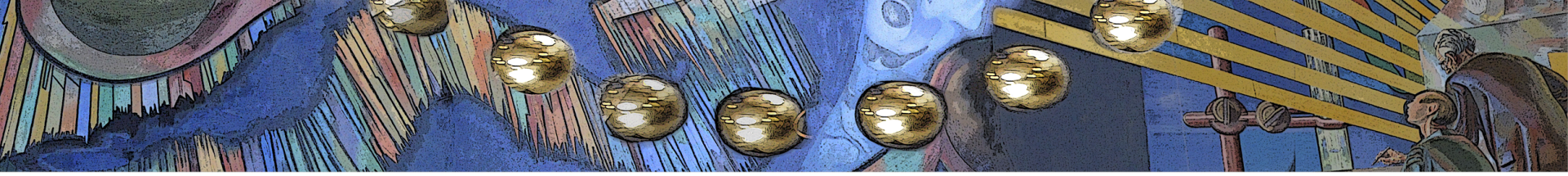

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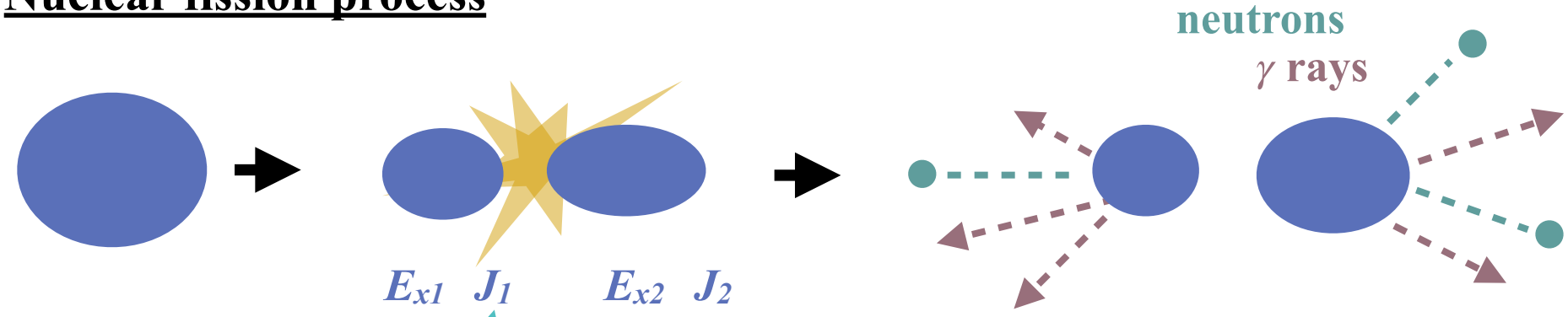
What impacts the angular momentum of the fission fragments?

Dorthea Gjestvang
PostDoc, University of Oslo

Nuclear fission process



No complete theoretical description of fission!

Recent: angular momentum generation in fission

Article

Angular momentum generation in nuclear fission

https://doi.org/10.1038/s41586-021-03304-w
Received: 18 June 2020
Accepted: 9 December 2020
Published online: 24 February 2021
Check for updates

J. N. Wilson[1✉], D. Thisse[1], M. Lebois[1], N. Jovančević[1], D. Gjestvang[2], R. Canavan[3,4], M. Rudigier[3,5], D. Étasse[6], R-B. Gerst[7], L. Gaudefroy[8], E. Adamska[9], P. Adsley[1], A. Algora[10,11], M. Babo[1], K. Belvedere[3], J. Benito[12], G. Benzoni[13], A. Blazhev[7], A. Boso[4], S. Bottoni[13,14], M. Bunce[4], R. Chakma[1], N. Cieplicka-Oryńczak[15], S. Courtin[16], M. L. Cortés[17], P. Davies[18], C. Delafosse[1], M. Fallot[19], B. Fornal[15], L. Fraile[12], A. Gottardo[20], V. Guadilla[19], G. Häfner[1,7], K. Hauschild[1], M. Heine[16], C. Henrich[5], I. Homm[5], F. Ibrahim[1], Ł. W. Iskra[13,15], P. Ivanov[4], S. Jazrawi[3,4], A. Korgul[9], P. Koseoglou[5,21], T. Kröll[5], T. Kurtukian-Nieto[22], L. Le Meur[19], S. Leoni[13,14], J. Ljungvall[1], A. Lopez-Martens[1], R. Lozeva[1], I. Matea[1], K. Miernik[9], J. Nemer[1], S. Oberstedt[23], W. Paulsen[2], M. Piersa[9], Y. Popovitch[1], C. Porzio[13,14,24], L. Qi[1], D. Ralet[25], P. H. Regan[3,4], K. Rezynkina[26], V. Sánchez-Tembleque[12], S. Siem[2], C. Schmitt[16], P.-A. Söderström[5,27], C. Sürder[5], G. Tocabens[1], V. Vedia[12], D. Verney[1], N. Warr[7], B. Wasilewska[15], J. Wiederhold[5], M. Yavahchova[28], F. Zeiser[2] & S. Ziliani[13,14]

