Electric Monopole Transitions in ^{74}Se

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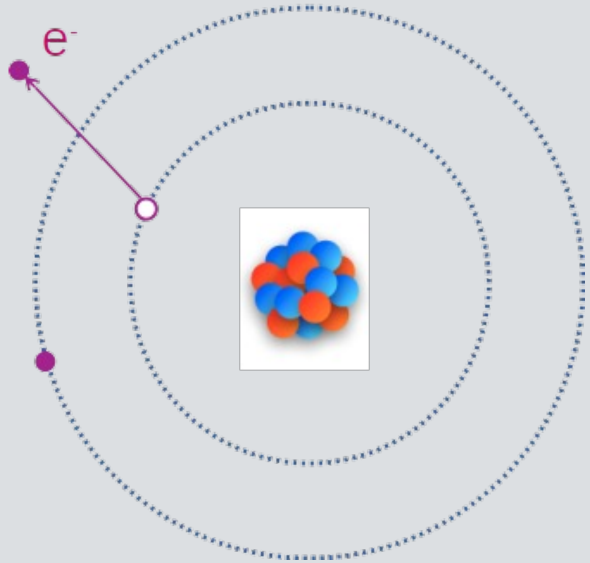
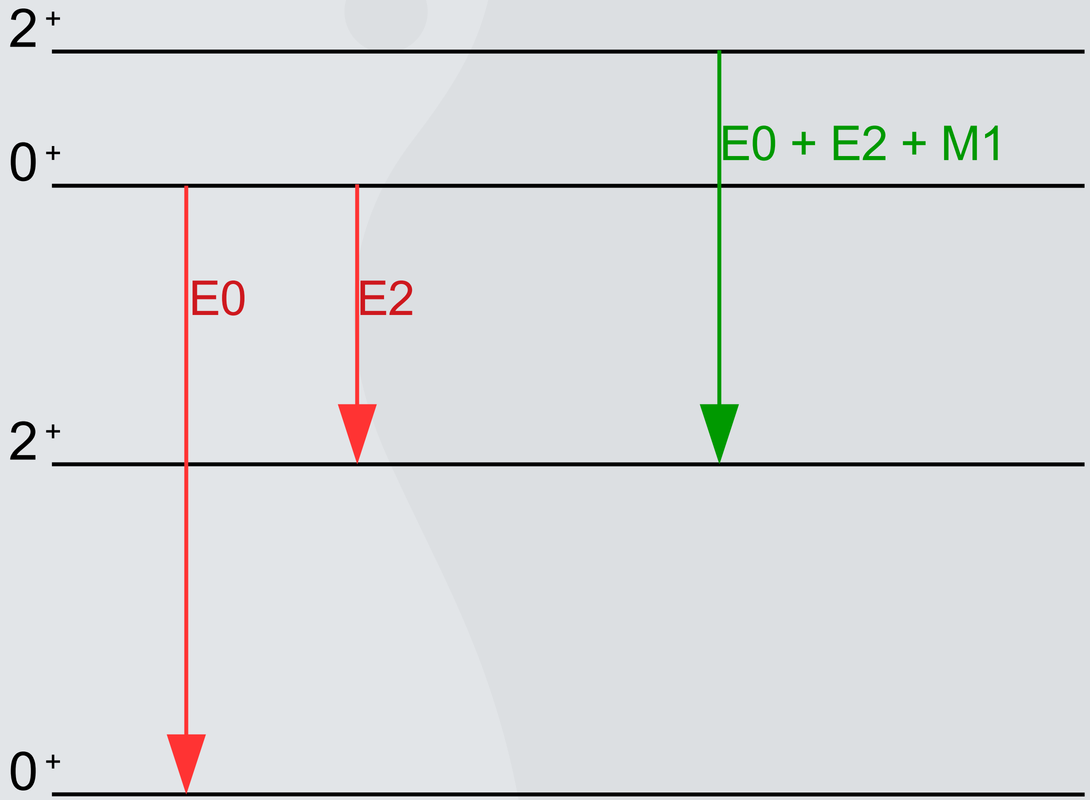
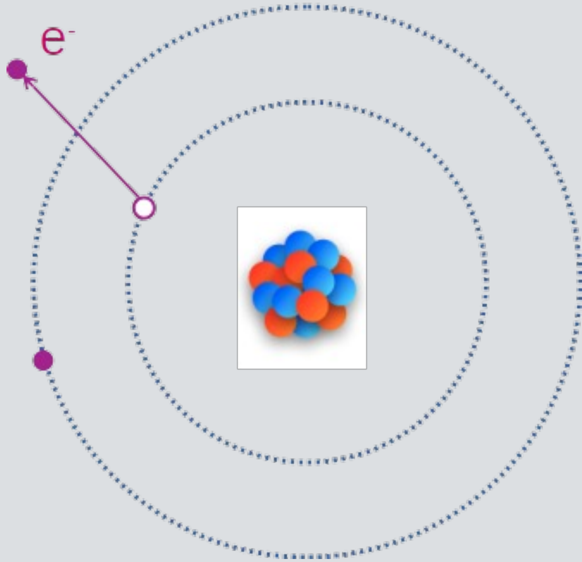


