$^{44\text{-}49,50?}$Sc Data @COLLAPS

Xiaofei Yang, Shiwei Bai

Data of $^{44,44m,\ 46,47,48,49,\ 50?}$Sc from COLLAPS

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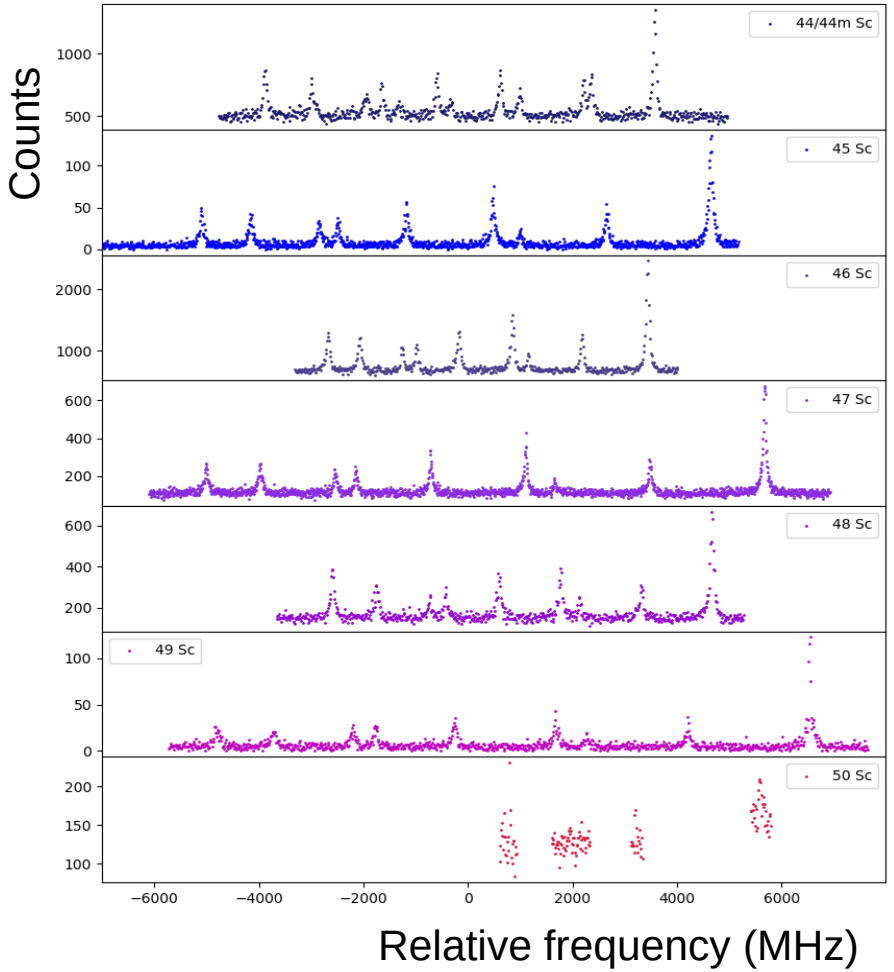
Data obtained:

μ: $^{47,48,\ 49}$Sc (revised)

Q: ^{47}Sc (revised), $^{48,\ 49}$Sc (new)

$\langle r^2 \rangle$: ^{47,48,49}Sc (new), reaching $N = 28$



Publications?

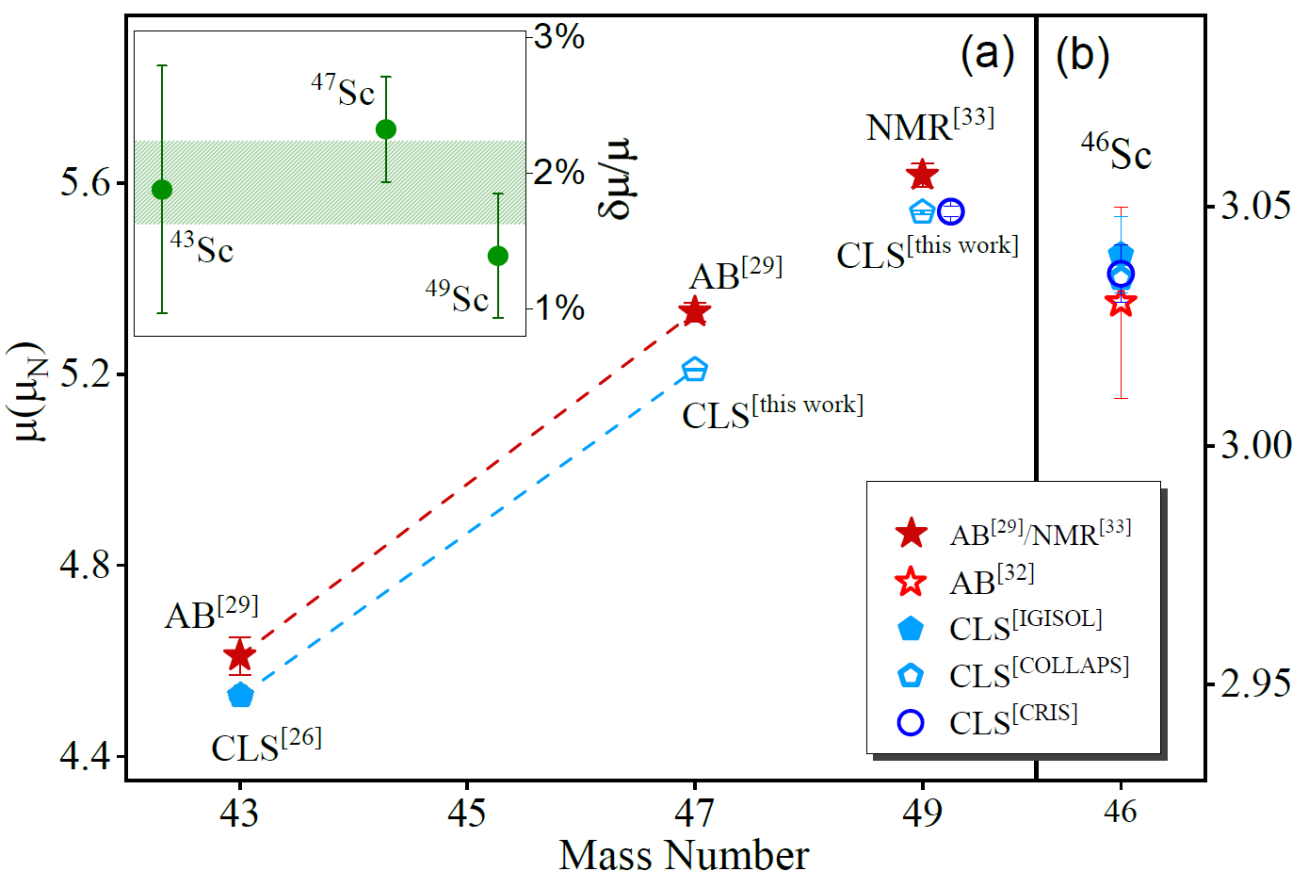
- μ, Q **(even-odd cases):** resubmitted to PLB (2022)
- μ, Q **(all cases):** preparation for PRC (2022)?
- $\langle r^2 \rangle$ **$^{44\text{-}49,\ 50?}$Sc:**