Independent *J* magnitudes

What impacts the *J* of the fission fragments?

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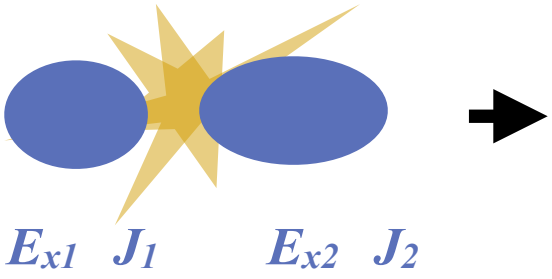
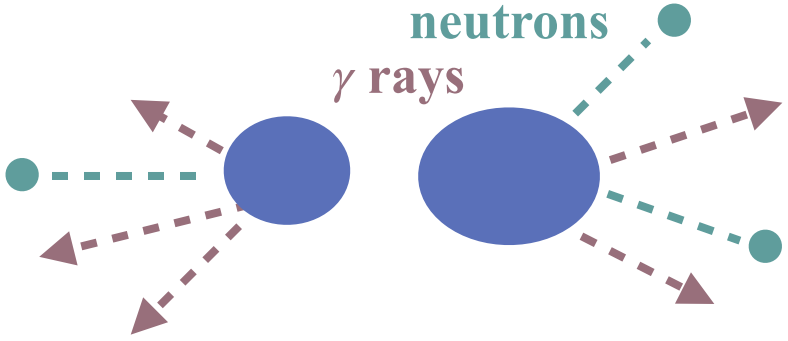
How to investigate *J* experimentally?



Want to know these

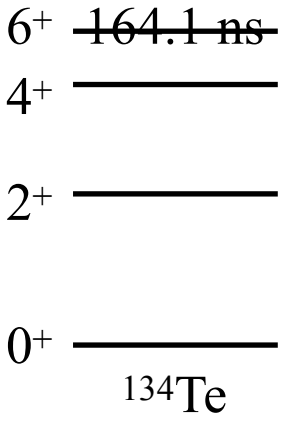


Can measure neutrons and γ rays

fission fragments: some have isomers

Isomeric Yield Ratio (IYR):
How large fraction of the decays go through the isomer?

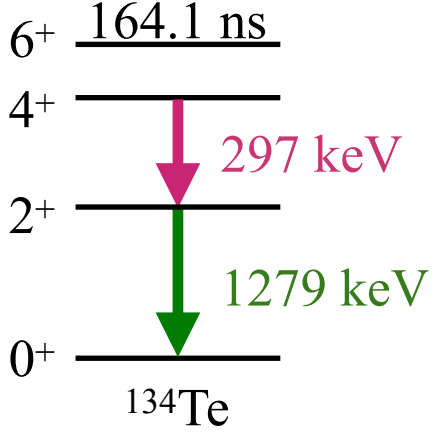
$$IYR = \frac{\text{isomeric decays}}{\text{total decays}}$$

