

# Isospin-symmetry breaking in the $B(E2)$ transitions of $T = 1$ multiplets

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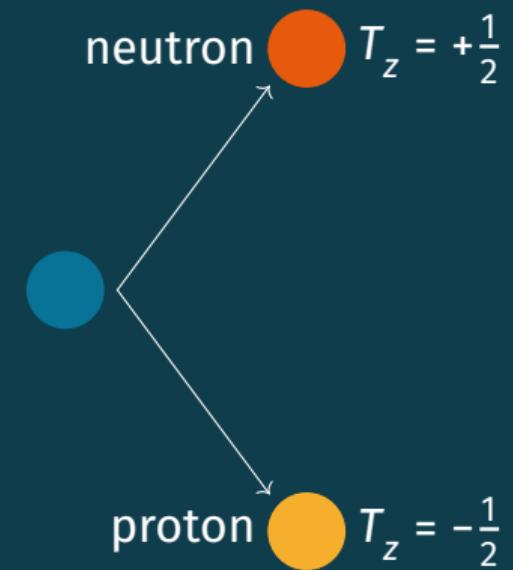


ARIS  
2023



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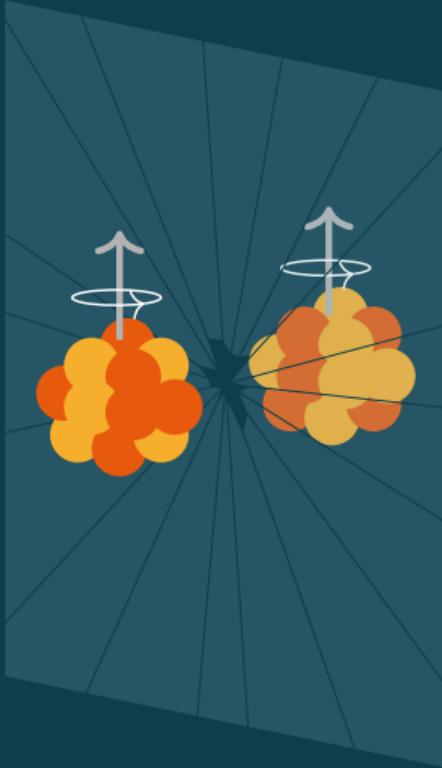


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$$B(E\lambda, J_i \rightarrow J_f) = \frac{1}{2J_i + 1} \left| \langle f | \hat{E}\lambda | i \rangle \right|^2$$



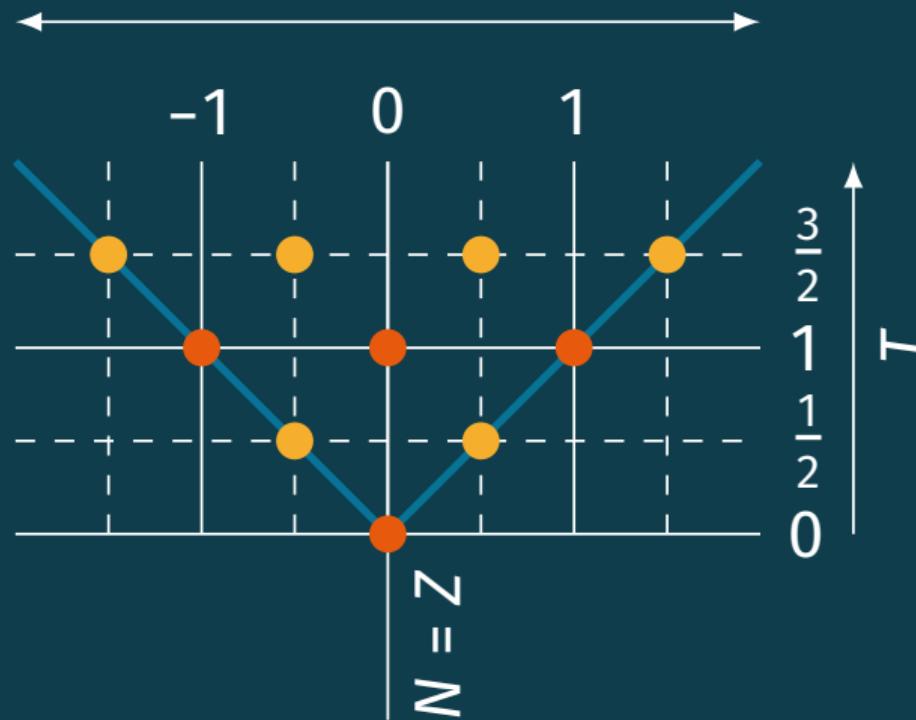
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$$T_z = \frac{N-Z}{2}$$

