(For Review) Examining Complex Atomic Spectra for Fundamental Wavelengths

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Abstract

This paper searches for the source wavelengths of high-energy multi-electron atoms. Two equations are derived and incorporated to solve for the source of complex emission spectra lines of atoms. The derived equations are applied to the known emission of the sulfur atom. A computerized search looks for pairs of matches within the existing complex line spectrum. The sulfur atom reveals an astounding number of matches when compared to comparable random sets. The wavelengths that structure the atom are adding in ionization states. The results show which wavelengths are most active in forming other wavelengths. This disclosure does not solve quantum levels but looks for the source of the complex spectra using the known spectra lines from the atom under investigation. Similar results have been observed in other atoms.

Keywords

Spectroscopy, Atomic Spectra, Complex Spectra, Sulfur, Emission Spectra

1. Introduction

This paper will discuss a new method for determining the high-energy emission spectrum wavelengths of atoms heavier than hydrogen. When an atom is excited by an electric current or flame, it emits light at specific wavelengths, comprising its atomic spectra. Each element has its own unique set of wavelengths. The Schrödinger wave equation and the Rydberg formula are used to calculate the spectrum of hydrogen.

https://en.wikipedia.org/wiki/Emission_spectrum#/media/File:Emission_spectrum-Fe.svg

https://en.wikipedia.org/wiki/Rydberg_formula

In highly excited atoms, the average electron distance is far from the nucleus. The extra space and high energy allow the electron to take on a more random behavior, as it is no longer confined by a small capsule. Collisions occur due to this somewhat chaotic behavior, and new spectra wavelengths form.

The Schrödinger wave equation and the Rydberg formula both provide incorrect results for multi-electron atoms. The "quantum defect" is a correction for the Rydberg formula for these atoms. However, this correction has its faults.

This paper aims to provide a unique method for calculating the source of the complex atomic emission spectra of atoms heavier than hydrogen. It employs the existing line spectra wavelengths to reveal the source of the unaccounted line spectra. The process's concept is to find the two wavelengths that form the third.

The process discussed herein follows: Two equations are derived from a sample set of four numbers. The simple addition and subtraction of any two numbers in the sample set results in two answers. One resultant is derived from addition, and the other from subtraction. All four of the sample numbers are processed, resulting in 12 numbers. Then, the 12 resultants and the four original numbers are combined and alphabetized in ascending order, for a total of 16 numbers.
Using the derived equations and the full set of 16 numbers, the original four numbers can be located when hidden within the full set. The method is then applied to the atomic spectra of sulfur.

These two equations are used to look back into the atomic spectra for source wavelengths.
The method reveals how many of the complex sets of all atoms' spectra wavelengths came to be.
The derived equations are applied to 252 wavelengths of the sulfur atom (ionization levels I-V).

The method presented here focuses on adding and subtracting spectral wavelengths, not frequencies. The author is clear that these calculations do not result in energy levels or quantum jumps. The process shown herein reveals that many complex spectra result from the addition or subtraction of wavelengths. This method extends beyond the Rydberg and Schrödinger wave equations.

2. The Method

First, two equations are derived by adding and subtracting a ‘sample set of numbers. This exercise is conducted only to give an example, which is later applied to actual spectra values. Four numbers are picked: 3, 7, 13, and 60. (Any quantity or set of numbers can be picked, and the outcome will be the same.)

Equation (1) is derived simply to add and subtract any two numbers. The equation is similar to the heterodyning equation used in radio, except in this case it will not represent frequencies.
The numbers are inserted in equation (1), which adds and subtracts two at a time until all the combinations have been solved. Two numbers are generated each time because the equation is plus and minus, and the lower number is always subtracted from the higher, so we always have a positive result.

$$\lambda n = \lambda_1 \pm \lambda_2 \tag{1}$$

Where "λn" are the resultants, and "λ_1" is the higher number and "λ_2" is the lower.

Note: The numbers were chosen so that when added cannot generate another of the original five (see exception). This will be an important fact for later. The results are in the following Table I. The complete set is shown below.

Table I
07 ± 03 = 10,04
13 ± 03 = 16,10
60 ± 03 = 63,57
13 ± 07 = 20,06
60 ± 07 = 67,53
60 ± 13 = 73,47

Originals: Resultant set:
(3,7,13,60), *and* (4,10, 10,16, 57,63, 6,20, 53,67, 47,73)

A total of 12 numbers, not too astounding but necessary for the sake of applying it to the atomic spectra as shown later in the search for source wavelengths. Later we can locate the original numbers (3,7,13,60) from the full set of 12 numbers in a solve-then trial and error search. Notice the number 10 was generated twice. The results are similar to beat or harmonic frequencies except later in this paper, they will be wavelengths.

