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Knotted Radon

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Abstract: *The knotted 3d orbits enable the double surface stability of Radon.*

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1. INTRODUCTION

The subject of interest of this paper is - with the help of orbit knotting - to explain the double surface stability of Radon, the 6th noble gas and the 86th element of Mendeleev's periodic table. Its essential characteristics are denoted in Figure1:

Figure1. *Radon*

Actually our task is to repeat the excersise made in the previous article[1]being focused on the double surface stability of Xenon (Xe) which is noble predecessor of Radon (Rn).

2. THE REALLY STABLE ATOM

Unstable orbit lengths deduced from the effective nuclear charge can become stable by the double improvement:

a) the energy free knotting

b) as well as the energy dependent orbit length change[1].

To achieve a really stable atom following the double surface concept the overall orbit link should be really stable as well as become more stable than any particular orbit itself[1]. That is, the energy change of the atom overall orbit link $\Delta E_{overall\ \ orbit\ \ link}$ should be negative and at the same time smaller than the energy change of any individual orbit ΔE_n^{orbit} [1]:

$$\Delta E_{overall\ \ orbit\ \ link} < 0 < \Delta E_n^{orbit}. \qquad (1)$$

In such a way (1) all atom orbits can be given and linked to the overall orbit as their sum to enable the double surface stability of atom as follows:

$$\Delta E_{overall\ \ orbit\ \ link} = Ry.\alpha^{-1}\sum_{k=1}^{k_{max}}\left(\frac{1}{(m \in \mathbb{N})\ x\ s_k^{Bohr-like}} - \frac{1}{s_{n\in\mathbb{N}}}\right) < 0. \qquad (2)$$

Where $Ry = 13.6\,eV$ denotes Rydberg constant, $\alpha^{-1} = 137.036$ denotes the inverse fine structure constant, k denotes some individual orbit and k_{max} denotes the whole number of atom orbits, m denotes the natural number of knots of concerned Bohr-like orbit and $s_{n\in\mathbb{N}} = n\left(2 - \frac{1}{\sqrt{1+\frac{\pi^2}{n^2}}}\right)$denotes the double surface stable orbit length of choice enabling the smallest absolute change of energy$|\Delta \mathrm{E}|_n = minimal$.[1]

3. The Unstable Unknotted Radon

According to the previouslly mentioned criteria (1), (2) the unknotted Radon is unstable as can be seen in Table1 since it does not satisfy the relation (1).

Table1.*The unstable unknotted Radon. Here m = number of orbit knots; s = unstable Bohr-like orbit length; s(n) = respecting double surface stable orbit length; ds = orbit length difference; d(1/s) = inverse orbit length difference; ΔE = energy of stable orbit length formation; less energy (more negative energy) of orbit length formation means more stable the orbit*