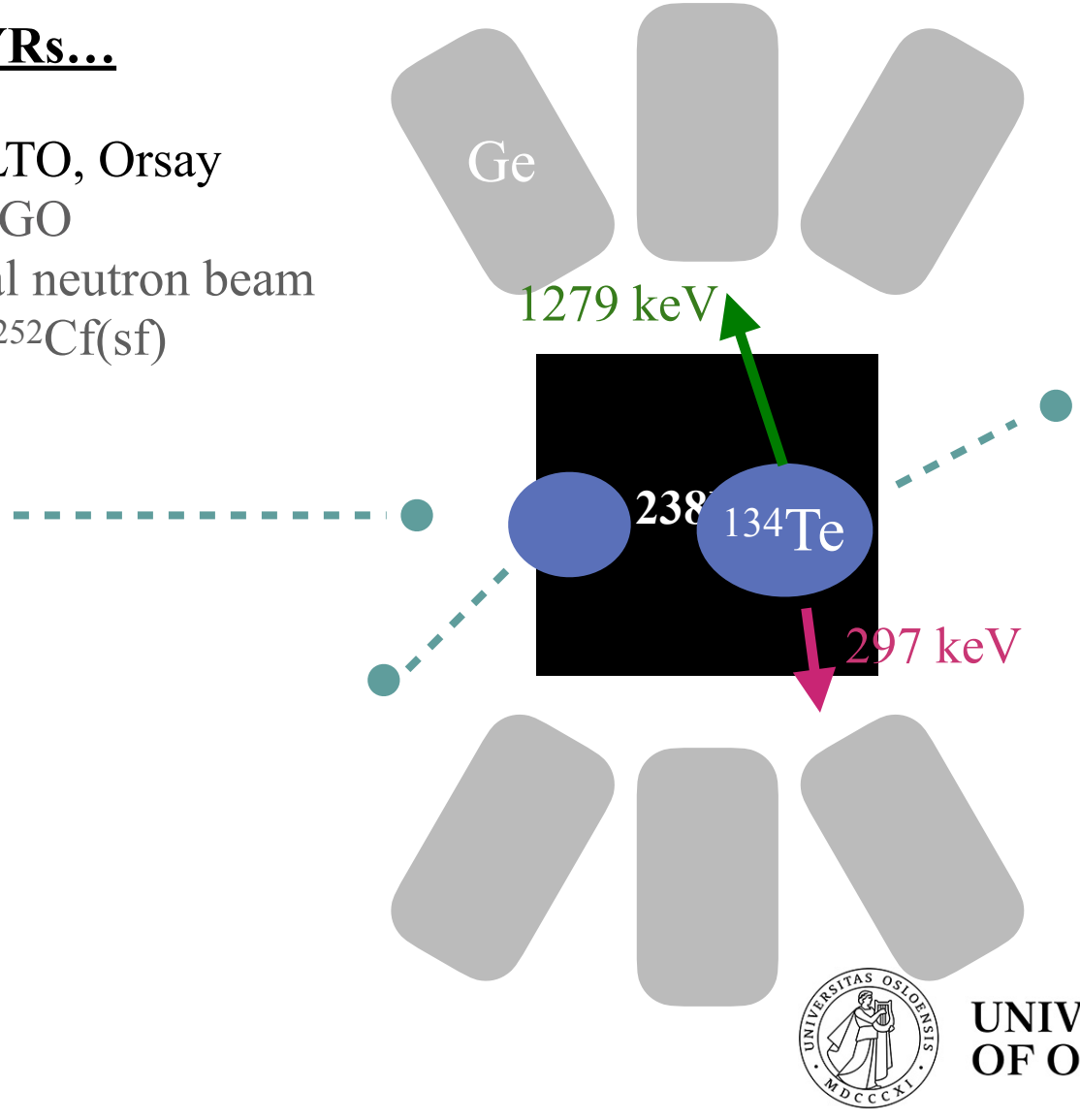


IYR sensitive to fragment angular momentum *J*!
→ probe small differences between systems

A new way to measure IYRs…

nuBall experiment at ALTO, Orsay
→ array of Ge, $LaBr_3$, BGO
→ LICORNE directional neutron beam
→ ^{238}U(n,f), ^{232}Th(n,f), ^{252}Cf(sf)