- odd  $A$
- even  $A$



$$M_p(T_z) = \sqrt{B(E2, 0^+ \rightarrow 2^+)} = \frac{1}{2}(M_0 - M_1 T_z)$$

**For a meaningful test we need the data  
for the complete triplet!**



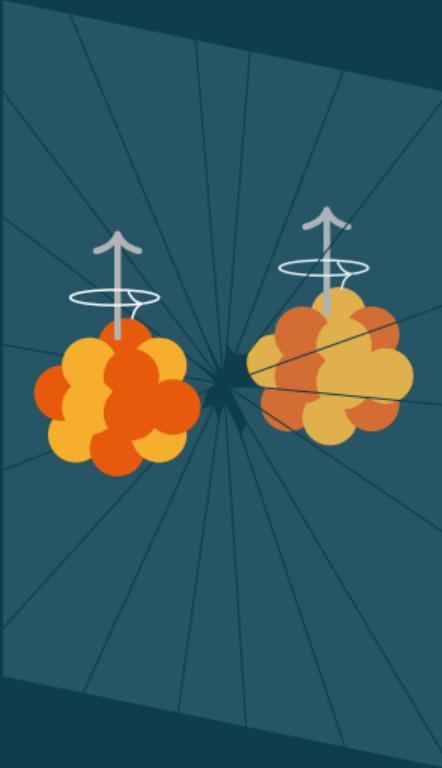
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!

Experiment:  
 $A = 70$   
 $T = 1$

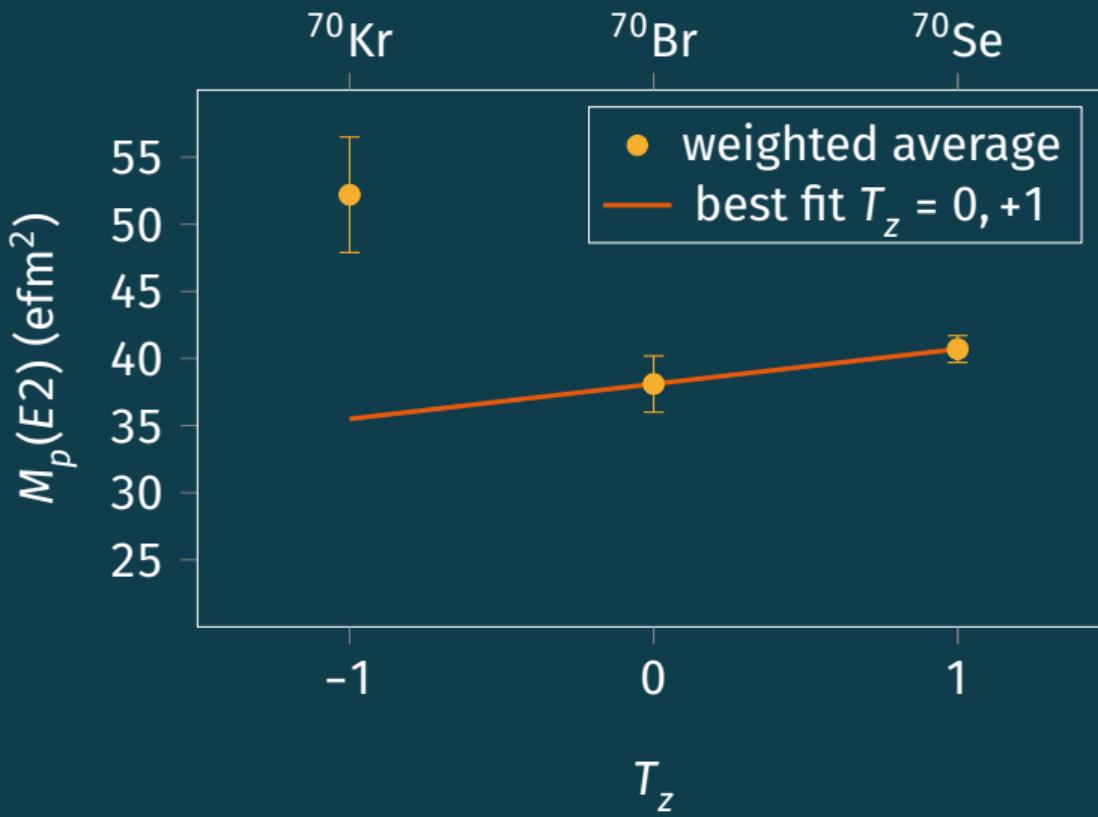


!

