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### **Moseley's law refuted:**

**Not atomic number determines X-ray radiation but atomic mass A**

**Atoms show periodic incremental patterns**

*Atomic number Z is pointless and can be cancelled*

*Atomic nuclei with Z protons and N neutrons don't exist*

### **Abstract**

A is the number of hydrogen building blocks of an element and its isotopes. X-ray radiation of elements can be explained due to the specific atomic architecture of hydrogen and helium building blocks.

According to Moseley's law, isotopes of elements (for example Ag-107 and Ag-109) would cause equal X-ray frequencies which is impossible

Nature of observed x-rays: For Moseley, excited elements emit X-rays, but in reality he measured frequencies of the dielectric aether.

Excited Eigen frequencies of the elements result in enforced oscillations of the dielectric aether that can be measured.

Till now it is a common belief that the cause of the X-rays is an removed inner electron and that an electron from an outer electron shell fills the vacancy. See my other articles where I argue that electron shells don't exist...

*From Moseley's data it is impossible to infer that atoms possess Z extra-nuclear electrons, electrons that are arranged in shells or orbitals.*

*It is also impossible to infer that there are atomic nuclei with Z protons*

*Atomic number Z is pointless and can be cancelled.*

Moseley ignored that not all isotopes ( $^{35}\text{Cl}$  and  $^{37}\text{Cl}$  for example) of an element can exhibit the same X-ray spectrum because that is due to the unique atomic number Z for the element ( $Z = 17$  for Cl).

Obviously, the number of atomic building blocks (H's) and their architecture determine frequencies and not the hypothesized proton or electron number Z!

The alkali elements have an increasing mass number but the chemical behaviour remains unchanged because their surface remains the same.

So it is assumed that this mass increase is nothing but an increase in oxygen building blocks that are chemically inactive. There is a kernel under a chemically active surface

$^{35}\text{Cl}$  and  $^{37}\text{Cl}$  as well the alkalis Na, K, Rb, Cs, ... are chemically equivalent.

For example the combinations NaCl, KCl, CsCl are possible.

When  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$  are treated as isotopes and not as elements then one can also the alkalis treat as isotopes. Only their surface is chemically equivalent, their core comprises different numbers of oxygens as building blocks.

If the alkalis are treated as elements, then also  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$  can be treated as elements as well as  $^{63}\text{Cu}$  and  $^{65}\text{Cu}$ .

**Moseley's claim that atomic numbers determine the number of protons is pointless. It is the number of hydrogen's that (or mass number) that determines the atoms...**

### ***Fame of Moseley***

*Soon after Rutherford's landmark experiment of discovering the proton in 1911, Moseley subjected known elements to x-rays. He was able to derive the relationship between x-ray frequency and number of protons. When Moseley arranged the elements according to increasing atomic numbers and not atomic masses, some of the inconsistencies associated with Mendeleev's table were eliminated. The modern periodic table is based on Moseley's Periodic Law (atomic numbers)*  
<http://www.wonderwhizkids.com>

Moseley was Rutherford's student. The following quotation of Rutherford's comment [rub] on the work done by Moseley shows *paternal benevolence*:

*The importance of the atomic number in fixing the properties of an atom was shown by the remarkable work of Moseley on the X-ray spectra of the elements. He showed that the frequency of vibration of corresponding lines in the X-ray spectra of the element depended on the square of a number, which varied by unity in successive elements. This relation received an interpretation by supposing that the nuclear charge varied by unity in passing from atom to atom, and was given numerically by the atomic number. I can only emphasise in passing the great importance of Moseley's work, not only in fixing the number of possible elements, and the position of undetermined elements, but also in showing that the properties of an atom were defined by a number which varied by unity in successive atoms. This gives a new method of regarding the periodic classification of the elements, for the atomic number, or its equivalent the nuclear charge, is of more fundamental importance than the atomic weight.*

Then Rutherford mentioned that *several researches in the Cavendish Laboratory at Cambridge are in progress... to test the accuracy of this relation*, meaning the question *whether the atomic number of an element is the actual measure of its nuclear charge...* among these researchers was Chadwick.  
See [giu] for Moseley's original drawing, where K and L are the K or L series of characteristic radiation.