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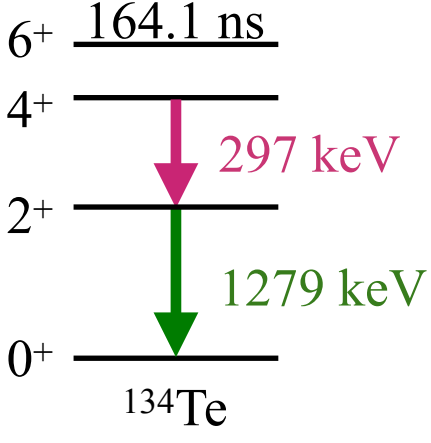
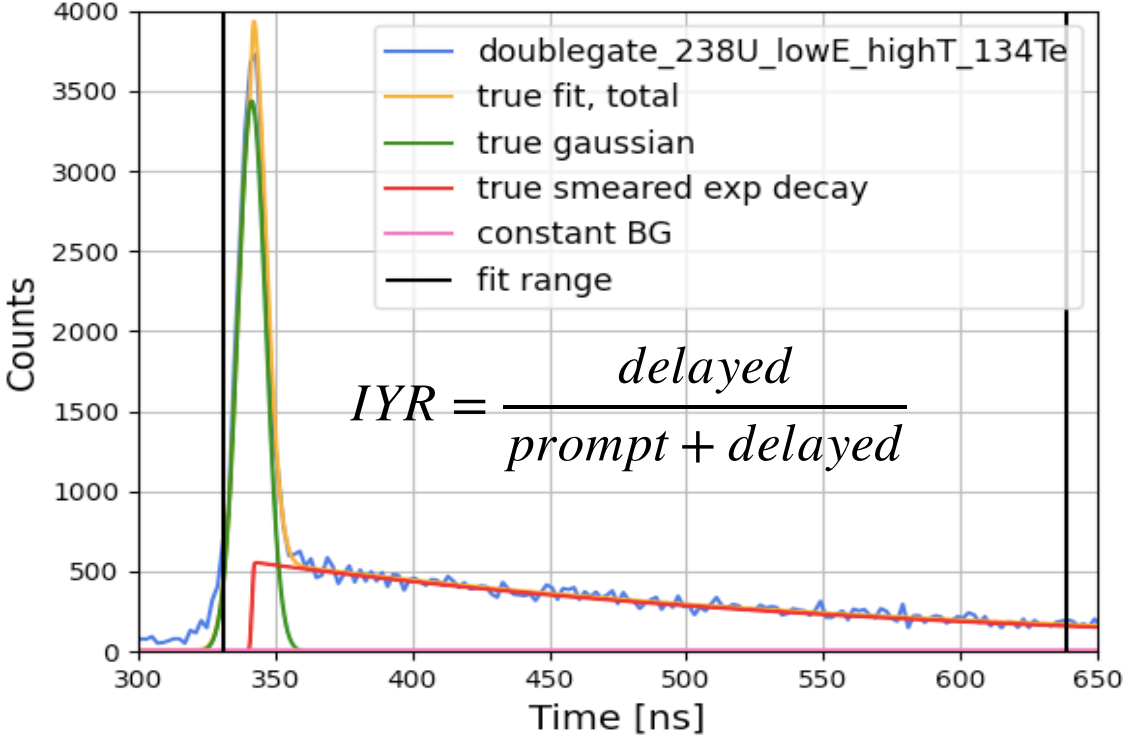
Overview of new method

