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Knotted Xenon

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Abstract: *The knotted 5s orbit enables the double surface stability of Xenon.*

Keywords: *Bohr-like orbit, double surface, conditionally stable atom orbit, really stable overall orbit link, Xenon*

1. Introduction

The subject of interest of this paper is - with the help of orbit knotting - to explain the double surface stability of Xenon, the 5th noble gas and the 54th element of Mendeleev's periodic system. Its essential characteristics are denoted in Figure1:

Figure1. *Xenon*

2. The Stable Double Surface Orbit

Respecting the double surface concept [1],[2] the length of any stable orbit expressed in Compton wavelengths of the electron is the average elliptic-hyperbolic length s_n determined by the elliptic length $n \in \mathbb{N}$ of that orbit as follows:

$$s_n = n\left(2 - \frac{1}{\sqrt{1 + \frac{\pi^2}{n^2}}}\right), n \in \mathbb{N}. \tag{1}$$

The elliptic length n being the natural number is at the same time the name of such orbit.

3. Bohr-Like Orbit

The effective nuclear charge $Z_{effective}$[1],[2] can be attributed to each atomic orbital as well as Bohr-like orbit length may be assigned to each effective nuclear charge. Expressing the orbit length in Compton wavelengths of the electron we have[1], [2]:

$$s_{Bohr-like} = \frac{\alpha^{-1}}{Z_{effective}}. \tag{2}$$

Where α^{-1} denotes the inverse fine structure constant and $Z_{effective}$ denotes the effective nuclear charge.

4. The Double Surface Stability oF Bohr-LIKE Orbit

Bohr-like orbit deduced from the effective nuclear charge $Z_{\text{effective}}$ (2) is in principle unstable since except for $n = 137$ (Bohr orbit) it does not meet the double surface criteria (1):

$s_n \neq s_{Bohr-like}, n \in \mathbb{N}.$ (3)

5. THE KNOTTED BOHR-LIKE ORBIT

Bohr-like orbit can improve its double-surface stability by knotting - where the orbit length $s_{Bohr-like}$ is at constant energy multiplied by the natural factor $m \in \mathbb{N}$ - becoming completely stable at $m = \infty$. To become completelly stable earlier at $m \neq \infty$ the multiplied orbit length $m\ x\ s_{Bohr-like}$ should be further modified (shortened or extended) to $s_{n\in\mathbb{N}}$ with the help of energy change (released or consumed energy, respectively) as follows:

$$\Delta E = Ry.\alpha^{-1}\left(\frac{1}{(m \in \mathbb{N}).s_{Bohr-like}} - \frac{1}{s_{n\in\mathbb{N}}}\right) \gtrless 0. \quad (4)$$

Where $Ry = 13.6\ eV$ denotes Rydberg constant, $\alpha^{-1} = 137.036$ denotes the inverse fine structure constant and $s_{n\in\mathbb{N}}$ denotes the orbit length of choice enabling the least absolute change of energy $|\Delta E|_n = minimal$.

6. THE CONDITIONALLY STABLE BOHR-LIKE ORBIT

To achieve a conditionally stable Bohr-like orbit by knotting at $m \neq \infty$ the multiplied orbit length $m\ x\ s_{Bohr-like}$ should be further extended to $s_{n\in\mathbb{N}}$ with the help of missing energy consumption:

$$\Delta E = Ry.\alpha^{-1}\left(\frac{1}{(m \in \mathbb{N})\ x\ s_{Bohr-like}} - \frac{1}{s_{n\in\mathbb{N}}}\right) > 0. \quad (5a)$$

The energy change for achieving the conditional orbit stability is thus positive:

$$\Delta E > 0. \quad (5b)$$

7. THE REALLY STABLE BOHR-LIKE ORBIT

To achieve a really stable Bohr-like orbit by knotting at $m \neq \infty$ the multiplied orbit length $m\ x\ s_{Bohr-like}$ should be further contracted to $s_{n\in\mathbb{N}}$ with the help of excess energy release:

$$\Delta E = Ry.\alpha^{-1}\left(\frac{1}{(m \in \mathbb{N})\ x\ s_{Bohr-like}} - \frac{1}{s_{n\in\mathbb{N}}}\right) < 0. \quad (6a)$$