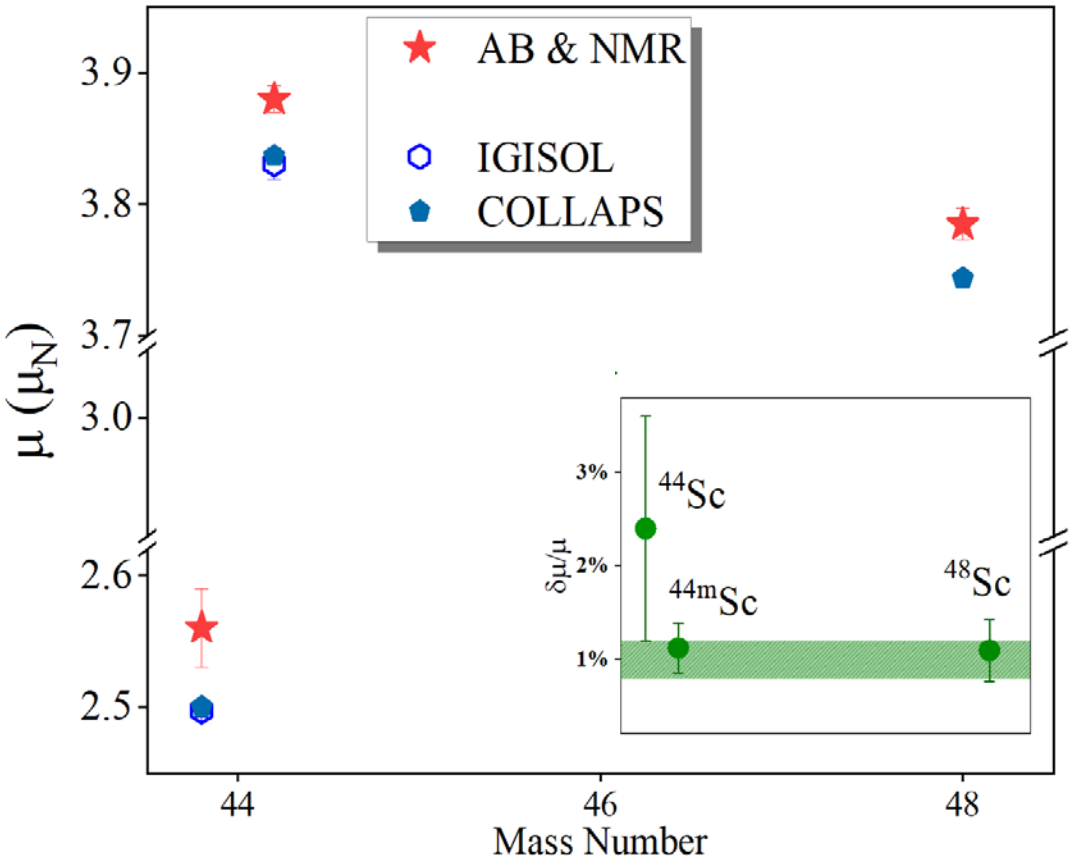
  Atomic theory: A. Borschevsky (FSCC)

  Nuclear theory: J. Holt, B.S.Hu (IMSRG)

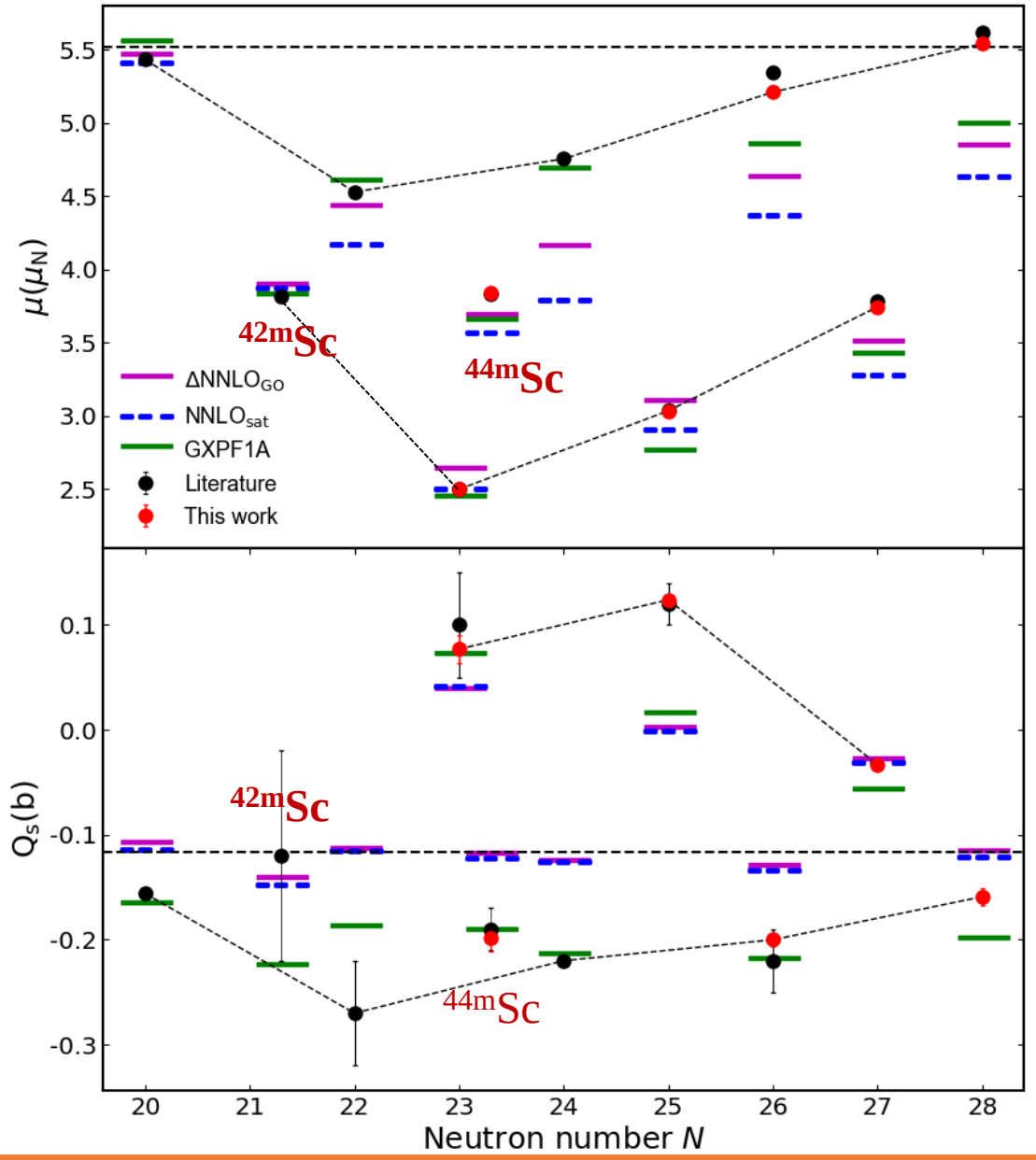
  W. Nazarewicz, P.-G. Reinhard (Fayan DFT)