→ Use Ge-detectors to select γ rays from fragment decay

→ Plot time of arrival



Gate on 1279 keV and 297 keV, plot time



Overview of new method

→ Use Ge-detectors to select γ rays from fragment decay

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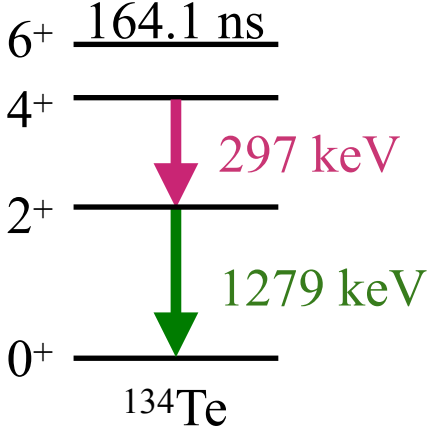
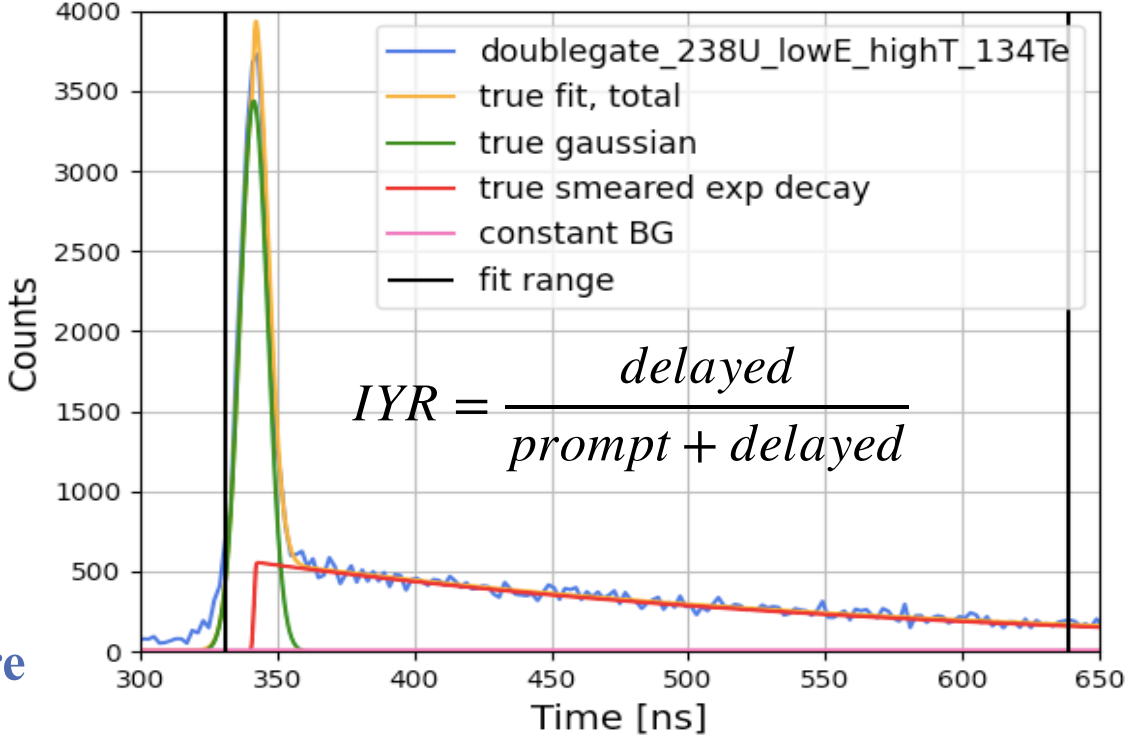
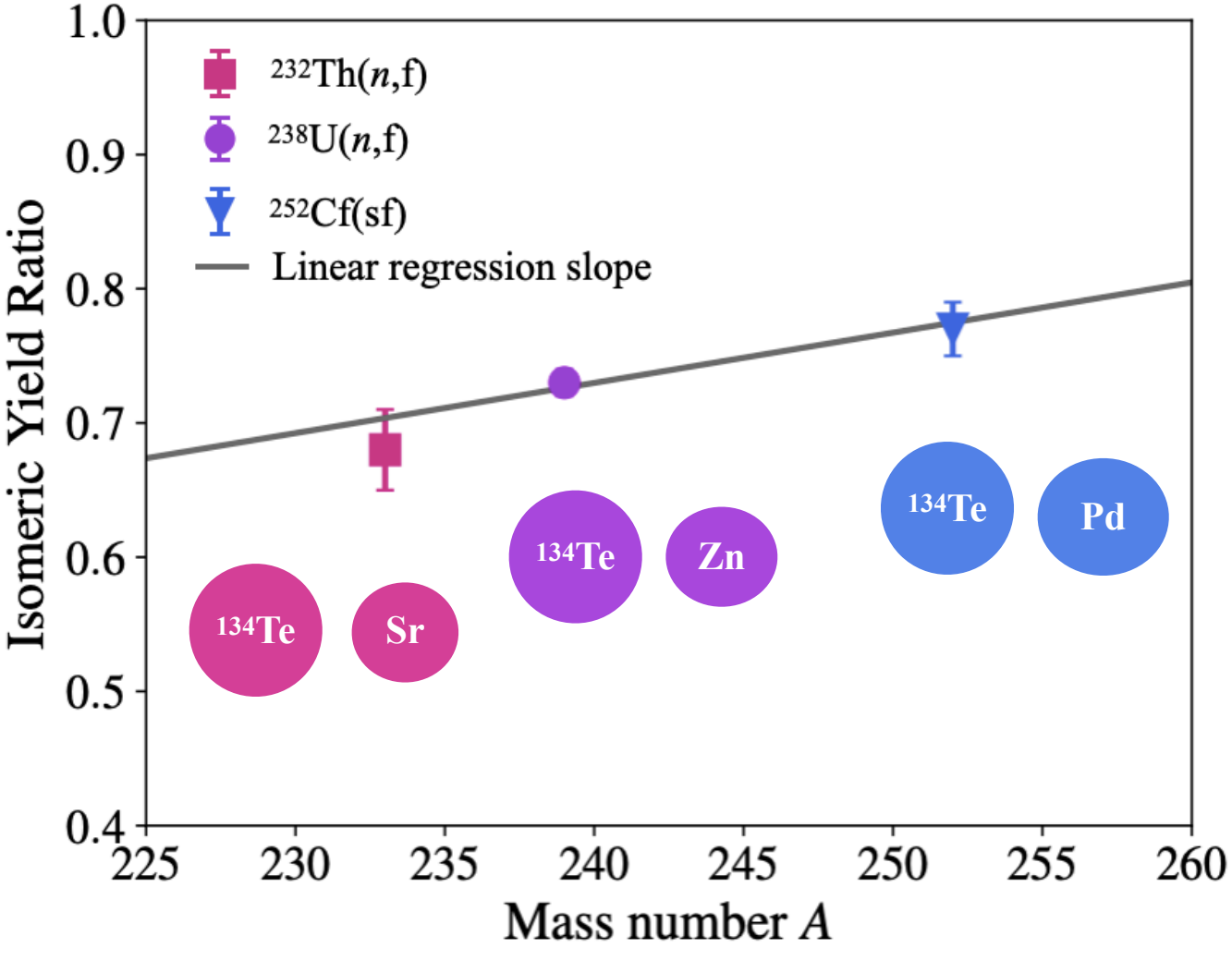