The energy change for achieving the real orbit stability is thus negative:

$$\Delta E < 0. \quad (6b)$$

8. THE REALLY STABLE ATOM

To achieve a really stable atom following the double surface concept the overall orbit link should be really stable as well as more stable than any particular orbit itself. That is, the energy change of the atom overall orbit link $\Delta E_{overall\ orbit\ link}$ should be negative (6a,6b) and at the same time smaller than the energy change of any particular orbit ΔE_n^{orbit}:

$$\Delta E_{overall\ orbit\ link} < 0 < \Delta E_n^{orbit}. \quad (7)$$

In such a way (7) 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:

$$\Delta E_{overall\ orbit\ link} = Ry.\alpha^{-1}\sum_{k=1}^{k_{max}}\left(\frac{1}{(m \in \mathbb{N})\ x\ s_k^{Bohr-like}} - \frac{1}{s_{n\in\mathbb{N}}}\right) < 0. \quad (8)$$

Where k denotes some particular orbit and k_{max} denotes the whole number of atom orbits.

9. THE UNSTABLE UNKNOTTED XENON

According to the previouslly mentioned criteria (7), (8) the unknotted Xenon is unstable as can be seen in Table1 since the overall orbit link is unstable ($\Delta E > 0$) and after all 5s orbit is stable ($\Delta E < 0$). So the instability of other atom orbits is not enough to create a stable overall orbit link.

Table1. *The unstable unknotted Xenon*

Orbital	Effective nuclear	Orbit length	Unknot multiple	Unknot length	Stable unknot	Length difference	Energy difference	Stability

	charge ($Z_{effective}$)	(s) in λ_e	(m)	(ms) in λ_e	length (s_n) in λ_e	(Δs) in λ_e	(ΔE) in eV	
1s	52.9215	2.58942	1 ○	2.58942	2.92594	<0	> 0	
2s	39.803	3.442856	1 ○	3.442856	3.92814	<0	> 0	
2p	49.8346	2.749817	1 ○	2.749817	2.92594	<0	> 0	
2p	49.8346	2.749817	1 ○	2.749817	2.92594	<0	> 0	
2p	49.8346	2.749817	1 ○	2.749817	2.92594	<0	> 0	
3s	35.5764	3.85188	1 ○	3.85188	3.92814	<0	> 0	
3p	35.6676	3.84203	1 ○	3.85188	3.92814	<0	> 0	
3p	35.6676	3.84203	1 ○	3.85188	3.92814	<0	> 0	
3p	35.6676	3.84203	1 ○	3.85188	3.92814	<0	> 0	
4s	26.173	5.235778	1 ○	5.235778	5.76633	<0	> 0	
3d	39.9468	3.430463	1 ○	3.430463	3.92814	<0	> 0	
3d	39.9468	3.430463	1 ○	3.430463	3.92814	<0	> 0	
3d	39.9468	3.430463	1 ○	3.430463	3.92814	<0	> 0	
3d	39.9468	3.430463	1 ○	3.430463	3.92814	<0	> 0	
3d	39.9468	3.430463	1 ○	3.430463	3.92814	<0	> 0	
4p	24.957	5.490885	1 ○	5.490885	5.76633	<0	> 0	
4p	24.957	5.490885	1 ○	5.490885	5.76633	<0	> 0	
4p	24.957	5.490885	1 ○	5.490885	5.76633	<0	> 0	
5s	**14.218**	**9.638206**	**1** ○	**9.638206**	**9.50280**	**0.1354 > 0**	**-2.7552 < 0**	**STABLE**
4d	21.893	6.259353	1 ○	6.259353	6.68455	<0	> 0	
4d	21.893	6.259353	1 ○	6.259353	6.68455	<0	> 0	
4d	21.893	6.259353	1 ○	6.259353	6.68455	<0	> 0	
4d	21.893	6.259353	1 ○	6.259353	6.68455	<0	> 0	
4d	21.893	6.259353	1 ○	6.259353	6.68455	<0	> 0	
5p	12.424	11.02994	1 ○	11.02994	11.4229	<0	> 0	
5p	12.424	11.02994	1 ○	11.02994	11.4229	<0	> 0	
5p	12.424	11.02994	1 ○	11.02994	11.4229	<0	> 0	
Overall orbit link		**142.5452**		**142.5452**	**143.0345**	**-0.4893 < 0**	**0.0032 > 0**	**UNSTABLE**

10. THE STABLE KNOTTED XENON

To make a stable Xenon all atom orbits except 5s orbit should stay unknotted (to stay unstable) but 5s orbit should be properly knotted to become less stable than the stable overall orbit link. This happens at 15-times knotted 5s orbit as can be seen in Table2.