3. Derivation of the Two Equations

Now assume we do not know what the four original numbers were. But we have the entire set, the originals, and all the results. The following derives two equations that can be used to find what the original numbers were, given we have all or most of the set of 12. If some are missing, we can still draw some conclusions about what they might be.

Still working with the ‘sample set,’ the following two equations are derived to solve for the original numbers (7 & 3) when the results (4 & 10) are known. Where λn is the new wavelength.

Given two numbers as examples (see Table 1), 7 and 3, inserting them into equation “1” results in the two numbers below.

$$7 \pm 3 = 10 \; and \; 4 \tag{2}$$

Subtracting 4 from 10 and dividing by 2 results in one of the original numbers.

$$(10 - 4)/2 = 3 \tag{3}$$

Taking the above result (3) and subtracting it from the higher number results in the other original number.

$$10 - 3 = 7 \tag{4}$$

The resulting two equations (Fundamental 1 and Fundamental 2) are as follows:

$$F_1 = (PickHi - PickLo)/2 \tag{5}$$

$$F_2 = PickHi - (PickHi - PickLo)/2 \tag{6}$$

Where “F_1” and “F_2” are matches to the original set, and “PickHi” is any large number from the original set and “PickLo” is any lower.

These two equations can locate the original numbers which produced the resultant set of numbers from the previous example. This works with any combination of numbers. The problem is you don’t know which pairs go together. The next section will resolve this issue by evaluating every possible combination and searching for a match within the full set of numbers, a trial-and-error process.

4. Applying the Equations “5 & 6” to the ‘Sample Set’

Not to over simply, but for the sake of presenting a complete explanation of the procedure. From the previous example: ‘original’ and ‘resultant’ sets (3,7,13,60), and (4,10), (10,16), (57,63), (6,20), (53,67), (47,73) respectively. Notice that two tens were generated by two different pairs. This is not only okay but also provides an eye-opener when evaluating actual spectra.

Assuming we have no idea, which numbers generated the full set, and no order is known. If the complete set of 12 numbers is available, the original numbers 3, 7, 13, and 60 can be located from the jumbled set using the two source equations "5" & "6" derived above. The trial-and-error procedure as follows untangles the set, finding the original set of four numbers.

The entire set is alphabetized in ascending order: (3,4,6,7,10,13,16,20,47,53,57,60,63,67,73).

1. Two numbers are picked, a low and a high, and inserted into the F_1 "5" and F_2 "6" equations.

   For example: 57 and 63

$$F_1 = (63 - 57)/2 = 3 \tag{7}$$

and

$$F_2 = 63 - (63 - 57)/2 = 60 \tag{8}$$

2. A match using the full set is then attempted (these are matches).
3. When every possible combination of pairs is evaluated, the original set reveals itself, and non-matches are rejected. (Some of the non-matches are expected to show when the ionization level is increased.)

Next, we will assume these are atomic spectra (using real spectra values) with the prospect that the results will match them. If this is the case, then some, if not all, of the source wavelengths can be found by a trial-and-error method. Comparing the actual results to randomly generated sets provides good proof of the concept's validity.

5. Procedure Applied to the Atomic Line Spectra of Sulfur (Ionization levels I-V)

The author employed a specialized computer program (Rainbow) to aid the evaluation. A similar trial and error procedure as previously outlined above is applied to the atomic spectra of the sulfur atom[1]. A high pick and low pick spectra value from the element sulfur is inserted in the F_1, "5" and F_2 "6" equations (the set must be alphabetized). A search for a spectra match to the result is then performed. A computer loop procedure cycles through all spectra, inputting each wavelength into the two equations until all possible combinations are evaluated. The spectra matches are located in the 'Match' column in Table II. Further evaluation (not detailed here) can also be accomplished.

Example of two of sulfur's wavelengths inserted into F_1 equation "5". (See line 2 Table II)

$$\begin{aligned} F_1 &= (1316.618 - 437.4)/2 \\ &= 439.609 \end{aligned} \tag{9}$$

This result matches sulfur spectra 439.60 Angstroms.

$$\text{Error} = 439.609 - 439.6 = 0.009 \tag{10}$$

The source for the sulfur spectra wavelengths used in this paper was the "CRC Handbook of Chemistry and Physics"[1]. Table II shows the compelling results of processing 252 wavelengths of sulfur spectra. Results from equations are rejected if the answer does not match a known spectra value within a tolerance of .01 Angstroms. Sulfur's spectra exhibit 2.6 to 3.9 times more matches than randomly generated sets with similar limits. Sulfur exhibits 56 astonishing results with zero error (perfect matches) in a total of 88 matches. Comparable random generated sets only generate 0 to 1 matches with a zero error. The error average of randomly generated sets is approximately .005 when compared to sulfur .0009, a 5 to 1 ratio. These are substantial differences. The x-ray value 83.4 Angstroms appears as a source wavelength further enhancing the results. Due to the small value of the remaining x-ray spectra the author elected to remove these for this disclosure.