Gate on 1279 keV and 297 keV, plot time



⇒ **Shorter half-lives than before**

Results: IYR of ^{134}Te from different fissioning systems



⇒ IYR (and thus *J*) of ^{134}Te maybe has a slight slope with CN mass

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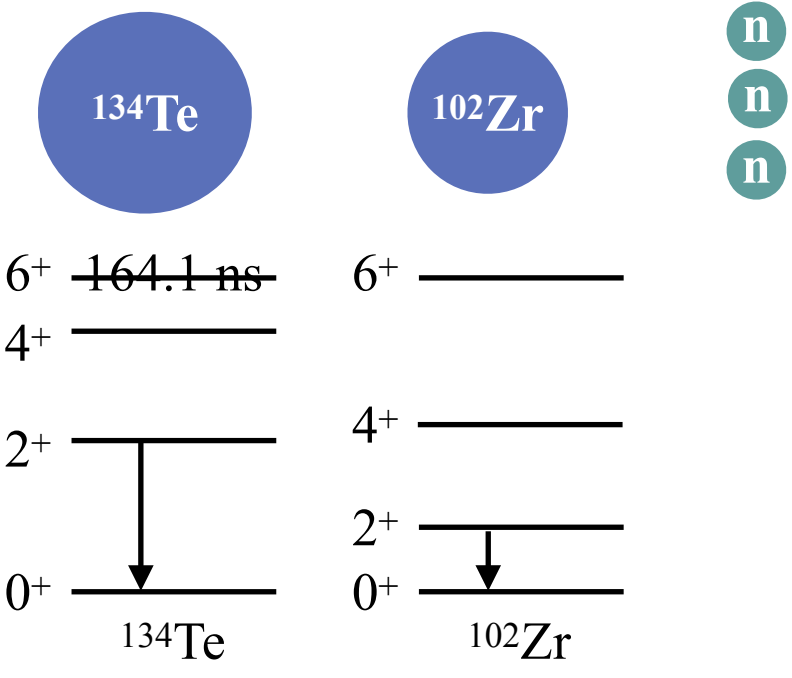
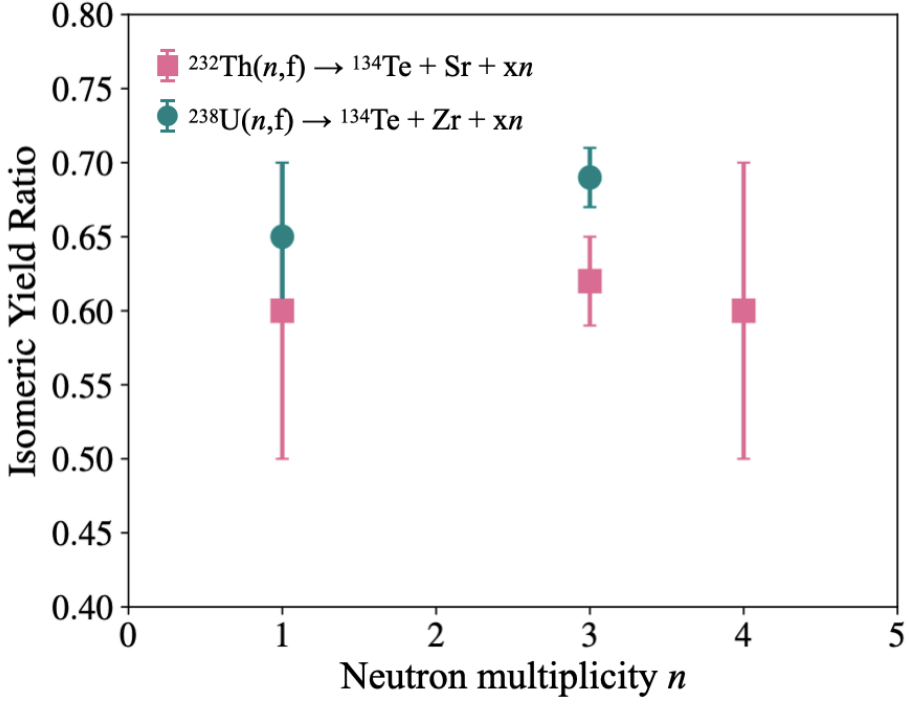
New possibility: partner gating

^{238}U(n,f): ^{134}Te can emerge with ^{102}Zr and 3 neutrons





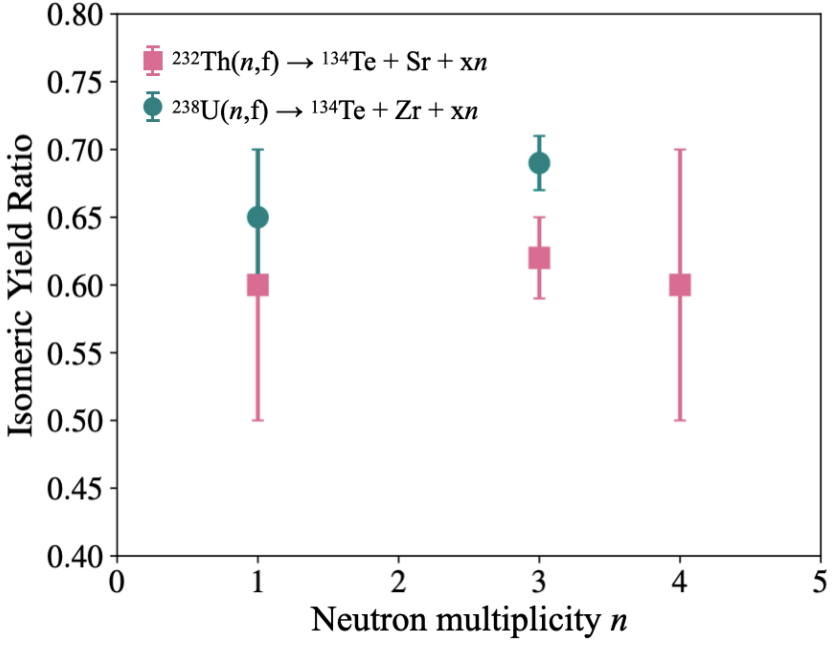
Demand that ^{134}Te was produced with ^{102}Zr
→ 3n emitted from the combined system!