Experiment:

$$A = 70$$
$$T = 1$$







# Is there a shape change?



# **How did we explore this topic?**



UNEDF1 energy  
density functional  
+  
HFODD code  
+  
full  
angular-momentum  
restoration

\*\*\*\*\*  
\* S I N G L E - C O R E      V E R S I O N \*  
\*  
\*\*\*\*\*



\* UNIVERSAL NON-RELATIVISTIC NUCLEAR DFT CODE VERSION: 3.16N \*

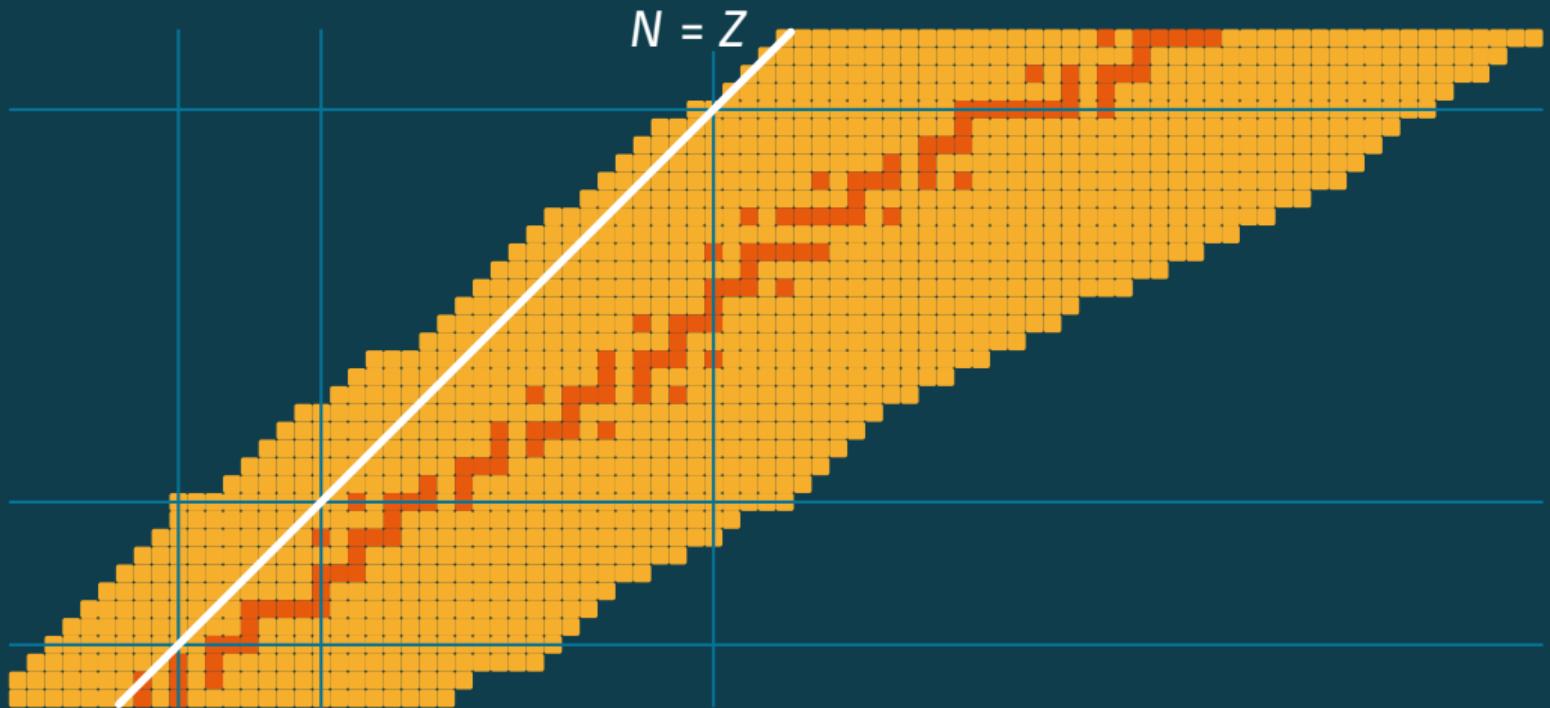
\* NO SYMMETRY-PLANES AND NO TIME-REVERSAL SYMMETRY \*

\* DEFORMED CARTESIAN HARMONIC-OSCILLATOR BASIS \*

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explore  
all even-even  
 $T = 1$  mirrors  
with  
 $42 \leq A \leq 98$