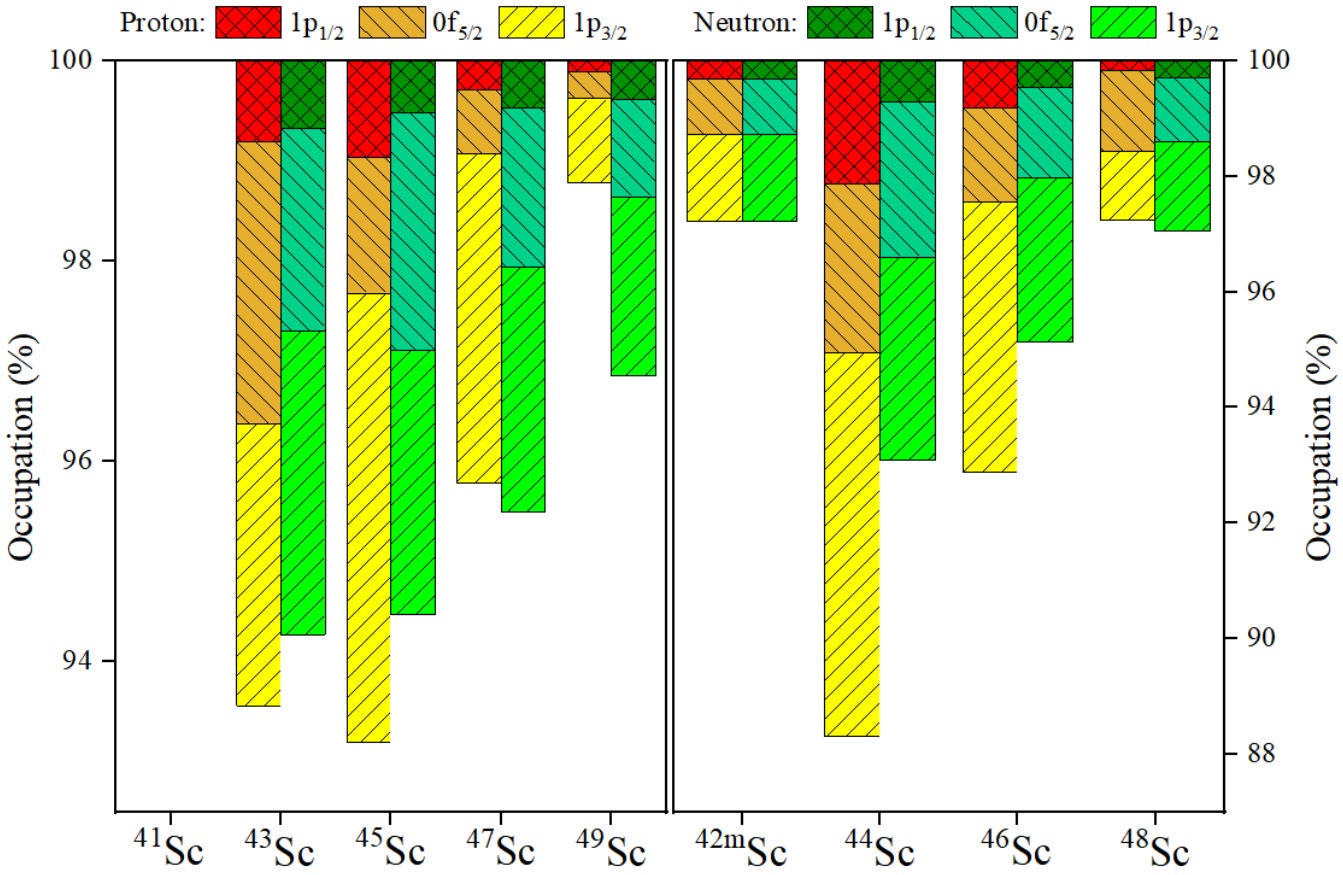
Revision of the magnetic moments of ^{43,44,44m,47,48,49}Sc