The alleged physical significance of Moseley's law:

Atomic number  $Z$  is the number of protons of nuclei and also the number of electrons in the extra nuclear electron shells. The number of neutrons of nuclei is  $N = A - Z$ , where  $A$  is mass number.

Moseley corrected the positions of cobalt and nickel in the periodic table according to x-ray spectrum. Co should precede Ni. The former sequence, namely Ni, then Co was justified by increasing atomic weights

Obviously Moseley could not investigate isotopes that were discovered a short time before his tragic death in World War I.

Let us investigate the right places in the periodic table of Co and Ni when the nickel isotopes are concerned. The two Ni isotopes of significance are Ni-58 and Ni-60. Obviously, Ni-58 and Ni-60 must possess different Eigen frequencies whereas Moseley considered only one frequency for all Ni isotopes.

But it is impossible to combine two frequencies into one that follows from the formula  $\nu = k (Z - 1)^2$  where for Z the number 28 works! If chemical properties of Co and Ni ascertain the order Co, Ni, then follows for the re-numeration:

Co is # 27, Ni has numbers 28a and 28b!

Same considerations for Cl-35 and Cl-37 as like for Cu-63 and Cu-65.

The second claim is that Moseley has put also Te-I (tellurium and iodine) *in their correct chemical order – the reverse of the order based on increasing atomic weights.*  
[rub]

For Te and I there is the following order:

Te with #52a and #52b for Te-126 respective Te-130, then I-127 with #53.

Of course these numbers have nothing to do with the amount of protons in the nuclei. This would be a fallacy.

Only the number of the building blocks of these atoms gives a physically meaningful significance. These numbers are the numbers of hydrogen building blocks. This are the mass numbers A.

As it will follow from my article *All Elements Consist of Hydrogen* that the building block of all elements is hydrogen, a thesis that postulated Prout in 1815.

For the periodic table element numbers Z are superfluous, they don't have any physical importance.

Not convinced? Then carry out a crucial experiment: Take Ni-58 and Ni-60 atoms. Bombard them with alpha particles. Then count the fragments. The bombardment of Ni-58 should deliver 28 protons, 28 electrons and 30 neutrons and Ni-60 should deliver 28 protons, 28 electrons and 32 neutrons, respectively.

## Moseley's law

Moseley showed that for X-ray frequencies of the elements the relation  $\nu = k (Z - 1)^2$  holds. For the so called K lines the proportion is:

$$\nu = \nu_{\text{Ry}} (= \text{Rydberg frequency } 3,29 \cdot 10^{15}) (1-1/4) (Z - 1)^2 = (3/4) \nu_{\text{Ry}} (Z - 1)^2$$

Now we rewrite Moseley's formula for an mass number dependency A when Z is exactly A/2 for monoisotopes or when  $Z = A/2$  for the predominant isotope: Examples: Ca-40, Ne-20, Si-28, S-32, Mg-24.

$$\nu = (3/4)(1/4) \nu_{\text{Ry}} (A - 2)^2 \quad \nu = (3/16) \nu_{\text{Ry}} (A - 2)^2$$

The scope of the formula for atomic mass is only to show that the square root of the frequency increases with atomic mass. Therefore we conclude that also for isotopes greater masses have greater Eigen frequencies!

The terms  $(A - x)^2$  that holds for Moseley's law for some elements are listed in the table. Regarding elements with isotopes the predominant isotopes are listed, isotopes with minute occurrences neglected.

Remarks: There are columns (groups) of elements with periodic vibratory behaviour. In a column mass steps from above are  $\Delta m = 4$  mass units. That means that the addition of a He-4 building block changes X-ray frequencies according to a rule: The expression for mass dependence of frequency is  $(A - x)^2$  where  $x = 2, 3, 6, 7$ , for the specific column.

