An upgrade of the UoA nuclear electromagnetic moments database

Pelonis Stefanos* and Theo J. Mertzimekis

Department of Physics, University of Athens, Zografou Campus, GR 15784, Athens, Greece

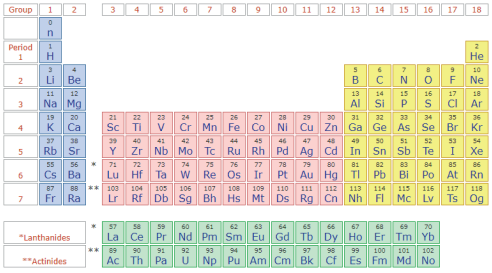
Why do we need a database for EM moments?

Nuclear moments play a vital role in our effort to better understand the nucleus. The Electric Quadrupole Moment (Q) is an observable that relates directly to the shape and size of the nucleus. On the other hand, the Magnetic Dipole Moment (μ) is a quantum operator that describes the proton and neutron contents in a level's wavefunction. Despite the significance of the above values, the related experimental data are scattered throughout literature. As a result, the need to provide a user-friendly database that includes all the available experimental data is substantial.

http://magneticmoments.info

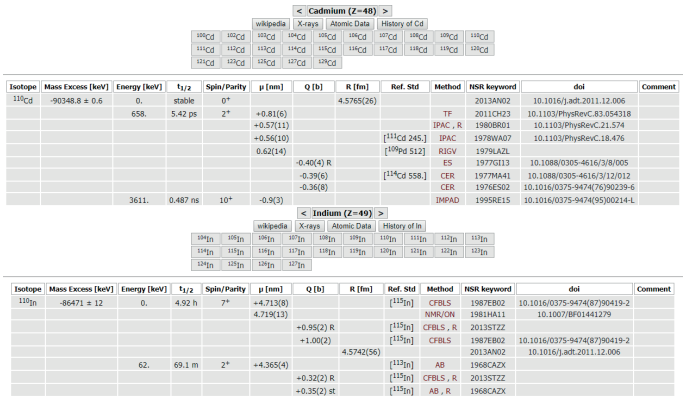
Database Architecture

The user interface of the database comprises of a search form based on the atomic/mass number. Alternatively, a periodic table or a Z-helix can be used, focusing solely on the atomic number of each element.



The periodic table

By clicking on an isotope, all available values for each of its energy levels are displayed. Alternatively, the selection of any mass number will display the related data for a group of isobars.



Isotope	Mass Excess [keV]	Energy [keV]	$t_{1/2}$	Spin/Parity	μ [nm]	Q [b]	R [fm]	Ref. Std	Method	NSR keyword	doi	Comment
^{110}Cd	-90348.8 ± 0.6	0.	stable	0$^+$			4.5765(26)			2013AN02	10.1016/j.adt.2011.12.006	
		658.	5.42 ps	2$^+$	+0.81(6)				TF	2011CH23	10.1103/PhysRevC.83.054318	
					+0.57(11)				IPAC , R	1980BR01	10.1103/PhysRevC.21.574	
					+0.56(10)			[^{111}Cd 245.]	IPAC	1978WA07	10.1103/PhysRevC.18.476	
					0.62(14)			[^{109}Pd 512]	RIGV	1979LAZL		
							-0.40(4) R		ES	1977GI13	10.1088/0305-4616/3/8/005	
							-0.39(6)	[^{114}Cd 558.]	CER	1977MA41	10.1088/0305-4616/3/12/012	
							-0.36(8)		CER	1976ES02	10.1016/0375-9474(76)90239-6	
		3611.	0.487 ns	10$^+$	-0.9(3)				IMPAD	1995RE15	10.1016/0375-9474(95)00214-L	

Isotope	Mass Excess [keV]	Energy [keV]	$t_{1/2}$	Spin/Parity	μ [nm]	Q [b]	R [fm]	Ref. Std	Method	NSR keyword	doi	Comment
^{115}In	-86471 ± 12	0.	4.92 h	7$^+$	+4.713(8)			[^{115}In]	CFBLS	1987EB02	10.1016/0375-9474(87)90419-2	
					4.719(13)				NMR/ON	1981HA11	10.1007/BF01441279	
							+0.95(2) R	[^{115}In]	CFBLS , R	2013ST2Z		
							+1.00(2)	[^{115}In]	CFBLS	1987EB02	10.1016/0375-9474(87)90419-2	
										2013AN02	10.1016/j.adt.2011.12.006	
							4.5742(56)					
		62.	69.1 m	2$^+$	+4.365(4)			[^{113}In]	AB	1968CA2X		
							+0.32(2) R	[^{115}In]	CFBLS , R	2013ST2Z		
							+0.35(2) st	[^{115}In]	AB , R	1968CA2X		

To further assist the user, a help button with access to instructions and annonations is present. The accompanying blog, with additional information on electromagnetic moments and the option to leave a comment is also available.

The database

The current version includes information for nearly every element (up to Z = 118), with the most recent update having a cut-off date 2019-03-31.

Major features of the current upgrade :

Magnetic Moments

Over 150 entries and 3 new experimental deduction methods of electric quadrupole and magnetic dipole moments based on literature values found at NSR.

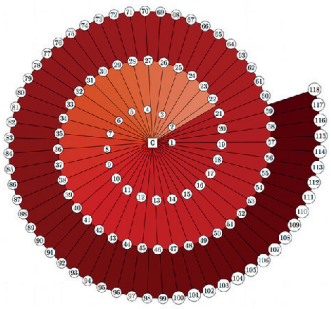
Radii

Incorporation of rms nuclear charge radii($\delta\langle r^2\rangle$) published after 2017, found at NSR.

Spectroscopic info of isotopes

Syncing of level energies, half-lives and spin/parity values based on the ENSDF database.

Overall, the database includes over 6363 levels with nuclear EM monents and charge radii. Every value may be accompanied by a reference standard and the experimental method employed to deduce it. Elementary particle data are also available, adopting directly the Particle Data Group Evaluations. Another key feature of this database is the inclusion of the NSR keywords and the DOI (digital object identifier) linked to the original citations.



Elements in the form of a Z-Helix

Future Work

Collectively, the current update offers the most up-to-date experimental values. Future updates will aim at :

- Syncing data precisions with older tabulations, such as those by Fuller and Raghavan
- An easy-to-use mobile version
- Providing plotting capabilities based on the reliable jpgraph php library

References

1. T.J. Mertzimekis et al. NIM A 807, 56 (2016)
2. https://www-nds.iaea.org/nsr/
3. https://www.nndc.bnl.gov/ensdf/
4. M. Tanabashi et al. Phys. Rev. D 98, 030001 (2018)
5. G.H. Fuller, J. Phys. Chem. Ref. Data, 5, 835 (1976)
6. P. Raghavan, At. Data, Nucl. Data Tables 42, 189 (1989)

NUSTRAP
Nuclear Structure, Reactions & Applications

*Presenting Author email :

sph1700135@uoa.gr

Scan me