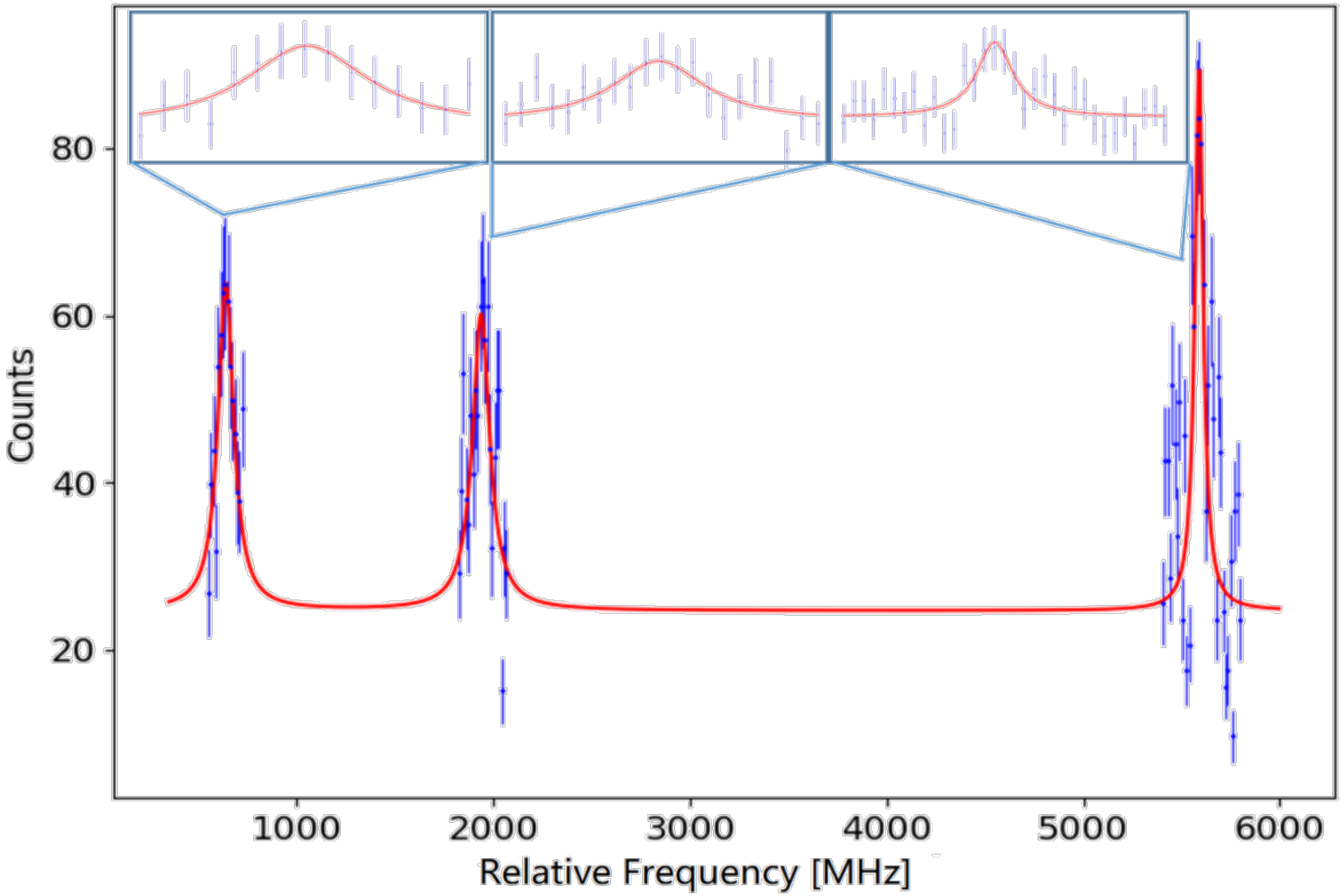
Moments of ^{43,44,44m,47,48,49}Sc

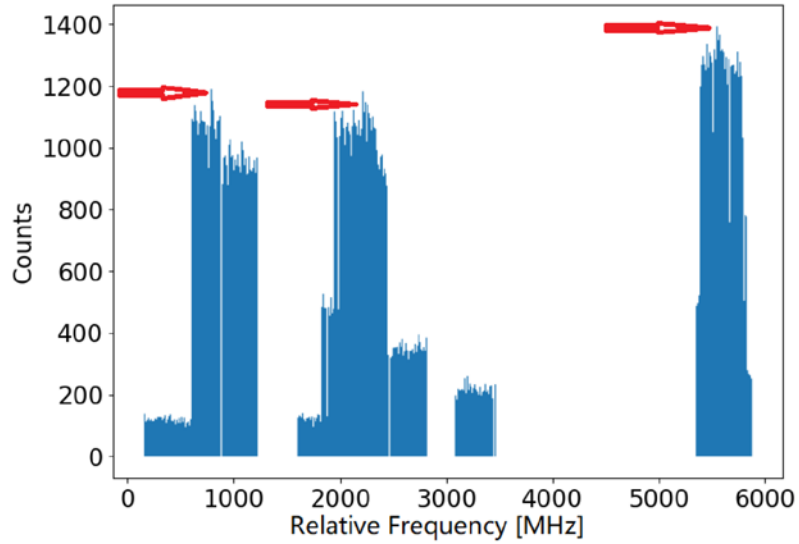




Hyperfine components of ^{50}Sc

$$E+\frac{A_u K_u}{2}+B_u\frac{3K_u(K_u+1)-4I(I+1)J_u(J_u+1)}{8I(2I-1)J_u(2J_u-1)}-\frac{A_l K_l}{2}-B_l\frac{3K_l(K_l+1)-4I(I+1)J_l(J_l+1)}{8I(2I-1)J_l(2J_l-1)}=L_i$$



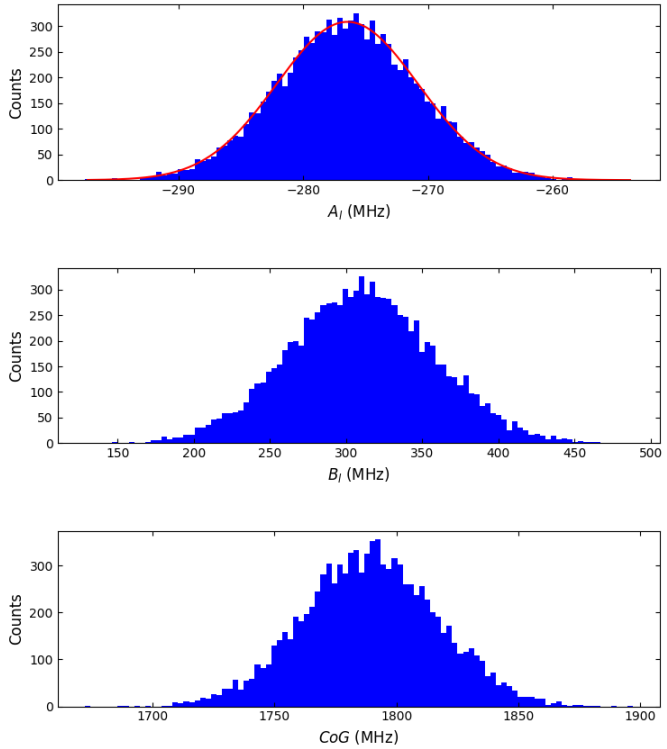


Hyperfine components of ^{50}Sc

Set: Au/Al = fixed Bu/Bl = fixed

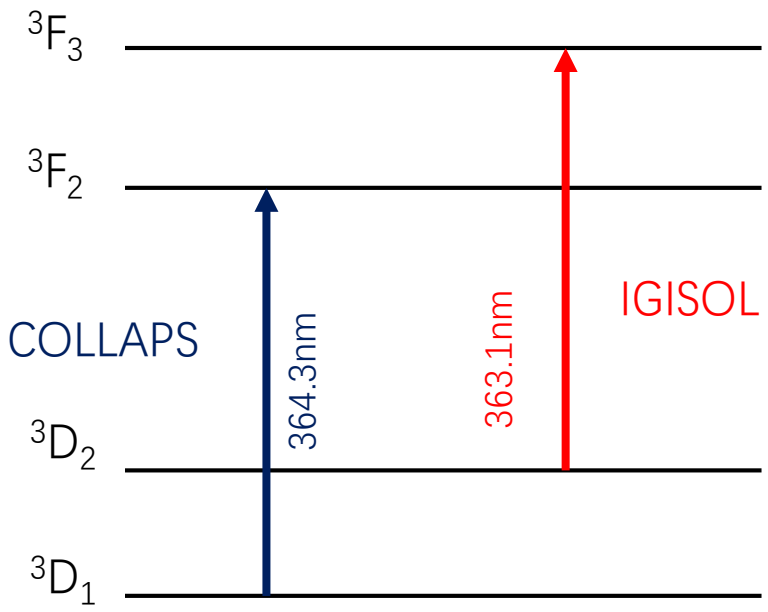
Comb.	COG	Al	Bl
(5,4)	1811(15)	-271(2)	363(12)
μ		3.83(3)	

Comb	COG	Al	Bl
(6,4)	1789(28)	-276(6)	310(48)
μ		3.91(8)	