For the isotopes Cl-35, Cl-37, Ni-58, Ni-60, Cu-63, Cu-65, Zn-64, Zn-66, Zn-68, Ag-107, Ag-109 etc. frequency measurements are necessary.

Moseley's recipe does not work because, for example, atomic number  $Z = 18$  for Cl does not deliver two frequencies for the isotopes each. The same holds for the silver isotopes...

Law-like X-ray frequency dependencies on mass number  $A$ .

$$\nu = (3/16) \nu_{Ry} (A - x)^2 = K (A - x)^2 ; K = 1 \text{ for the graph!}$$

**There are 4 vertical periodic groups** according to term  $(A - x)^2$  with  $x = 2, 3, 6, 7$ . Obviously, there is a separating line between elements with even and odd mass numbers  $A$ .

atom	$(A - 2)^2$	atom	$(A - 3)^2$	atom	$(A - 4)^2$	atom	$(A - 5)^2$
Ne-20	$18^2$	Na-23	$20^2$	Cl-35	$31^2$	Cl-37	$32^2$
Mg-24	$22^2$	Al-27	$24^2$				
Si-28	$26^2$	P-31	$28^2$			Sc-45	$40^2$
S-32	$30^2$						
		K-39	$36^2$			Ni-58	$53^2$
Ca-40	$38^2$						
Increment of mass $\Delta m = 4$	Increment of $(A - 2) = 4$	Increment of mass $\Delta m = 4$	Increment of $(A - 3) = 4$				

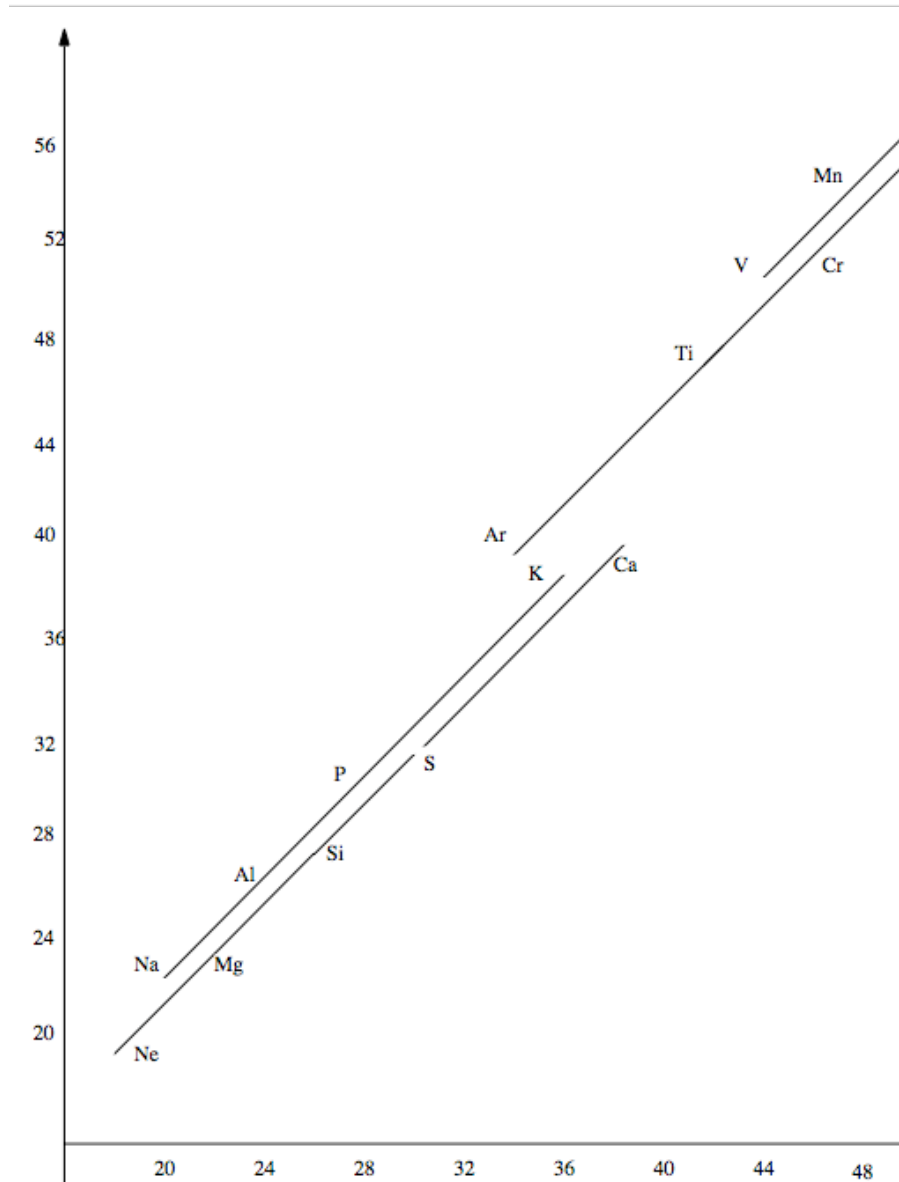
atom	$(A - 6)^2$	atom	$(A - 7)^2$	atom	$(A - 8)^2$	atom	$(A - 9)^2$
Ar-40	$34^2$						
Ti-48	$42^2$	V-51	$44^2$				
Cr-52	$46^2$	Mn-55	$48^2$				
Fe-56	$50^2$	Co-59	$52^2$				
Ni-60	54	--		Cu-63	$55^2$	Cu-65	$56^2$
		Y-89	$82^2$				
Increment of mass $\Delta m = 4$	Increment of $(A - 6) = 4$	Increment of mass $\Delta m = 4$	Increment of $(A - 7) = 4$				

