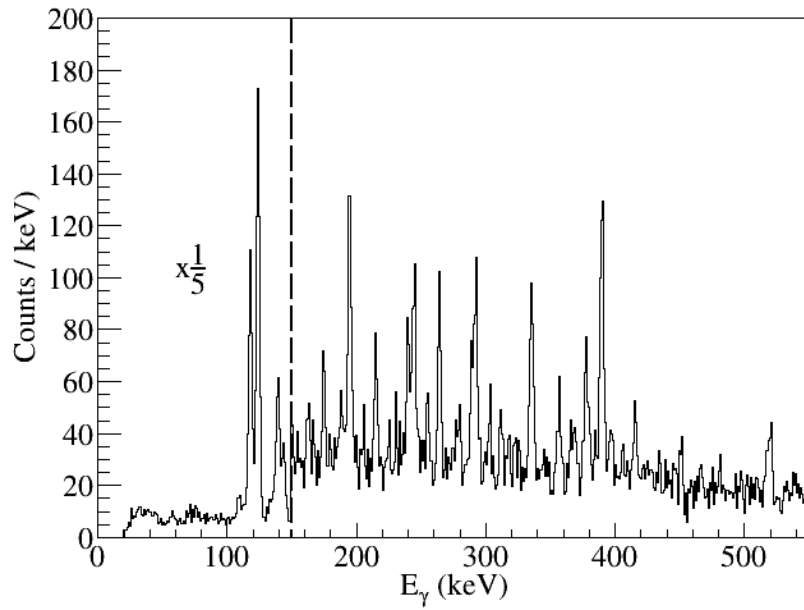
Future work



Future work



Summary



- We have performed in-beam and decay γ -ray spectroscopy of ^{251}Md
- We have placed the isomer and identified its configuration
- More to come!

Acknowledgments

R.M. Clark, C.M. Campbell, H.L. Crawford, M. Cromaz,
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T.L. Khoo, F.G. Kondev, T. Lauritsen, D. Potterveld,
W. Reviol, G. Savard, S. Stolze, G.L. Wilson, J. Wu, S. Zhu



A. Korichi



D. Rudolph



Z. Favier