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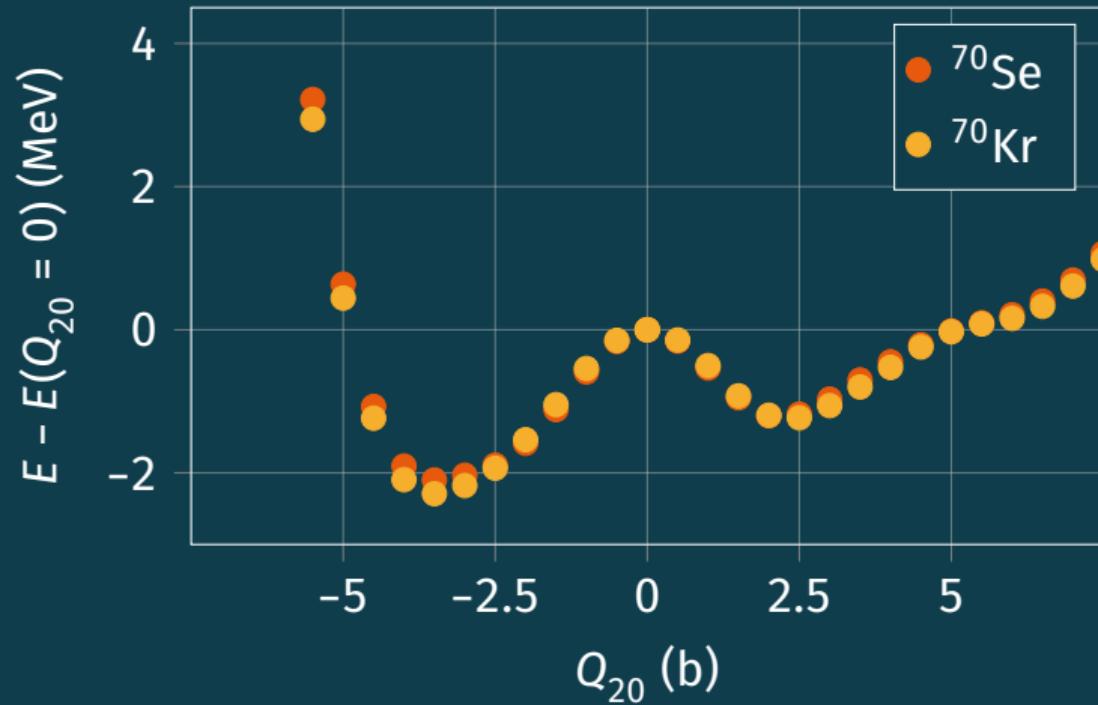
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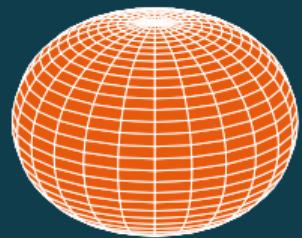
observe  
systematics;  
compare  $B(E2)$   
with exp  
data