E0 Transitions

- E0 transitions are determined by a change in the radial distribution of the electric charge inside the nucleus, and high E0 strength is expected whenever configurations with different mean-square charge radii mix





E0 Transitions

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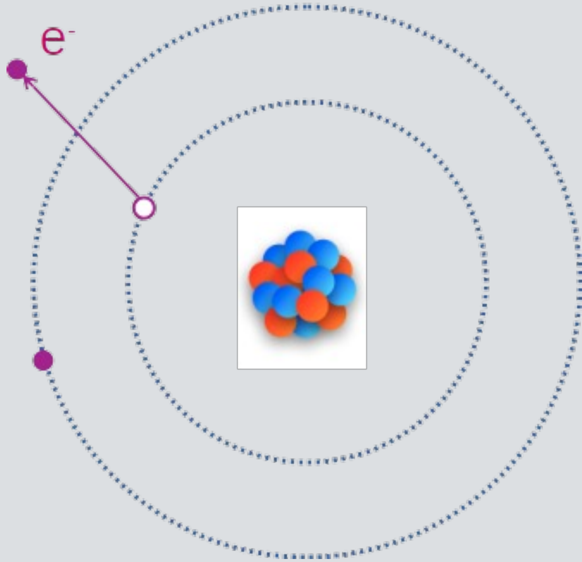
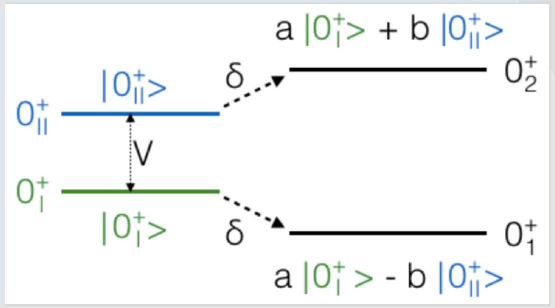
- Enhanced monopole strength may be considered as a “signature” for shape coexistence



- Simple two levels mixing model:



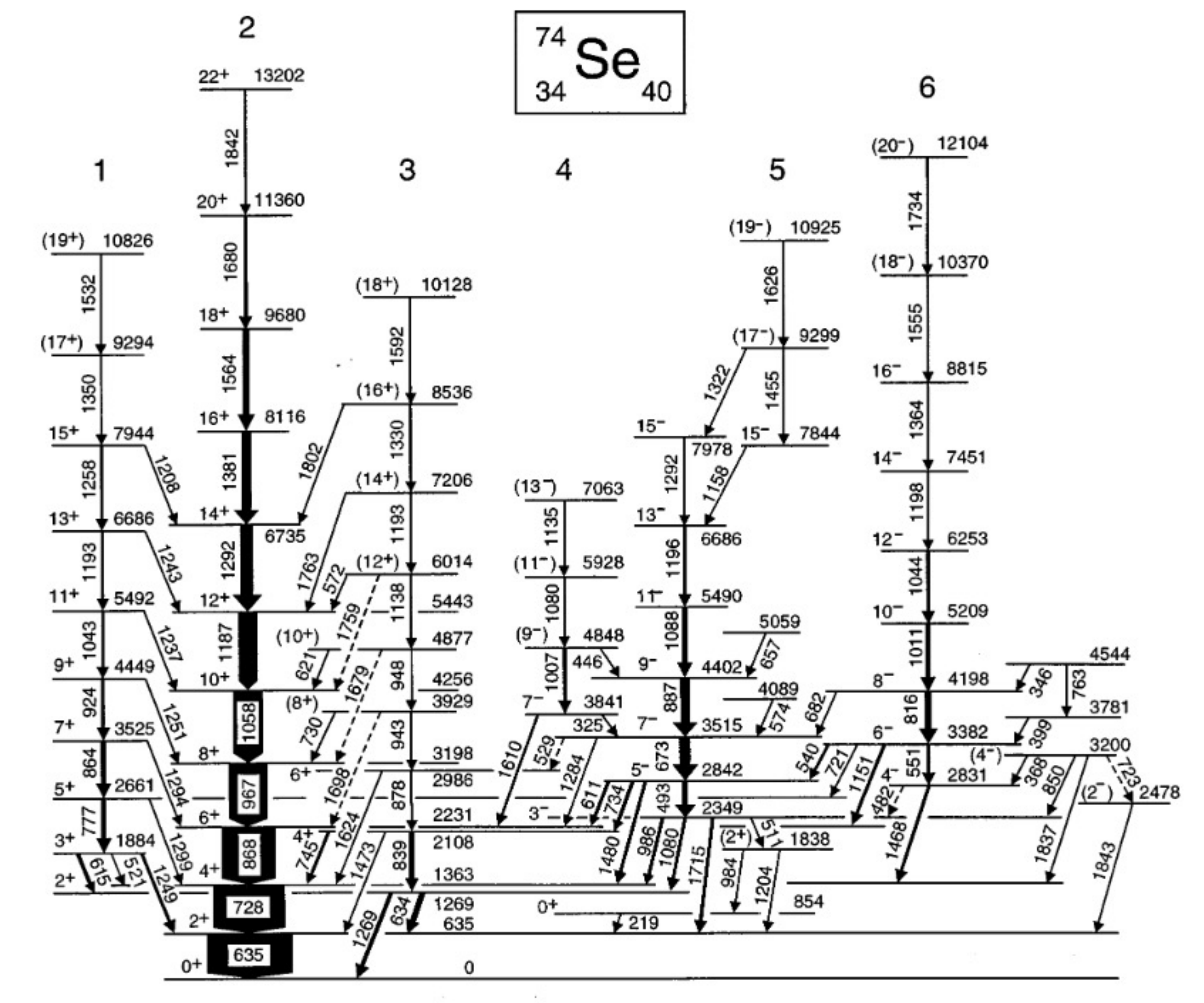
$$\rho^2(E0) = \frac{Z^2}{R^4} a^2 b^2 \left(\Delta \langle r^2 \rangle\right)^2$$