^{50}Sc	GXPF1A
μ	3.806
Q	-0.2419

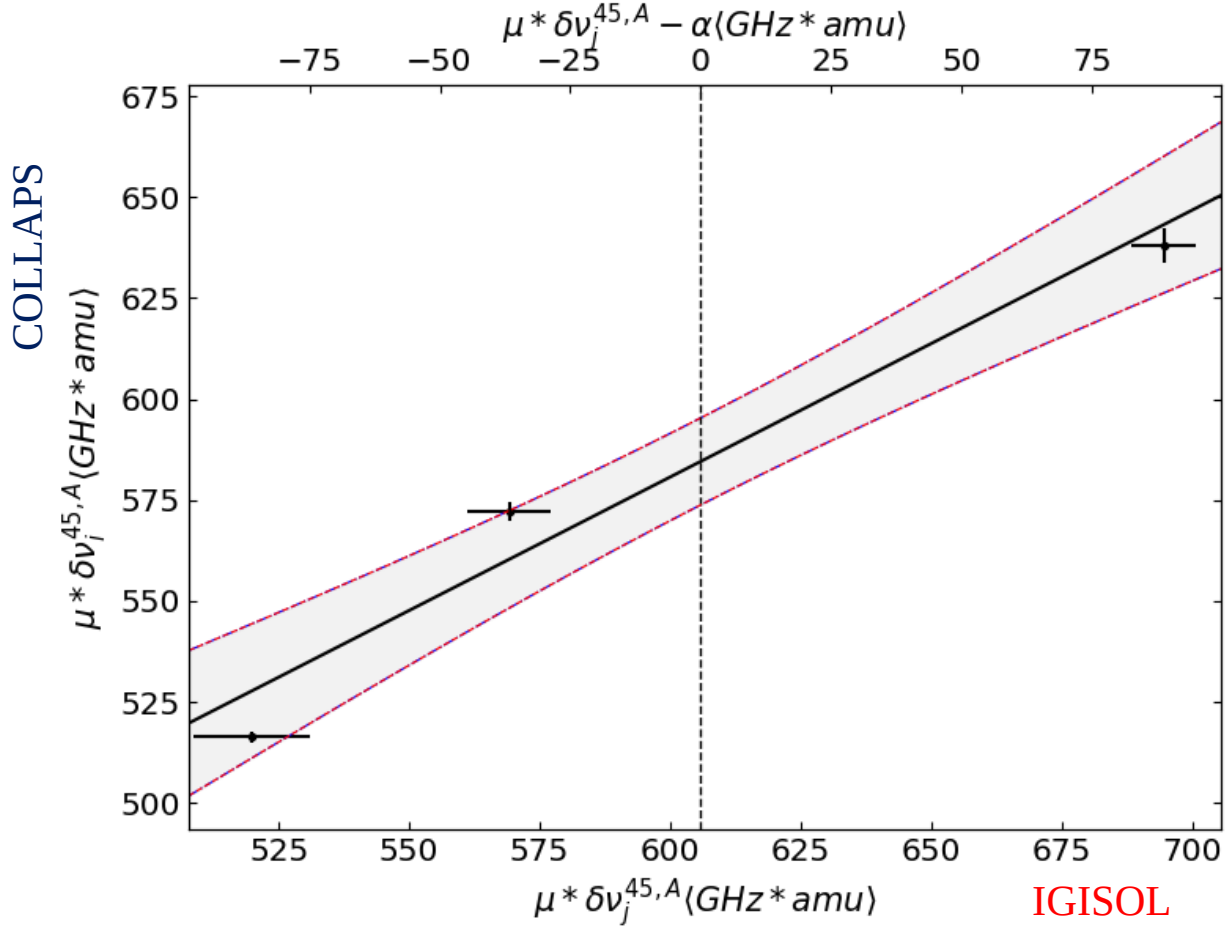
King plot analysis



3d4s $^3D_2$ —> 3d4p $^3F_3$

$F = -349(15)$ MHz fm^{-2}
$M = +625(60)$ GHz u

Á.Koszorús et al., PLB 819 (2021) 136439.



3d4s 3D1 —> 3d4p 3F2

$F = -231(20)$ MHz fm^{-2}
$M = +597(58)$ GHz u

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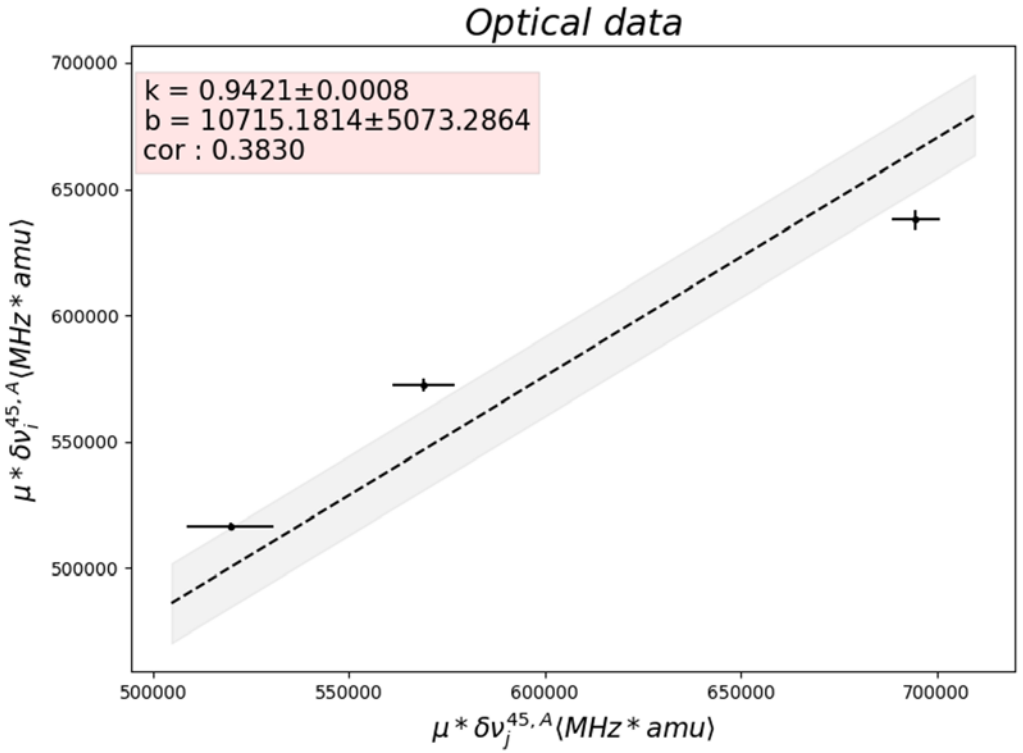
Atomic theory status:

Atomic field shift factors of 3d4s $3D_2 \rightarrow$ 3d5s $3F_3$ and 3d4s $3D_1 \rightarrow$ 3d5s $3F_2$ using Fock-space coupled cluster (FSCC) [for F] and configuration interaction approach with many-body perturbation theory (CI-MBPT) [for M] methods.