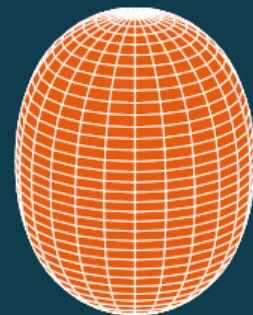
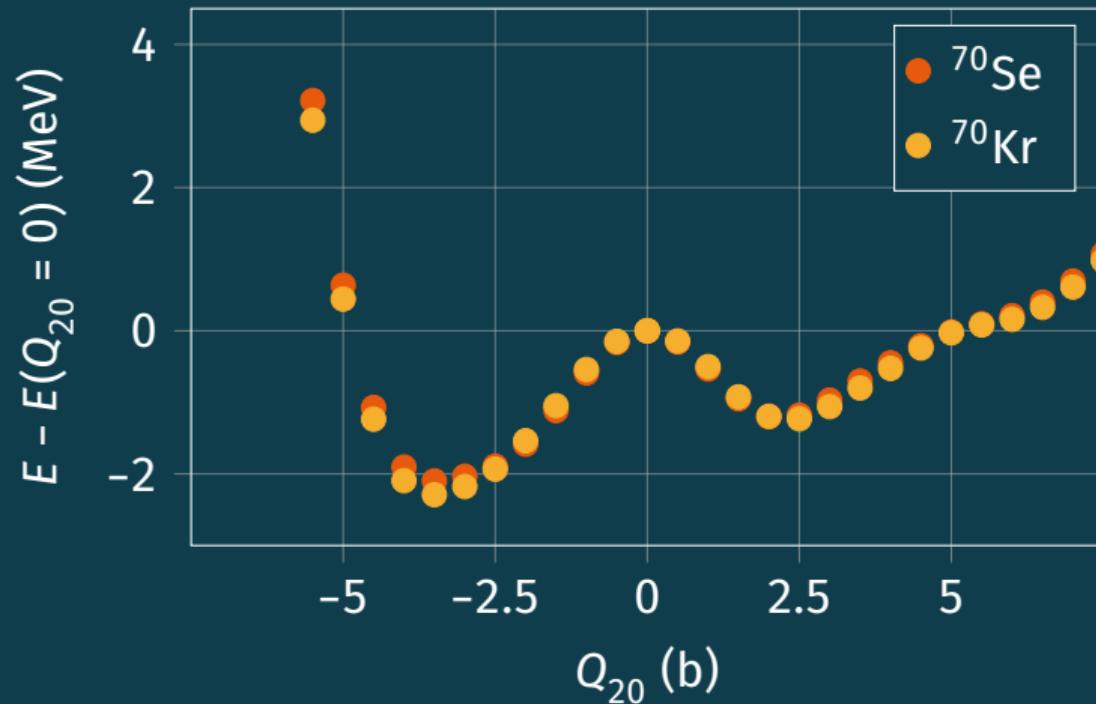
i.

constrained HFB  
to determine  
potential  
energy curves





Oblate  
 $Q_{20} < 0$



Prolate  
 $Q_{20} > 0$

i.

constrained HFB  
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i.

constrained HFB  
to determine  
potential  
energy curves

ii.

unconstrained  
calculation  
close to  
the minima

i.

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iii.

angular-momentum  
projection  
to extract  
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we also employed the Generalised Bohr Hamiltonian (BH)  
to study the effect of quadrupole collectivity



# **How to deal with the $N = Z$ odd-odd nuclei?**



$^{79}\text{Zr}$

$J_\pi = 5/2^+$

$^{77}\text{Y}$

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$^{78}\text{Y}$

$^{79}\text{Y}$

$J_\pi = 5/2^+$

$^{77}\text{Sr}$

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look at exp data  
for the ground state  
of neighbouring  
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perform AMP  
of the HFB states  
with pair-blocked  
configurations

$$(T = 1, J = 0)$$



!