Orbital	m	s in λ_e	s(n) in λ_e	ds	d(1/s)	ΔE in eV	
1s	○1	1,625	1,697	-0,072	2,60E-02	4,85E+01	
2s	○1	2,161	2,926	-0,765	1,21E-01	2,25E+02	
2p	○1	1,683	1,697	-0,014	4,90E-03	9,13E+00	
2p	○1	1,683	1,697	-0,014	4,90E-03	9,13E+00	
2p	○1	1,683	1,697	-0,014	4,90E-03	9,13E+00	
3s	○1	2,243	2,926	-0,683	1,04E-01	1,94E+02	
3p	○1	2,200	2,926	-0,726	1,13E-01	2,10E+02	
3p	○1	2,200	2,926	-0,726	1,13E-01	2,10E+02	
3p	○1	2,200	2,926	-0,726	1,13E-01	2,10E+02	
4s	○1	2,733	2,926	-0,193	2,42E-02	4,51E+01	
3d	**○1**	**1,888**	**1,697**	**0,191**	**-5,96E-02**	**-1,11E+02**	**STABLE**
3d	**○1**	**1,888**	**1,697**	**0,191**	**-5,96E-02**	**-1,11E+02**	**STABLE**
3d	**○1**	**1,888**	**1,697**	**0,191**	**-5,96E-02**	**-1,11E+02**	**STABLE**
3d	**○1**	**1,888**	**1,697**	**0,191**	**-5,96E-02**	**-1,11E+02**	**STABLE**
3d	**○1**	**1,888**	**1,697**	**0,191**	**-5,96E-02**	**-1,11E+02**	**STABLE**
4p	○1	2,780	2,926	-0,146	1,80E-02	3,35E+01	
4p	○1	2,780	2,926	-0,146	1,80E-02	3,35E+01	
4p	○1	2,780	2,926	-0,146	1,80E-02	3,35E+01	
5s	○1	4,043	4,854	-0,811	4,13E-02	7,70E+01	
4d	○1	2,858	2,926	-0,068	8,09E-03	1,51E+01	
4d	○1	2,858	2,926	-0,068	8,09E-03	1,51E+01	
4d	○1	2,858	2,926	-0,068	8,09E-03	1,51E+01	
4d	○1	2,858	2,926	-0,068	8,09E-03	1,51E+01	
4d	○1	2,858	2,926	-0,068	8,09E-03	1,51E+01	
5p	○1	4,286	4,854	-0,568	2,73E-02	5,09E+01	
5p	○1	4,286	4,854	-0,568	2,73E-02	5,09E+01	
5p	○1	4,286	4,854	-0,568	2,73E-02	5,09E+01	
6s	○1	7,478	7,614	-0,135	2,37E-03	4,42E+00	
4f	○1	2,835	2,926	-0,091	1,09E-02	2,04E+01	
4f	○1	2,835	2,926	-0,091	1,09E-02	2,04E+01	
4f	○1	2,835	2,926	-0,091	1,09E-02	2,04E+01	
4f	○1	2,835	2,926	-0,091	1,09E-02	2,04E+01	
4f	○1	2,835	2,926	-0,091	1,09E-02	2,04E+01	
4f	○1	2,835	2,926	-0,091	1,09E-02	2,04E+01	
4f	○1	2,835	2,926	-0,091	1,09E-02	2,04E+01	
5d	○1	5,010	5,766	-0,756	2,62E-02	4,88E+01	
5d	○1	5,010	5,766	-0,756	2,62E-02	4,88E+01	
5d	○1	5,010	5,766	-0,756	2,62E-02	4,88E+01	
5d	○1	5,010	5,766	-0,756	2,62E-02	4,88E+01	
5d	○1	5,010	5,766	-0,756	2,62E-02	4,88E+01	

6p	1	8,524	8,554	-0,029	4,02E-04	7,50E-01	
6p	1	8,524	8,554	-0,029	4,02E-04	7,50E-01	
6p	1	8,524	8,554	-0,029	4,02E-04	7,50E-01	
Overall orbit link		**147,329**	**147,034**	**0,296**	**-1,37E-05**	**-2,55E-02**	**LESS STABLE**

Thus:

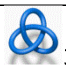
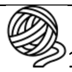
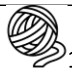
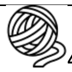
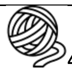
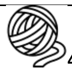
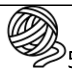
$$\Delta E_{overall\ \ orbit\ \ link} = -2.55 \text{ x } 10^{-2} \text{ eV} > \Delta E_{3d\ orbit} = -1.11 \text{ x} 10^{2} eV. \qquad (3)$$

So unfortunately the overall orbit link is less stable than the 3d orbits themselves and the instability of other atom orbits (1s, 2s, 2p, 3s,3p, 4s, 4p, 5s, 4d, 5p, 6s, 4f, 5d and 6p) does not meet all the conditions for the creation of a stable overall orbit link.

4. THE STABLE KNOTTED RADON

To make a stable Radon all atom orbits except3d orbits should stay unknotted (to remain unstable on their own)and in addition3d orbits should be properly knotted to become less stable in comparision with the stable overall orbit link.This happens first at three times knotted 3d orbits and then countless more times as can be seen in Table2.