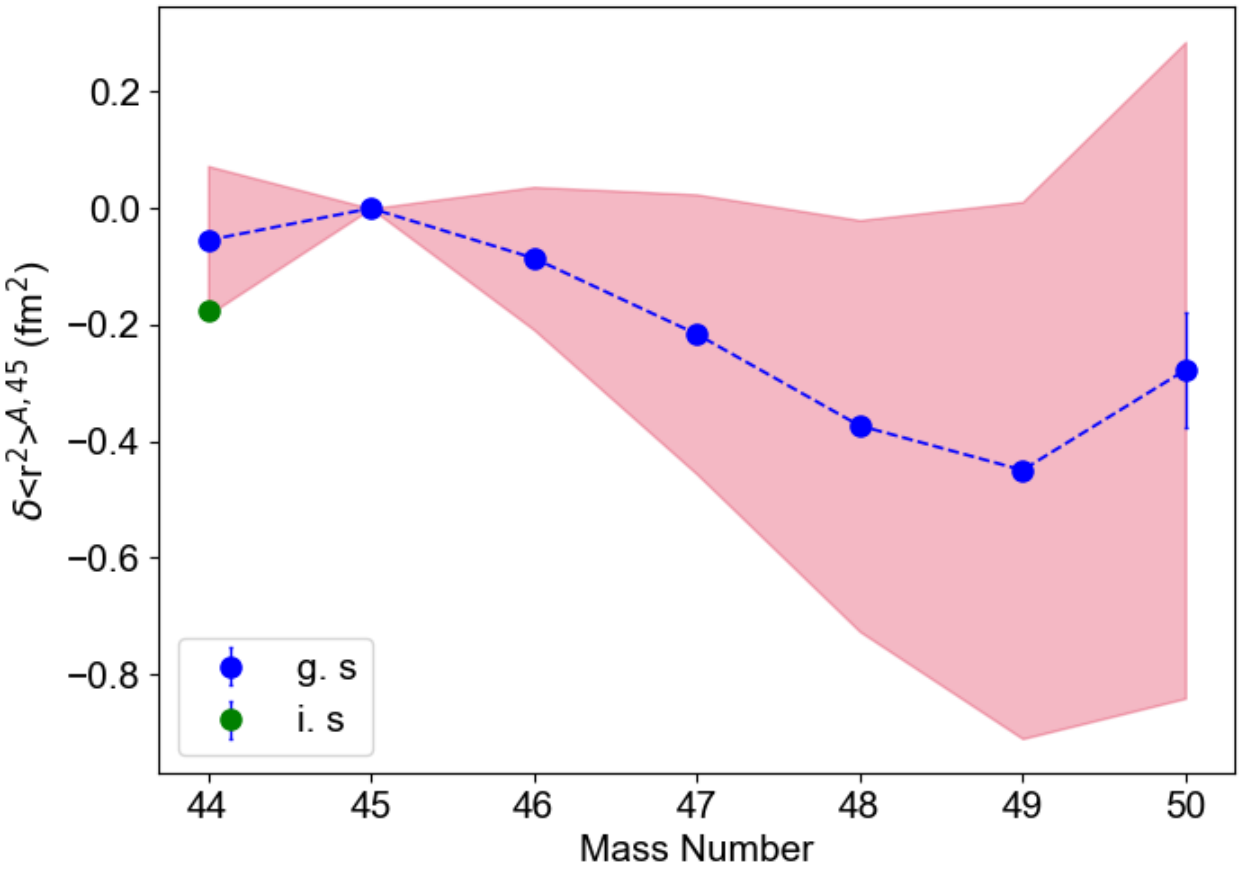
FSCC for field shift

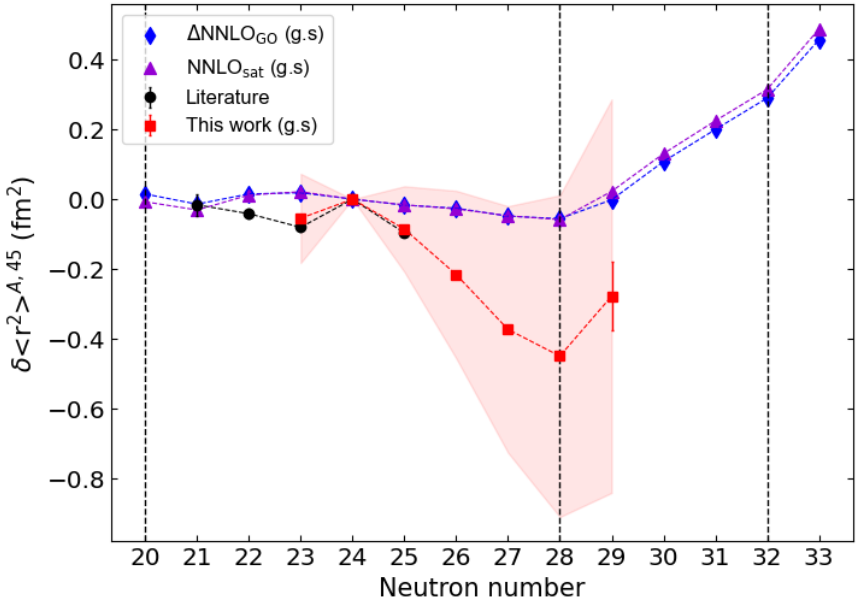
Transition		Field shift (MHz/fm^2)	Uncertainty (MHz/fm^2)
3d4s 3D1	3d4p 3F2	-373.10	11.48
3d4s 3D2	3d4p 3F3	-373.18	11.48

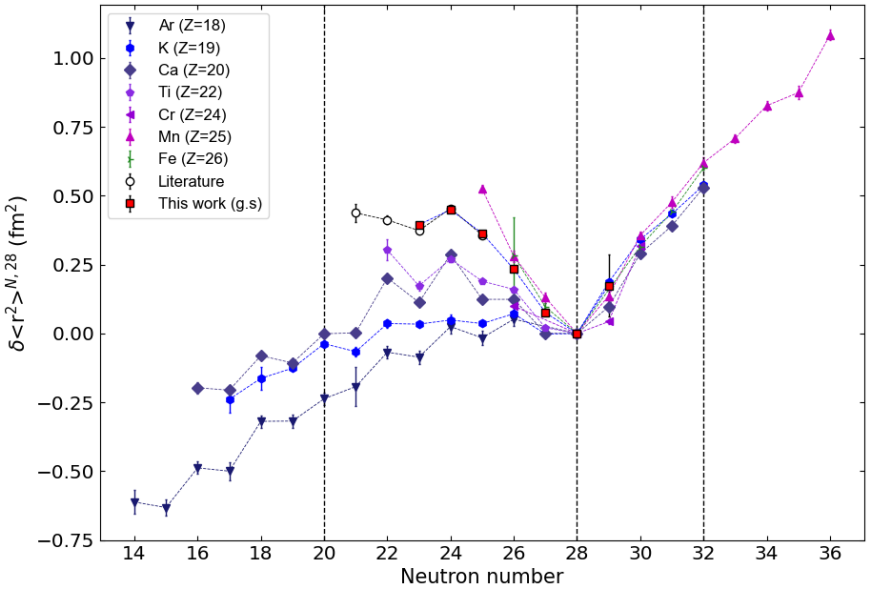
Ratio of Field shifts	King plot	FSCC
$^3D_2$-3F3/3D1-3F2	0.66(6)	1.00(4)