we can only perform  
calculations for  
the odd-odd nuclei  
with AMP



$A = 70$

heaviest triplet  
with  $B(E2)$  known  
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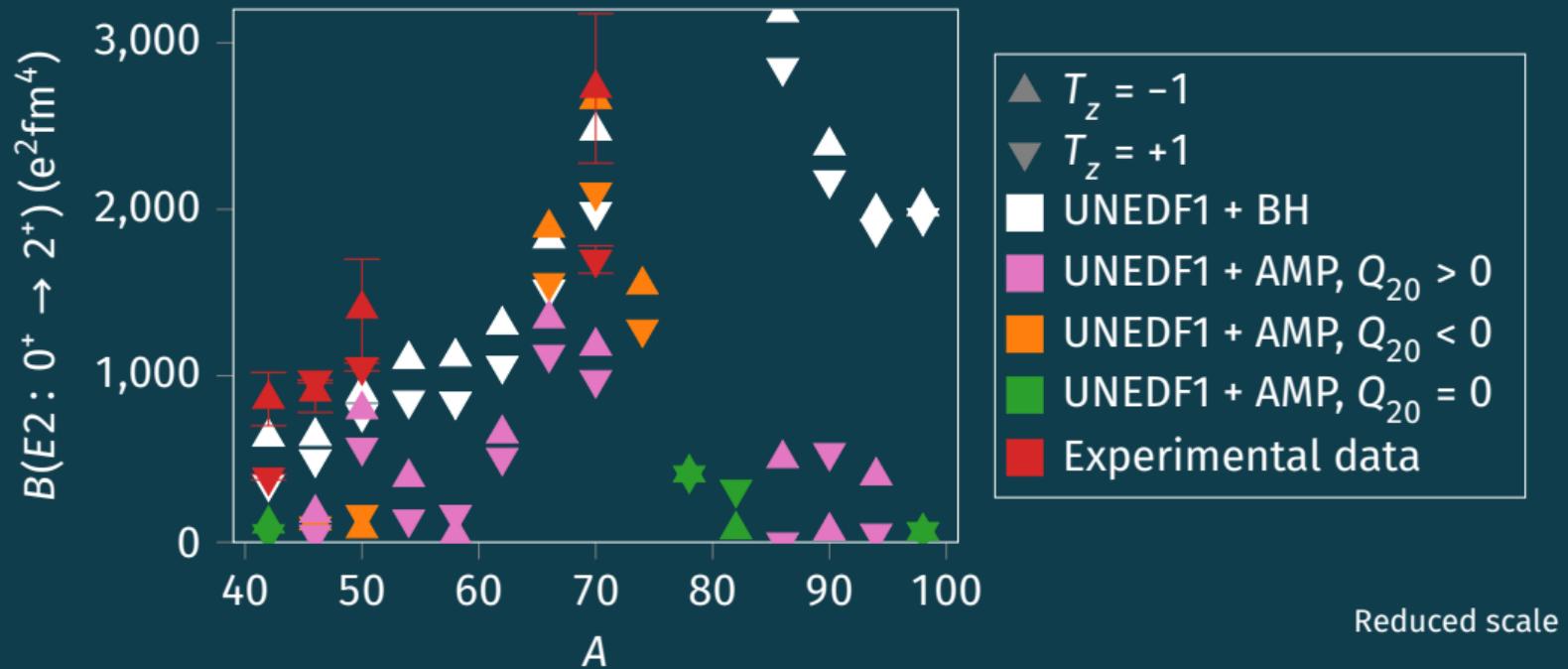
$A = 78$

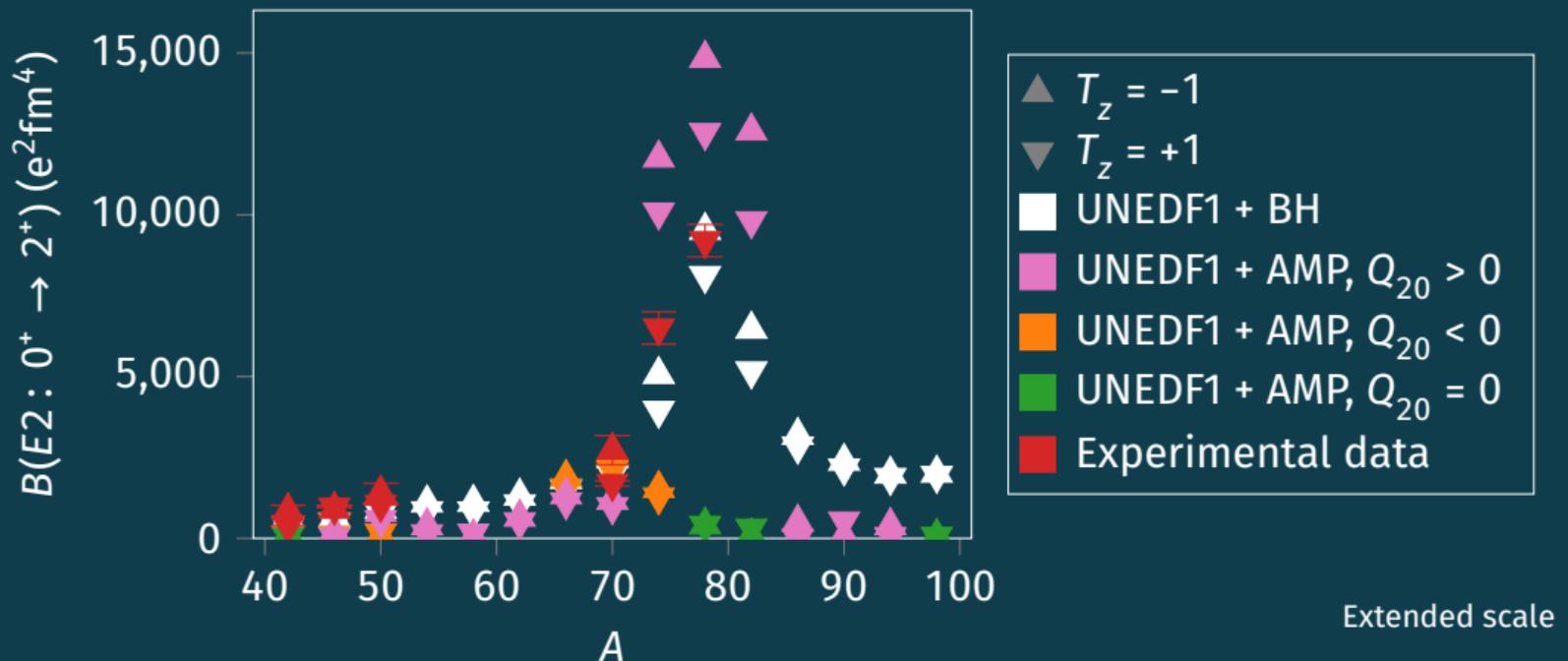
subject of interest for  
future experimental  
measurements