The difference between two spectra wavelengths was not included in this short table. The long table (not included here) designates these results as 'ADD' in the 'Eqn.' column.

Table II. Sulfur Spectra Calculation Results.
Ion levels I-V 252 Entries Range 83.4 to 10459 Å. Error Tolerance .01 Å.

Count	Match	PickLo	PickHi	Eqn.	Error
1	83.400	520.100	686.900	F_1	0.0000
2	439.600	437.400	1316.618	F_1	0.0090
3	522.000	2665.400	3709.400	F_1	0.0000
4	522.500	3117.700	4162.700	F_1	0.0001
5	522.500	8694.700	9739.700	F_1	0.0000
6	652.500	551.200	753.800	F_2	0.0000
7	653.600	7930.300	9237.500	F_1	0.0001
8	653.600	1201.000	2508.200	F_1	0.0000
9	655.900	6384.900	7696.700	F_1	0.0001
10	659.800	655.900	663.700	F_2	0.0001
11	660.900	1077.100	2398.900	F_1	-0.0001
12	660.900	438.200	883.600	F_2	0.0000
13	661.400	1396.112	2718.900	F_1	-0.0061

14	666.100	522.500	809.700	F_2	0.0000
15	677.300	664.800	689.800	F_2	0.0000
16	678.100	519.300	836.900	F_2	0.0000
17	680.300	83.400	1277.216	F_2	0.0080
18	680.900	4925.300	6287.100	F_1	0.0001
19	686.900	680.300	693.500	F_2	0.0000
20	691.700	1077.100	2460.500	F_1	0.0000
21	693.500	1073.500	2460.500	F_1	0.0000
22	738.500	680.300	796.700	F_2	0.0000
23	786.500	666.100	906.900	F_2	0.0000
24	786.500	8882.500	10455.500	F_1	0.0000
25	789.000	693.500	884.500	F_2	0.0000
26	796.700	902.800	2496.200	F_1	-0.0001
27	796.700	1392.588	2986.000	F_1	0.0060
28	798.300	3097.500	4694.100	F_1	0.0001
29	804.000	1110.900	2718.900	F_1	-0.0001
30	804.000	798.300	809.700	F_2	0.0000
31	816.000	748.400	883.600	F_2	0.0000
32	849.200	4120.800	5819.200	F_1	0.0002
33	860.500	658.300	1062.700	F_2	0.0000
34	883.600	902.800	2670.000	F_1	0.0000
35	885.800	663.200	1108.400	F_2	0.0001
36	902.800	693.500	2499.100	F_1	0.0001
37	905.900	1305.883	3117.700	F_1	0.0084
38	910.500	883.600	937.400	F_2	0.0000
39	910.500	678.100	2499.100	F_1	0.0001
40	912.700	824.900	1000.500	F_2	0.0000
41	937.700	798.300	1077.100	F_2	-0.0001
42	996.000	883.600	1108.400	F_2	0.0000
43	1073.000	1014.400	1131.600	F_2	0.0000
44	1073.000	522.000	1624.000	F_2	0.0000
45	1077.100	693.500	2847.700	F_1	0.0000
46	1102.300	1073.000	1131.600	F_2	0.0000
47	1108.400	900.900	3117.700	F_1	-0.0001
48	1131.000	6052.700	8314.700	F_1	0.0000
49	1131.600	1234.100	3497.300	F_1	0.0001
50	1131.600	439.600	2702.800	F_1	0.0000
51	1234.100	660.900	1807.311	F_2	0.0055
52	1250.500	1108.400	1392.588	F_2	-0.0060
53	1250.500	1131.000	3632.000	F_1	0.0000
54	1253.800	883.600	1624.000	F_2	0.0000
55	1303.430	786.500	1820.343	F_2	-0.0085
56	1388.435	1302.863	1473.995	F_2	-0.0061
57	1624.000	654.000	3902.000	F_1	0.0000
58	1629.200	750.200	2508.200	F_2	0.0000
59	1820.343	522.000	4162.700	F_1	0.0071
60	1826.245	789.000	2863.500	F_2	0.0050