Radii of neutron-rich Sc isotopes







Radii of neutron-deficient Sc isotopes from MSU

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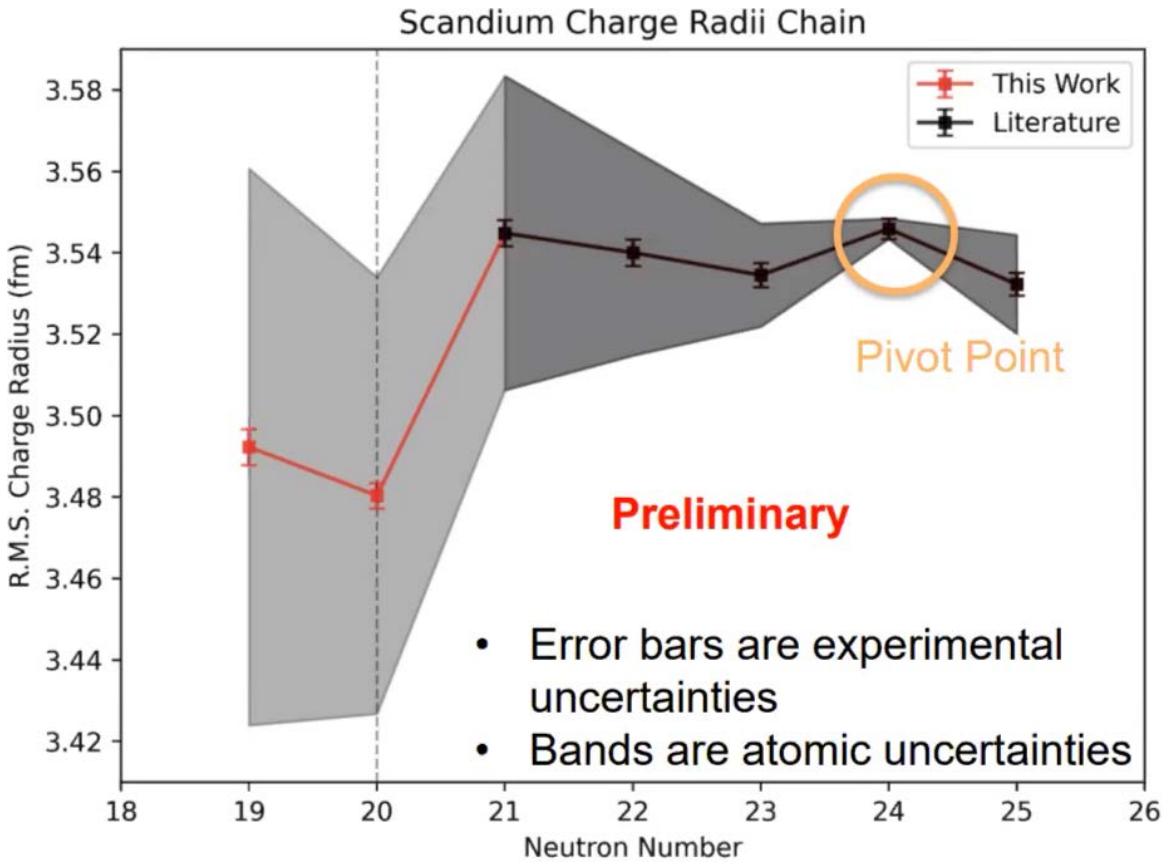
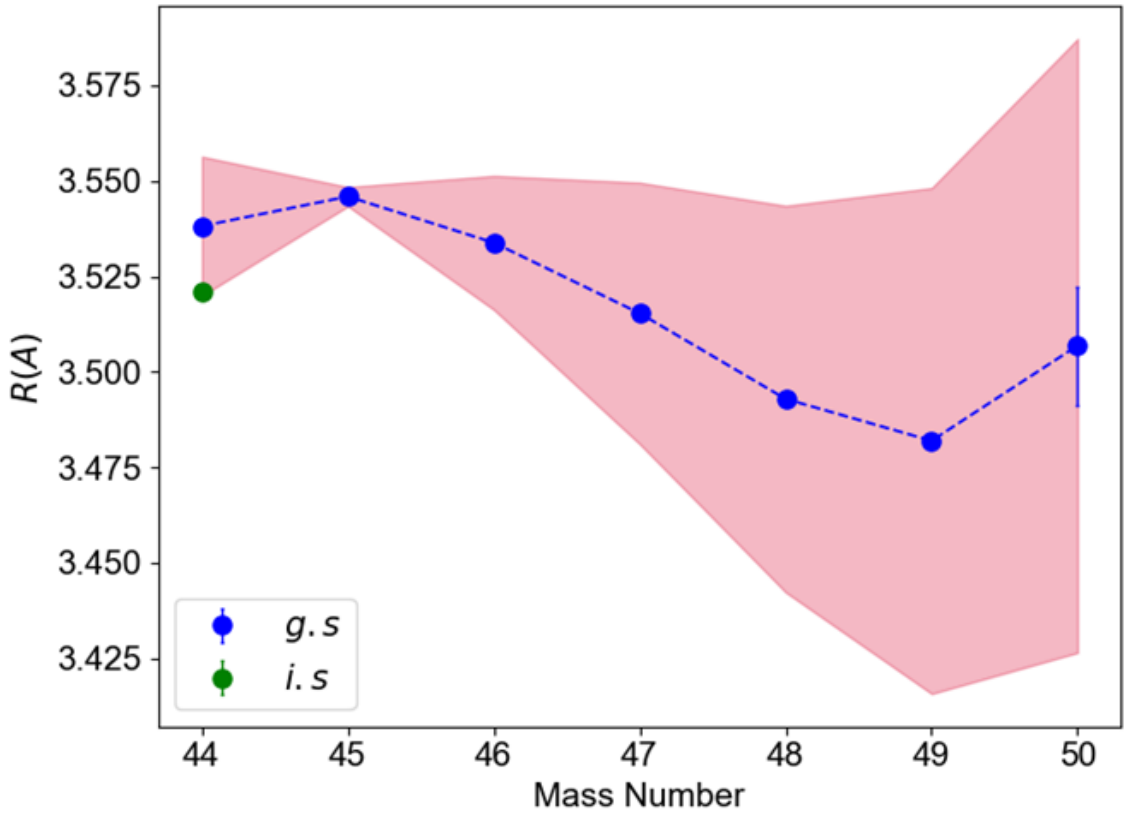
@MSU



The F, M from [Á. Koszorús et al., Phys. Lett. B 819 (2021) 1364]

@COLLAPS



The F, M from King-plot

Results and Publications

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Q: ^{47}Sc (revised), ^{48,49}Sc (new)

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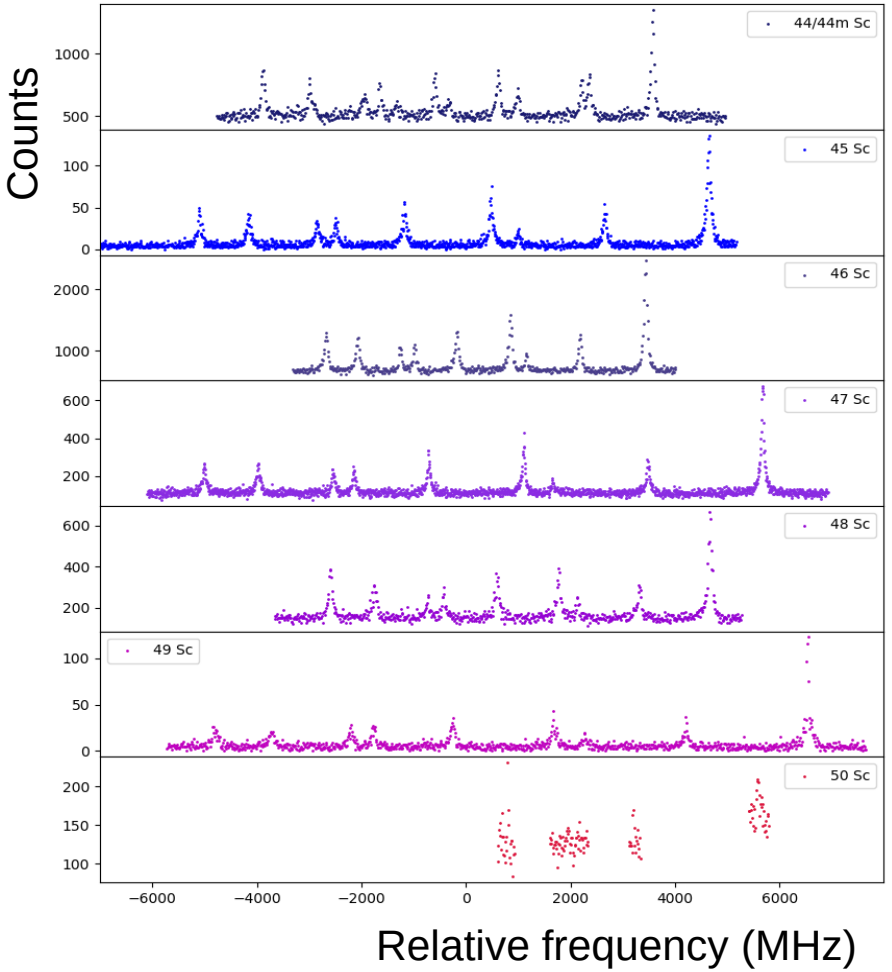