Table2. *The stable knotted Xenon*

Orbital	Effective nuclear charge ($Z_{effective}$)	Orbit length (s) in λ_e	(Un)knot multiple (m)	(Un)knot length (ms) in λ_e	Stable unknot length (s_n) in λ_e	Length difference (Δs) in λ_e	Energy difference (ΔE) in eV	Stability
1s	52.9215	2.58942	1 ○	2.58942	2.92594	<0	> 0	
2s	39.803	3.442856	1 ○	3.442856	3.92814	<0	> 0	
2p	49.8346	2.749817	1 ○	2.749817	2.92594	<0	> 0	
2p	49.8346	2.749817	1 ○	2.749817	2.92594	<0	> 0	
2p	49.8346	2.749817	1 ○	2.749817	2.92594	<0	> 0	
3s	35.5764	3.85188	1 ○	3.85188	3.92814	<0	> 0	
3p	35.6676	3.84203	1 ○	3.85188	3.92814	<0	> 0	
3p	35.6676	3.84203	1 ○	3.85188	3.92814	<0	> 0	
3p	35.6676	3.84203	1 ○	3.85188	3.92814	<0	> 0	

4s	26.173	5.235778	1 ○	5.235778	5.76633	<0	> 0	
3d	39.9468	3.430463	1 ○	3.430463	3.92814	<0	> 0	
3d	39.9468	3.430463	1 ○	3.430463	3.92814	<0	> 0	
3d	39.9468	3.430463	1 ○	3.430463	3.92814	<0	> 0	
3d	39.9468	3.430463	1 ○	3.430463	3.92814	<0	> 0	
3d	39.9468	3.430463	1 ○	3.430463	3.92814	<0	> 0	
4p	24.957	5.490885	1 ○	5.490885	5.76633	<0	> 0	
4p	24.957	5.490885	1 ○	5.490885	5.76633	<0	> 0	
4p	24.957	5.490885	1 ○	5.490885	5.76633	<0	> 0	
5s	**14.218**	**9.638206**	**15** 	**144.5731**	**145.034**	**-0.4609 < 0**	**0.0410 > 0**	**UNSTABLE**
4d	21.893	6.259353	1 ○	6.259353	6.68455	<0	> 0	
4d	21.893	6.259353	1 ○	6.259353	6.68455	<0	> 0	
4d	21.893	6.259353	1 ○	6.259353	6.68455	<0	> 0	
4d	21.893	6.259353	1 ○	6.259353	6.68455	<0	> 0	
4d	21.893	6.259353	1 ○	6.259353	6.68455	<0	> 0	
5p	12.424	11.02994	1 ○	11.02994	11.4229	<0	> 0	
5p	12.424	11.02994	1 ○	11.02994	11.4229	<0	> 0	
5p	12.424	11.02994	1 ○	11.02994	11.4229	<0	> 0	
Overall orbit link		**142.5452**		**277.4801**	**277.0178**	**0.4623 > 0**	**-0.0112 < 0**	**STABLE**

The double surface stability of Xenon can be achieved at higher number of 5s orbit knots, too, as presented in Table3.

Table3. *Energy change of forming a stable Xenon overall orbit link regarding the number of 5s orbit knots and overall orbit link length*

Rank	Number of 5s orbit knots	Energy change of forming a stable Xenon overall orbit link (ΔE in eV)	Frequency equivalent of energy change (ν in THz)	The elliptic length of Xenon stable overall orbit link (n in λ_e)
1	15	- 0.0112	-2.71	277
2	26	- 0.00619	-1.50	383
3	40	- 0.00295	- 0.71	518
4	51	- 0.00214	- 0.52	624
5	62	- 0.00164	- 0.40	730
6	73	- 0.00131	- 0.32	836
7	87	- 0.000841	- 0.20	971
8	98	- 0.000717	- 0.17	1077
9	120	- 0.000547	- 0.132	1289
10	145	- 0.000353	- 0.0854	1530
…	…	…	…	
∞	∞	0	0	∞

Actually the number of solutions for the formation of Xenon stable overall orbit link is infinite. Each subsequent solution found at higher number of 5s orbit knots is energetically less favourable (ΔE is less negative) showing a trend to become zero at the infinite knot. Knotting also determines the length of Xenon stable overall orbit link. As can be seen in Table3 the shortest Xenon stable overall orbit link is at the same time the most favourable.

11. Conclusion

The bright message of this fragment could be that there is no need to wait forever for something worthwhile to happen. And that the opportunity lost does not return.

Dedication

This fragment is dedicated to Easter Island

Figure2. *Easter Island*

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