⇒ IYR (and thus J) of ^{134}Te no measurable slope

Angular Momentum Removal by Neutron and γ-Ray Emissions during Fission Fragment Decays

I. Stetcu,[1] A. E. Lovell,[1] P. Talou,[1] T. Kawano,[1] S. Marin,[2] S. A. Pozzi,[2] and A. Bulgac[3]
[1]*Los Alamos National Laboratory, Los Alamos, New Mexico 87545, USA*
[2]*Department of Nuclear Engineering and Radiological Sciences, University of Michigan, Ann Arbor, Michigan 48109, USA*
[3]*Department of Physics, University of Washington, Seattle, Washington, D.C. 98195–1560, USA*

⇒ Suggests that neutrons may remove a lot of *J* from fragments



Working on determining how much *J* removed by neutrons

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Summary & Outlook

A new method for extracting IYRs of fission fragments
→ Possibility for partner gating

Investigated differences in the IYR of ^{134}Te with…
→ fissioning system

→ number of neutrons emitted

Outlook
→ Expand to more cases: H. Haug (^{135}Te and ^{130}Sn)
→ Higher-statistics data set

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Thank you!

PHYSICAL REVIEW C **108**, 064602 (2023)

Examination of how properties of a fissioning system impact isomeric yield ratios of the fragments

D. Gjestvang,[1,*] J. N. Wilson,[2] A. Al-Adili,[3] S. Siem,[1] Z. Gao,[3] J. Randrup,[4] D. Thisse,[2] M. Lebois,[2] N. Jovančević,[5] R. Canavan,[6,7] M. Rudigier,[6,8] D. Étasse,[9] R.-B. Gerst,[10] E. Adamska,[11] P. Adsley,[2] A. Algora,[12,13] C. Belvedere,[6] J. Benito,[14,15] G. Benzoni,[16] A. Blazhev,[10] A. Boso,[7] S. Bottoni,[16,17] M. Bunce,[7] R. Chakma,[2] N. Cieplicka-Oryńczak,[18] S. Courtin,[19] M. L. Cortés,[20] P. Davies,[21] C. Delafosse,[2] M. Fallot,[22] B. Fornal,[18] L. Fraile,[14] A. Gottardo,[23] V. Guadilla,[22] G. Häfner,[2,10] K. Hauschild,[2] M. Heine,[19] C. Henrich,[8] I. Homm,[8] F. Ibrahim,[2] Ł. W. Iskra,[16,18] P. Ivanov,[7] S. Jazrawi,[6,7] A. Korgul,[11] P. Koseoglou,[8,24] T. Kröll,[8] T. Kurtukian-Nieto,[25] S. Leoni,[16,17] J. Ljungvall,[2] A. Lopez-Martens,[2] R. Lozeva,[2] I. Matea,[2] K. Miernik,[11] J. Nemer,[2] S. Oberstedt,[26] W. Paulsen,[1] M. Piersa-Siłkowska,[11] Y. Popovitch,[2] C. Porzio,[16,17,27,†] L. Qi,[2] P. H. Regan,[6,7] K. Rezynkina,[28] V. Sánchez-Tembleque,[14] C. Schmitt,[19] P.-A. Söderström,[8,29] C. Sürder,[8] G. Tocabens,[2] V. Vedia,[14] D. Verney,[2] N. Warr,[10] B. Wasilewska,[18] J. Wiederhold,[8] M. Yavahchova,[30] and S. Ziliani[16,17]

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