Wave function mixing

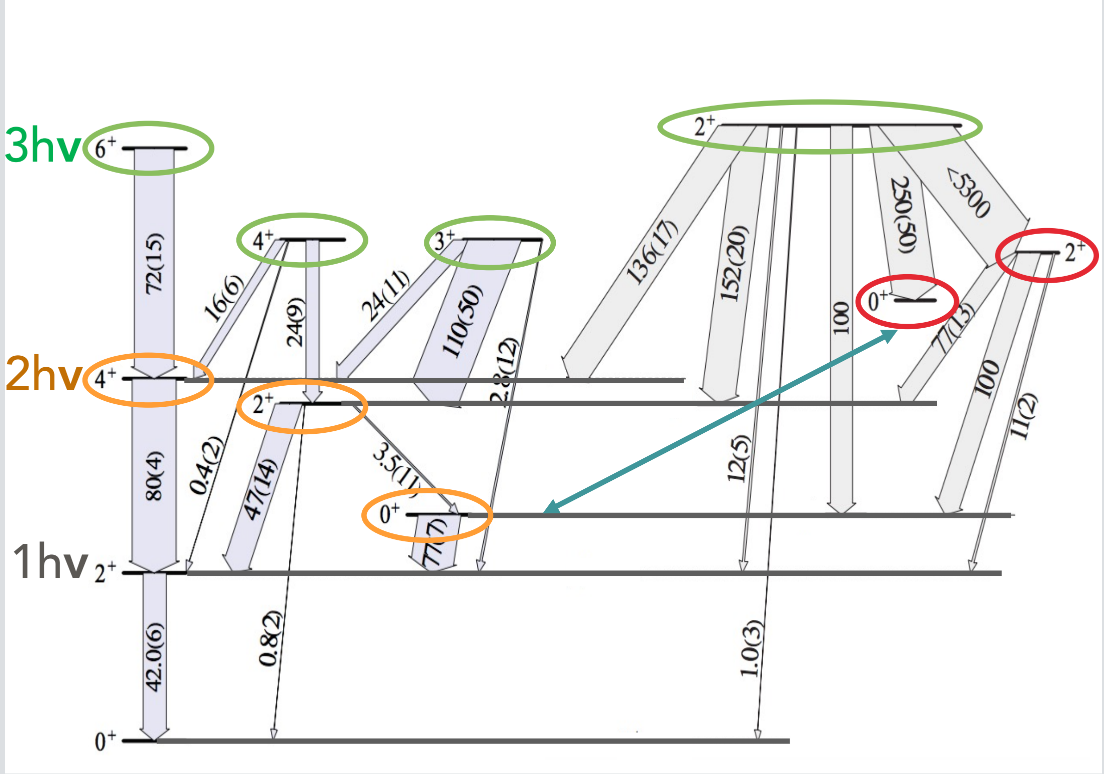
Difference in mean square radii

^{74}Se – Physics case

J. Döring *et al* Phys. Rev. C 57, 2912–2923 (1998)



E. A. McCutchan *et al* Phys. Rev. C 87, 014307 (2013)

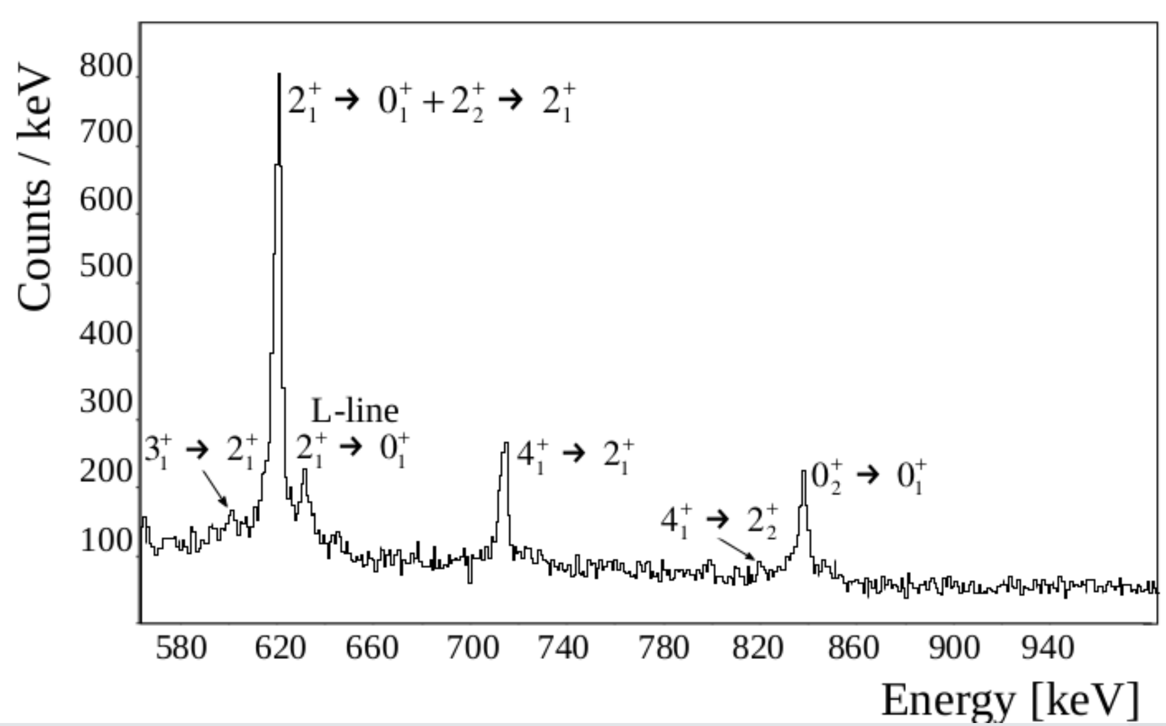


In this interpretation are expected:

- Strong $\rho^2(E0;\ 0_3^+ \rightarrow 0_2^+)$
- Negligible $\rho^2(E0;\ 2_2^+ \rightarrow 2_1^+)$

^{74}Se – Experiments

- $^{60}Ni(^{16}O,pn)$ @ 45 MeV
- ^{74}Br g.s. EC+β^+ decay in ^{74}Se with τ = 35m



$J_i^\pi \to J_f^\pi$	E_γ [keV]	$q^2(E0/E2)$ Present	$q^2(E0/E2)$ Previous	$\rho^2(E0)\cdot 10^3$ Present	$\rho^2(E0)\cdot 10^3$ Previous
$0_2^+ \to 0_1^+$	854	0.210(14)	0.202(14)	25(3)	22.9(25)
$0_3^+ \to 0_2^+$	804	< 15			
$2_2^+ \to 2_1^+$	634	0.39(22)		210(130)	

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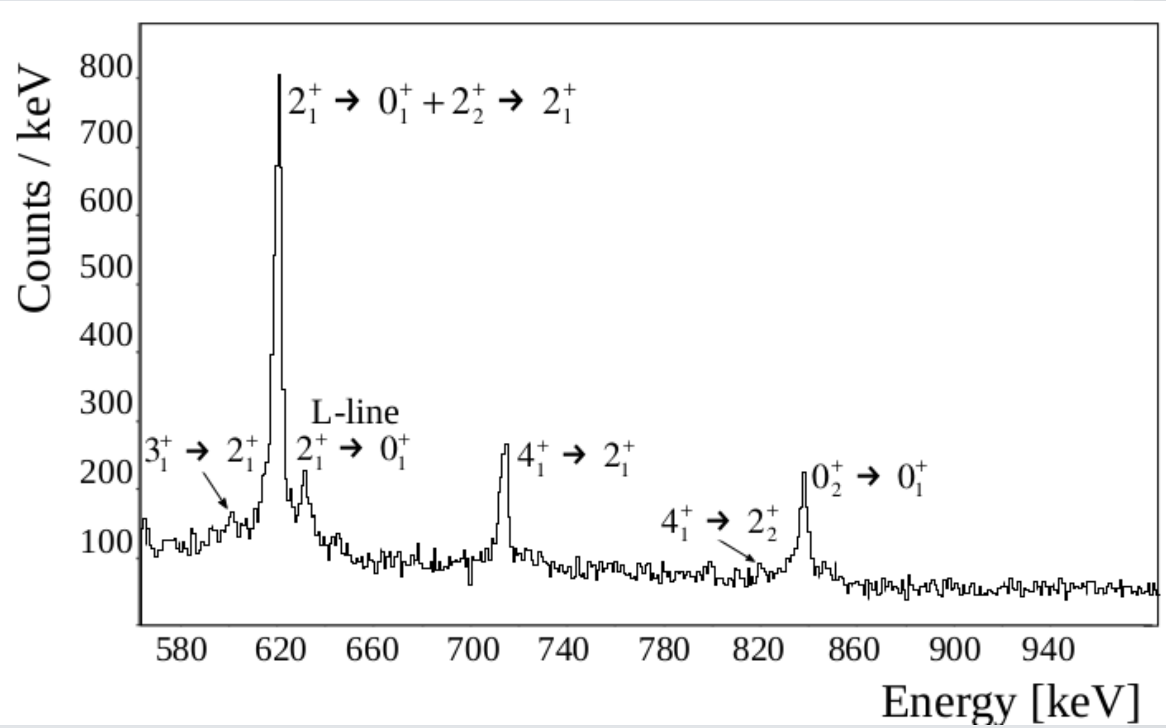

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- Small limit for the $q^2(E0;\, 0_3^+ \rightarrow 0_2^+)$

$$\rho^2(E0;0_3^+ \rightarrow 0_2^+)\cdot 10^3 = 3.28\cdot 10^{-3} q^2(E0/E2)\cdot B(E2;0_3^+ \rightarrow 2_1^+)$$

$\leq$ 5
(with B(E2) =100W.u.)