**Isobars:** Take Ca-40, Ar-40 and K-40. All of them possess 40 hydrogen building blocks but show different ionization energies due to different atomic architecture. Therefore each specific atomic architecture possesses also its own Eigen frequency!

X-ray frequencies for comparison: Ar-40:  $\nu = (3/16) \nu_{Ry} (A - 6)^2 \propto 34^2$

$$\text{Ca-40: } \nu = (3/16) \nu_{Ry} (A - 2)^2 \propto 38^2$$

The table can be continued... Till Cu-63 and Cu-65 we have even umbers for frequencies. Zr possesses 3 isotopes of about equal "weight". Now odd numbers must be introduced.



Concerning elements with approximate equal mass numbers  $A$  of isotopes, one striking result of Moseley's experimental result is Ag. It consists of 0.52 % Ag-107 and 48% Ag-109. Atomic number of Ag is 47. According to Moseley's measurement  $(Z - 1) = \sqrt{\nu / (3/4) \nu_{Ry}} = 46,6$ , therefore  $Z = 47,6$  instead of 47! See [mei]

Obviously, the number of atomic building blocks (H's) and their architecture determine frequencies and not the hypothesized proton or electron number  $Z$ ! (Same arguments hold for Pd.)

$Z$ - values according to atomic structure:

$$\text{Ag-107: } (Z - 16) = \sqrt{\nu / (3/4) \nu_{Ry}} = \sqrt{\nu} = (3/16) \nu_{Ry} (A - 16)^2 / (3/4) \nu_{Ry} = (1/2) \cdot (A - 16) = 91/2 = 45,5 \quad \rightarrow Z = 46,5$$

$$\text{Ag-109: } (Z - 17) = \sqrt{\nu / (3/4) \nu_{Ry}} = \sqrt{\nu} = (3/16) \nu_{Ry} (A - 17)^2 / (3/4) \nu_{Ry} = (1/2) \cdot (A - 17) = 92/2 = 46 \quad \rightarrow Z = 47$$

So Moseley's law holds only for atomic number 47, that is Ag-109. For Ag-107 the atomic number would be 46,5 but there are only even atomic numbers. Moseley cannot predict the corresponding X-ray frequency. Isotopes refute Moseley's law!