Table2. *The stable knotted Radon.Here s = unstable Bohr-like 3dorbit length; s(n) = respecting double surface stable 3dorbit length; ΔE = energy of really stable 3dorbit length formation; p = probability of 3dorbit knotting*

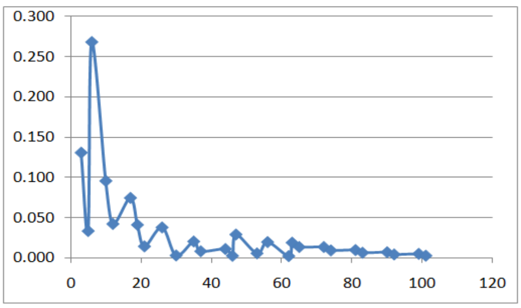
	m	s	s(n)	ΔE	p
		(in λ_e)	(in λ_e)	(in eV)	
1st	3	166,206	166,030	-1,19E-02	0,131
2nd	5	185,082	185,027	-3,00E-03	0,033
3rd	**6**	**194,520**	**194,025**	**-2,44E-02**	**0,268**
4th	10	232,272	232,021	-8,68E-03	0,095
5th	12	251,148	251,020	-3,81E-03	0,042
6th	17	298,339	298,017	-6,76E-03	0,074
7th	19	317,215	317,016	-3,70E-03	0,041
8th	21	336,091	336,015	-1,26E-03	0,014
9th	26	383,282	383,013	-3,41E-03	0,038
10th	30	421,034	421,012	-2,36E-04	0,003
11th	35	468,225	468,011	-1,82E-03	0,020
12th	37	487,101	487,010	-7,12E-04	0,008
13th	44	553,167	553,009	-9,66E-04	0,011
14th	46	572,044	572,009	-1,99E-04	0,002
15th	47	581,482	581,008	-2,61E-03	0,029
16th	53	638,110	638,008	-4,69E-04	0,005

17th	56	666,425	666,007	-1,75E-03	0,019
18th	62	723,053	723,007	-1,65E-04	0,002
19th	63	732,491	732,007	-1,68E-03	0,019
20th	65	751,367	751,007	-1,19E-03	0,013
21th	72	817,434	817,006	-1,19E-03	0,013
22th	74	836,310	836,006	-8,11E-04	0,009
23th	81	902,377	902,005	-8,50E-04	0,009
24th	83	921,253	921,005	-5,44E-04	0,006
25th	90	987,320	987,005	-6,02E-04	0,007
26th	92	1006,196	1006,005	-3,52E-04	0,004
27th	99	1072,263	1072,005	-4,18E-04	0,005
28th	101	1091,139	1091,005	-2,10E-04	0,002
…	…	…	…	…	0,080
∞th	∞	∞	∞	0	0
				∑ΔE= -0.091	∑p = 1

Actually the number of solutions for the formation of Radon stable overall orbit link is infinite having a trend to become energetically less favourable($\Delta E$is becoming less negative) with the increasing number of knots although deviations exist.For instance, the second solution at five knots is less favourable than the first solution at three knots but the third solution at six knots is generally the most favourable. Perturbations are found throughout solving the task but do not change the trend. The energetic benefit of an infinite knot is nil. The energetic benefit of all infinite number of knots is finite, i.e. $\sum_{k=1}^{k=\infty} \Delta E_k = 0.091\ eV$rounded to three decimal places. Knowing this data the probability of each solution for the formation of Radon stable overall orbit link can be calculated as follows:

$$p_k = \frac{\Delta E_k}{\sum_{k=1}^{k_\infty} \Delta E_k}. \quad (4)$$

Where k means the orbit in question, ΔE_k means the energy of stable orbit formation in question, and $p_k$means its probability.For instance the six-knotted 3d orbits of Radon are the most probable stable orbits. Their probability is 26.8%. And the probability of Radon with more than hundred 3d-knots is only 8%. If orbital means an infinite knotted orbit its probability is nil. First 28 values of Radon knotting are presented in Graph1.



Graph1. *Probability of Radon knotting. X-axis = number of 3d knots.*

5. Conclusion

It seems that Radon plays dice.

Dedication

This fragment is dedicated to Love which does not play dice. It conquers all since it does not seek for its own.

Figure2. *Amor Vincit Omnia*

References

[1] Janez Špringer, (2020).Knotted Xenon. International Journal of Advanced Research in Physical Science (IJARPS) 7(8), pp. 1-5 2020.

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