INCOMPATIBLE WITH THE INTEPRETATION OF THE SHAPE COEXISTENCE AND STRONG MIXING BETWEEN 0_2^+ AND THE 0_3^+ STATES

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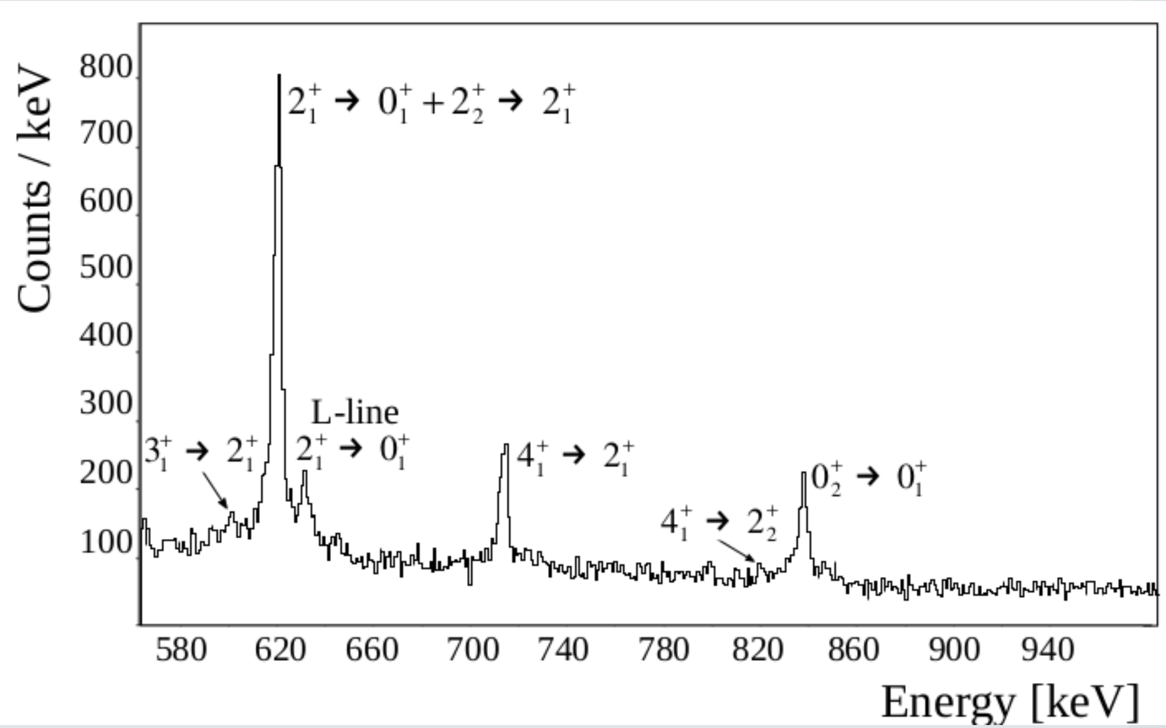