Frequency relation  $\text{Ag-109} / \text{Ag-107} = 92^2 / 91^2 = 1.0221$

$(A - 16)^2$	$(A - 17)^2$
Ag-107 = $91^2$	Ag-109 = $92^2$
Z = 46,5	Z = 47

Unfortunately Moseley died in world war II and therefore could not research isotopes. Because Moseley's formula does not distinguish for isotopes and its mass shift, this formula holds therefore no in the entire range.

### **Coster's attempt to rescue Moseley's wrong interpretations**

Coster investigated the slopes of Moseley's X-ray term curves. The plots show  $\sqrt{T/R}$  against atomic number A where T is the term value, R is the Rydberg constant. The curves are straight lines,

*"but upon closer examination the slope of the curves does not remain entirely unchanged throughout the whole periodic system. First of all this slope in general increases more or less with increasing atomic number due to relativity and spin effect".*

Coster considered L-, M-, N-, and O-curves that are not relevant for our consideration of the fundamentally erroneous atomic model of QM.

Coster did not understand that the experimental outcome for Ag, namely 46,6 instead of 47, is not only *"in error"*. Here the error is a primordial **systematic error**: There are Ag-107 and Ag-109, each with its own Eigen frequencies that depend on atomic structure.

The two different Eigen- frequencies cannot depend on one number, namely that of the alleged number of protons and extra nuclear electrons.

Concerning experimental values Coster refers to Siegbahn. The exactitude of Siegbahn's measurements was according to A. Gullstrand "a thousand times greater than that attained by Moseley". (Source: Presentation Speech, Nobel Price for Siegbahn, 1925)

So the experimental outcomes of Siegbahn that Coster mentioned are the best available. Alone for Ag they refute Moseley's law and its interpretation in terms of the Rutherford-Bohr atomic model.

**Moseley's formula also does not fit experimental data.**

See:

ON MOSELEY'S LAW FOR X-RAY SPECTRA  
 By Horace Scudder Uhler 1917  
 SLOANE PHYSICAL LABORATORY, YALE UNIVERSITY  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1091182>

Moseley's law does not hold exactly over the entire range. In the case of the  $L_{\beta_1}$  series for which 46 wave-lengths from arsenic ( $N=33$ ,  $\lambda=9.449 \text{ \AA}$ ) to uranium ( $\lambda=0.720 \text{ \AA}$ ) are given, another smooth curve of departure is obtained, the extreme deviations being +13.35%, -3.06%, and +5.84%, corresponding to As, Nd, and U, in the order named.

/

<http://www.physics.ox.ac.uk/history.asp?page=moseley> = Moseley's graph

### **Moseley's findings were interpreted in terms of the Bohr model**

Because of the high energy of the X-ray photon the corresponding quantum jump must also represent that energy. In terms of the Bohr model this is only possible when the jump goes on between the innermost shells of the atom.

A Textbook (Bill Graham 2002, P221 Modern physics Part 2.) explains: *This energy transfer promotes low lying electrons, leaving vacancies subsequently filled by higher lying electrons with the consequent emission of a photon (X-ray).*

*There may be several sequential transitions before the atom is restored to its ground state configuration... Assuming 2, 8, 18 represent the shielding of electrons by inner lying electrons then these electrons are grouped in shells.*

*~ 2e- n=1 K shell*

*~ 8e- n=2 L shell*

*~ 18e n=3 M shell.*

Therefore the shielding of electrons is necessary to calculate the series of jumps. Surprisingly the incoming X-ray photon does not disturb any of the electrons of the shielding layers...

From Moseley's data it is impossible to infer that atoms possess  $Z$  extra-nuclear electrons, electrons that are arranged in shells or orbital's. Also impossible to infer that there are atomic nuclei with  $Z$  protons.