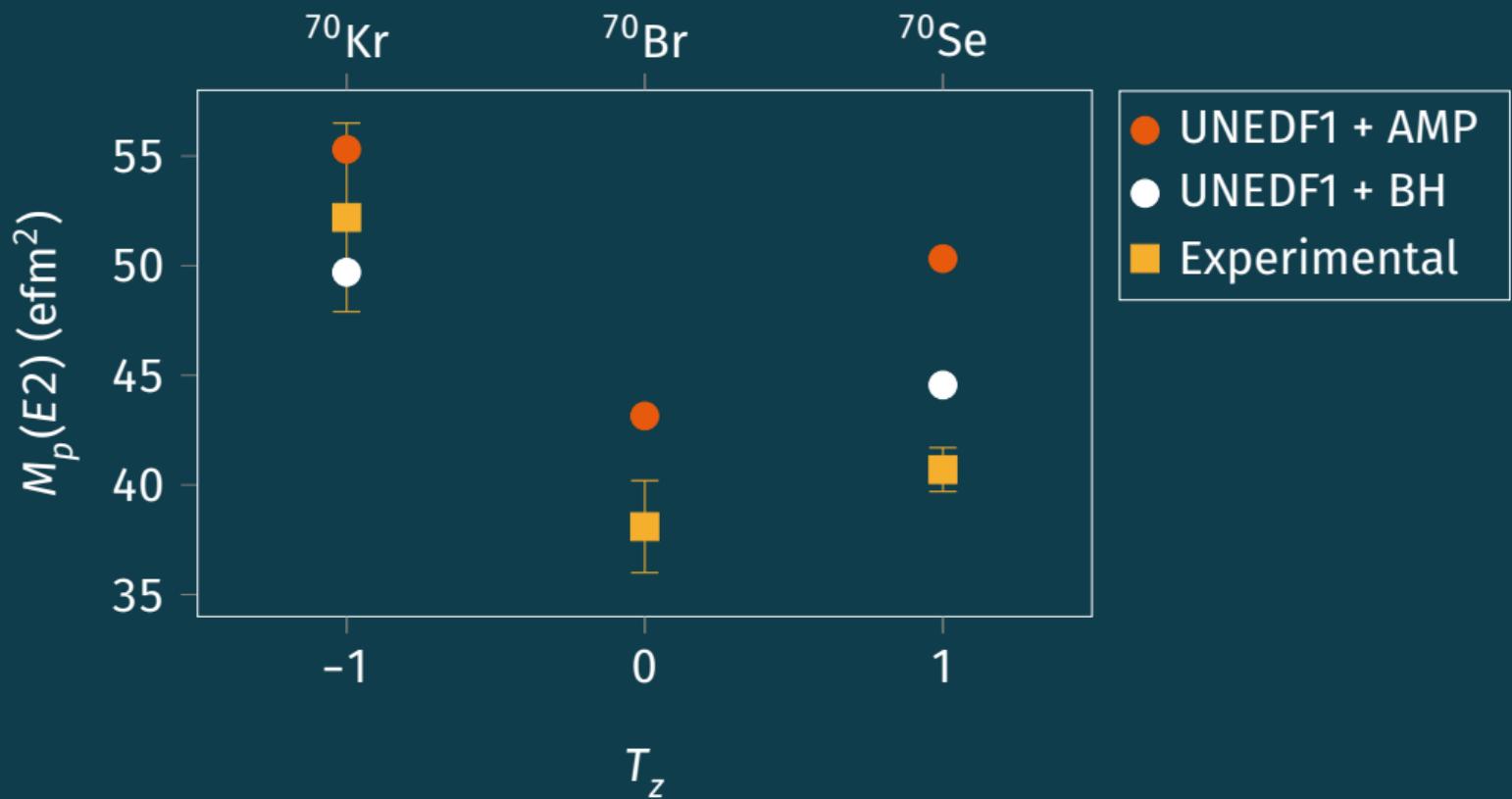
# What did we find out?