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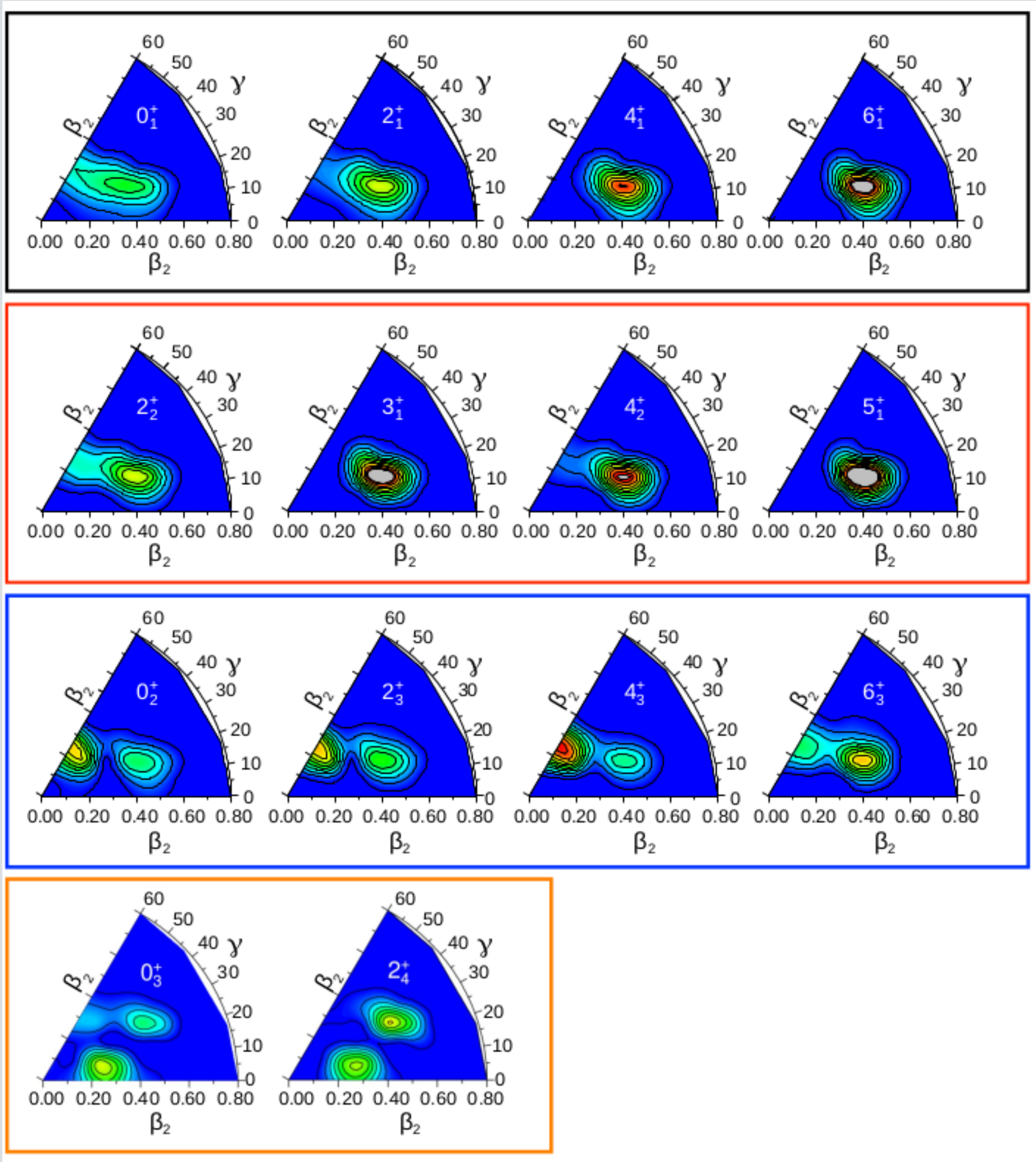
- Large value ρ^2 (E0; $2_2^+ \rightarrow 2_1^+$) compatible with those found for the Ni isotopes in L.J. Evitts *et al.* Phys. Lett. B 779 396 (2018)

INCOMPATIBLE WITH BOTH THE INTEPRETATIONS OF THE 2_2^+ STATE AS MEMBER OF THE TWO PHONON MULTIPLET AND AS THE BANDHEAD OF γ-BAND

^{74}Se - Theoretical Interpretation - BMF

First BMF calculations for the ^{74}Se isotope:

- the ground-state band built on top of the triaxial minimum, characterized by mixing with an oblate configuration in the ground state
- the band built on top of the triaxial 2_2^+ state associated with the ground-state band
- the band built on the 0_2^+ state with strong mixing of the oblate and triaxial configurations
- the band built on the 0_3^+ state with strong mixing of the prolate and triaxial configurations



Conclusions

Electric monopole transition strengths in the ^{74}Se isotope has been deduced:

- The obtained $\rho^2(E0;2_2^+ \rightarrow 2_1^+)$ value points out enhanced electric monopole transition between the 2_1 and 2_2 states as for the Ni isotopic chain
- The upper limit deduced for the electron intensity of the $0_3^+ \rightarrow 0_2^+$ transition is not in agreement with the explanation of the 0_2^+ state strongly mixed with the 0_3^+ state.
- The BMF calculations generally reproduce the experimental quantities, except for the $\rho^2(E0)$ values.
- The 0_2^+ state is interpreted as a shape coexisting state in the calculations, and the 2_2^+ state is the head of another band at low excitation energy.

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- <u>A more complex shape coexistence and mixing scenario is pictured for ^{74}Se at low-excitation energy</u>
- Further measurements of B(E2) and ultimately the determination of quadrupole invariants via low-energy Coulomb excitation are needed

Thank you for the Attention

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Emergence of triaxiality in ^{74}Se from electric monopole transition strengths

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