61	2387.000	1624.000	6398.000	F_1	0.0000
62	2398.900	849.200	5647.000	F_1	0.0000
63	2489.600	1073.500	6052.700	F_1	0.0000
64	2489.600	836.900	4142.300	F_2	-0.0002
65	2508.200	437.400	5453.800	F_1	0.0000
66	2680.500	4332.700	9693.700	F_1	0.0000
67	2680.500	664.800	4696.200	F_2	0.0000
68	2680.500	691.700	6052.700	F_1	0.0000
69	2691.800	902.800	6286.400	F_1	0.0000
70	2691.800	1014.400	6398.000	F_1	0.0000
71	2731.100	824.900	6287.100	F_1	0.0000
72	2785.500	854.800	4716.200	F_2	0.0000
73	2797.400	1473.995	4120.800	F_2	-0.0024
74	2863.500	2741.000	2986.000	F_2	0.0000
75	2904.300	3933.300	9741.900	F_1	0.0002
76	2904.300	884.500	4924.100	F_2	0.0000
77	3497.300	2741.000	4253.600	F_2	0.0000
78	3632.000	1624.000	5640.000	F_2	0.0000
79	3632.000	664.800	7928.800	F_1	0.0000
80	3867.600	1914.698	9649.900	F_1	0.0010
81	3928.600	1108.400	6748.800	F_2	-0.0002
82	4142.300	2856.000	5428.600	F_2	0.0000
83	4285.000	1102.300	9672.300	F_1	0.0000
84	4694.100	693.500	8694.700	F_2	0.0000
85	4694.100	1073.500	8314.700	F_2	0.0000
86	5640.300	4993.500	6287.100	F_2	0.0000
87	5706.100	3097.500	8314.700	F_2	0.0000
88	6384.900	3097.500	9672.300	F_2	0.0000

Error Average: 0.0009

Note the multiple hits (matches that came from different pairs). See Table II. (short table)
Line count: (4,5) (7,8) (11,12) (23,24) (26,27) (29,30) (38,39) (43,44) (49,50) (52,53) (63,64) (66,67,68) (69,70) (75,76) (78,79) (84,85). Here the same result came from two different sources, 23 matches of this type. Note the results 66,67 and 68, which had three separate sources. Random sets display only 1-4 of these and none with three. **It is highly unlikely these findings are coincidental.**

6. Conclusion

As previously covered in the introduction, **frequencies, not wavelengths, must be used to calculate atomic structure.** Here, however, something unusual is occurring as shown here is evidence that the complex spectra wavelengths are adding. The results show a clear indication that simple addition and subtraction are creating many of the complex atomic spectra wavelengths. The importance of the large number of computational results showing zero error within the sulfur spectra is overwhelming. When the tolerance is increased to .1 Angstroms all but five of the 252 wavelengths are engaged. When the match tolerance for sulfur spectra in the search is set at .25 Angstroms, 1612 matches show, and every one of the 252 wavelength entries[1] is engaged. Comparable random sets generate approximately 960 matches when tolerance is set at .25. Other elements checked thus far, helium, carbon, and lead, exhibit similar results. Hydrogen requires harmonic divisors incorporated into the equations to complete the set of spectral lines.

As a curiosity, most elements show only one source equation (F_1 or F_2) solved with any given pair of picks; Helium has several exceptions. There seems to be some significance because there are so many exclusions to the use of only one equation at a time. The author has further work regarding the addition and subtraction of waves. Normally, the frequency difference (quantum transitions), not wavelengths, are incorporated. All elements of all atomic weights complex spectra might be derived by incorporating both the Schrödinger wave equation and the addition of wavelengths shown here.

Combining two elements, such as hydrogen and nickel, which share the same transition level, is suggested as a harmonic match between each element. The results show which wavelengths are most active in forming other wavelengths, suggesting an understanding of the physics of a catalyst.

Some of the exotic subatomic particles created during the high-energy collisions in a supercollider may result from the addition, splitting, or splattering-like effect of waves. A true particle description should have a minimum life span before it decays.

The Schrödinger wave equation may not effectively describe the behavior of electrons in high-energy multi-electron atoms' spectra because it is designed for a smaller, well-controlled, confined space around the nucleus. As the ionization level increases, the space available for electrons expands, allowing the electrons to behave more randomly. This results in some chaos, allowing collisions, spurious emissions, and the addition of wavelengths, as shown with the sulfur atom.

See Ref (10). The results of other elements are at the bottom of the webpage.

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