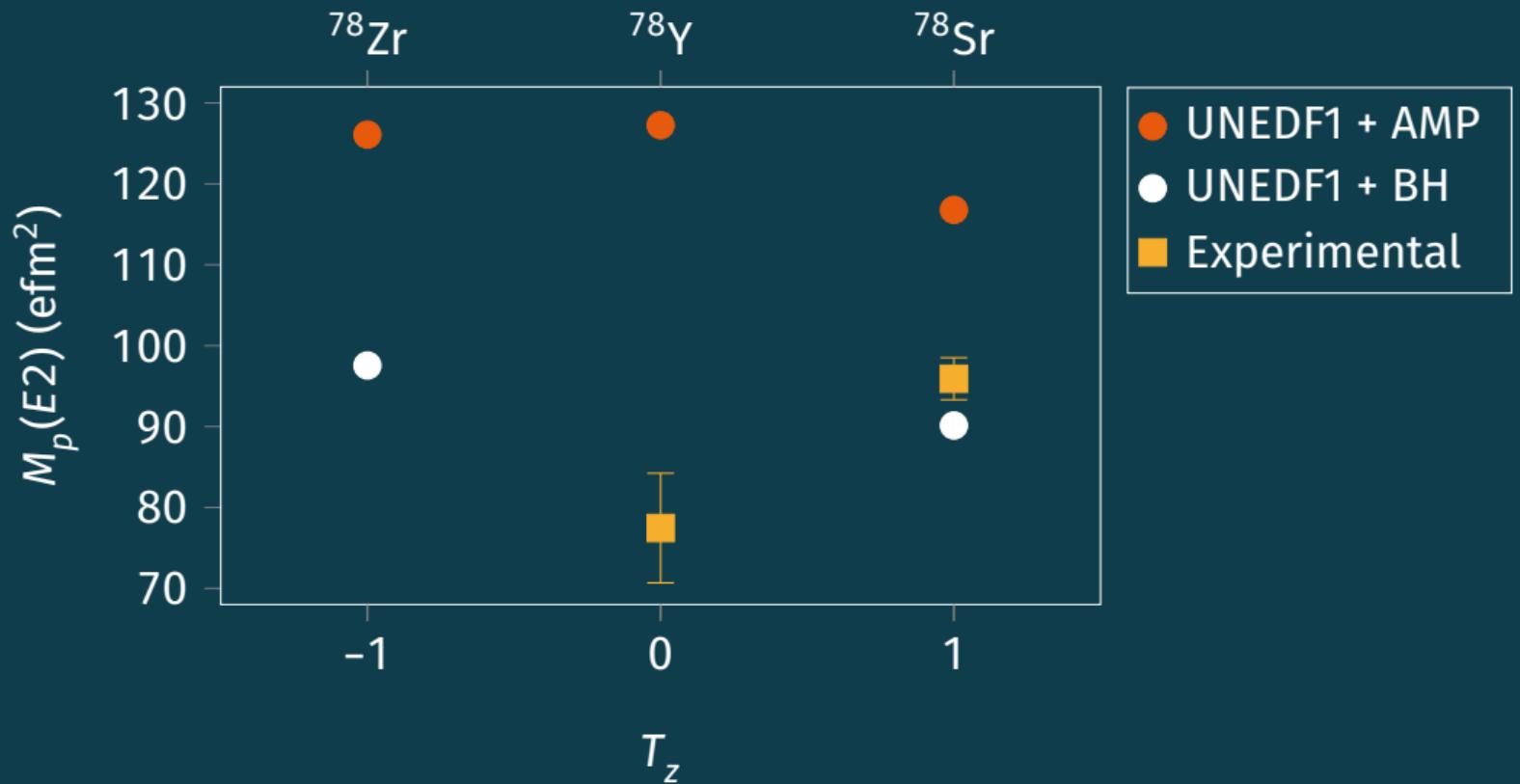














deviation from linearity  
without considering  
beyond-Coulomb ISB

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careful when  
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the odd-odd  $N = Z$

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no shape change  
in the  $A = 70$   
mirror pair



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