The QM model is capable to explain only some phenomena. Moseley's experiment is not a crucial one for the existence of  $Z$  extra-nuclear electrons or for  $Z$  protons in the nuclei.

Moseley's experimental data can only show that a physical property of the elements, namely a frequency due to radiation, depend on atomic mass number  $A$  and on its specific atomic architecture.

### ***Despair of QM***

<http://chemistry.stackexchange.com/questions/6929/understanding-moseley-s-law-from-the-rydberg-type-equation>

*Understanding Moseley's law from Rydberg-type equation?*

*To explain the characteristic X-ray emission peaks for various elemental targets, a formula was developed which was similar in construct to the Rydberg equation for H-atom as derived by the Bohr-model.*

$$\nu^{-1} = R (1/n_f^2 - 1/n_i^2)(Z - \sigma)^2$$

where  $\nu^{-1}$  is the wavenumber,  $\sigma = 1$  for the  $K_\alpha$  line.

My question is: Although Bohr model is wrong in light of the modern quantum mechanical concept of atomic structure, why does the energy for transition (and X-ray emission) of complicated atoms with complicated screening effect be represented by a simple adjustment of the  $Z$  factor in the Rydberg equation with the value of  $R$  used in case of H atom?

Why isn't there a need of complicated corrections (instead of simple subtraction of an experimentally obtained  $\sigma$  to predict the X-ray wavelength)?

**Answer:**

Though the Bohr model is oversimplified, the Rydberg equation itself is a good approximation (I wonder if it can be derived using the more accurate orbital model).... – [Nicolau Saker Neto](#) Nov 20 '13 at 13:08

### ***An alternative to the QM interpretation of Moseley's findings:***

When two waves of different frequency are superposed, two new waves occur with frequencies equal to the sum and the difference of the original frequencies.

We regarded the hydrogen atom and the aether as two music instruments that have an interplay. The series of Lyman, Balmer etc. are scales of tones. Excited atoms generally have an interplay with the aether.

The first "tone" of the Lyman series is  $\nu(H_\alpha) = \nu_{\text{Rydberg}} (1 - 1/4)$ , we interpret the first term as Eigen frequencies of the H-atom, the second term as the Eigen frequencies of the aether.

Moseley's law can be expressed for the so called  $K_\alpha$  lines of the elements:

$$\text{Frequency} = \nu(K_\alpha) = \nu_{\text{Rydberg}} (Z - 1)^2 (1 - 1/4)$$

For example sulfur, S:  $Z = A/2 = 16$  ;  $(Z - 1)^2 = 15^2$

$$\nu(K_\alpha) = \nu_{\text{Rydberg}} 15^2 (1 - 1/4) \text{ Hz}$$

This expression can be interpreted as a difference of frequencies (in acoustics this means a difference tone). This indicates that the physical cause for the frequency difference is a coupled oscillation.

There are the two oscillators that are coupled: on the one hand the excited atom and on the other hand the dielectric medium (aether) that is the carrier of all electromagnetic radiations.

Example for Na ( $Z = 11$ ):

$$\nu(K_\alpha) = \nu_{\text{Rydberg}} (100)(1 - 1/4)$$

The hydrogen atom H produces in its Lyman series the first tone

$$\nu(H_\alpha) = \nu_{\text{Rydberg}} (1 - 1/4), \text{ which frequency is } 1/100 \text{ of the}$$



$\nu$  ( $K_{\alpha}$ ) frequency of Na!

X ray spectra can also be interpreted as Raman shifting of incident ray!

## References

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chapter 34, author Dirk Coster, Groningen

[cos ] D. Coster, On the Moseley diagram of the X-ray term values  
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[rua] Rutherford, E., The Structure of the Atom,  
Phil. Mag., series 6, vol. 27, 1914, p.48

Nobel prize for Siegbahn:

[http://www.nobelprize.org/nobel\\_prizes/physics/laureates/1924/siegbahn-facts.html](http://www.nobelprize.org/nobel_prizes/physics/laureates/1924/siegbahn-facts.html)