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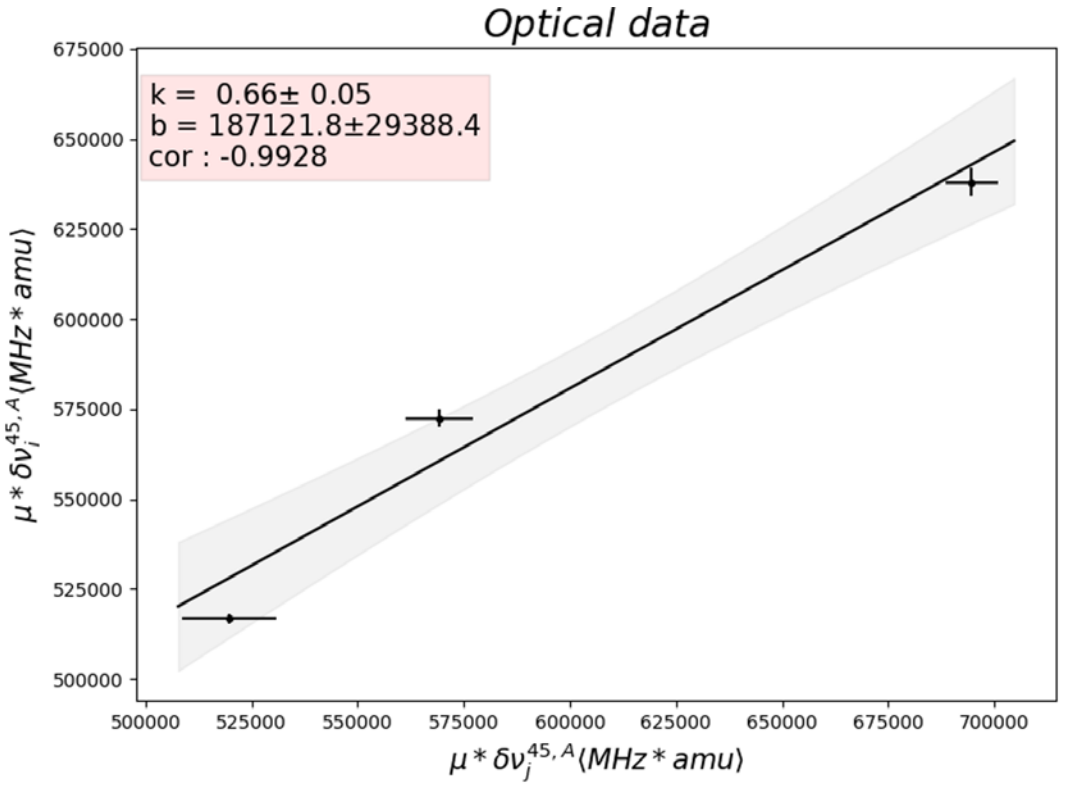
  W. Nazarewicz, P.-G. Reinhard (Fayan DFT)

Thank you !

Ratio of Field shifts	King plot	Theoretical
$^3D_2$-3F3/3D1-3F2	0.66(6)	1.00(4)

Using 1.00(4) as a constrain for the fit



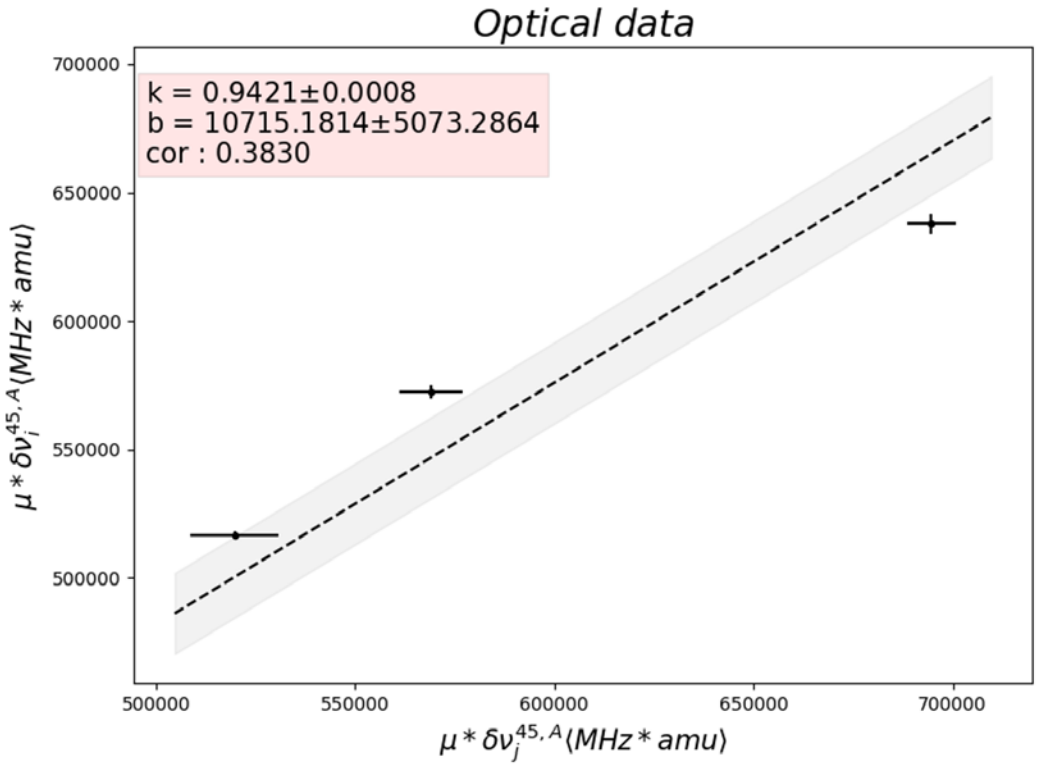


TABLE II: Ground state electromagnetic moments of ^{40,41,45}Sc. The ^{41}Sc electromagnetic moments were deduced from the weighted average of the moments calculated using the upper and lower level hyperfine coupling constants of both the $^3D_2 \leftrightarrow {}^3F^\circ_3$ and $^3D_1 \leftrightarrow {}^3P_0$ transitions. Previously measured values of the $^{41,\ 45}$Sc electromagnetic moments are also included in the table. The signs are not assigned experimentally, where it is given in a parenthesis.

Isotope	I^π	μ (μ_N)		Q (e^2fm^2)	
		this work	Lit.	this work	Lit.
^{40}Sc	4^-	+5.57(4)(2)		+42(38)(28)	
^{41}Sc	$7/2^-$	+5.4376(80)(06)	(+)5.431(2) [11]	-18.5(71)(01)	(-)15.6(3) [23]
^{45}Sc	$7/2^-$		+4.7563(5)[a]		-23.6(2)[b]

[a] This value was re-evaluated based on [24] in the present work. See text for detail.
[b] This value was re-evaluated in [23].