Examining Complex Atomic Spectra for Fundamental Wavelengths

Todd W. Grigsby
Email: todd.grig2@gmail.com

Abstract
Two equations are derived and incorporated to solve for the source of complex emission spectra lines of atoms heavier than hydrogen. The derived equations F1 and F2 (Fundamental 1 and Fundamental 2) solve for the results from the addition and subtraction of any pair of numbers within a large set of numbers.
In this paper, the equations are applied to the known emission spectrum of the sulfur atom. A computerized random search looks for pairs of matches within the existing line spectrum. The sulfur atom reveals an astounding number of matches when compared to comparable random sets. The structure wavelengths appear to be adding in ionization states.
  The method does not solve for quantum levels, but looks for the source of the complex spectra using known spectra lines. The results show which wavelengths are most active in forming other wavelengths, the author believes these wavelengths may assist in driving and controlling LENR pulsing circuitry.

1. Introduction

The emission spectrum of a chemical element is the spectrum of frequencies of electromagnetic radiation emitted due to an atom's electrons making a transition from a high energy state to a lower energy state. The energy of the emitted photon is equal to the energy difference between the two states. There are many possible electron transitions for each atom, and each transition has a specific energy difference. The result of these many transitions make up the emission spectrum. Each element has its own unique atomic emission spectrum.

  Both the Balmer and Rydberg formulas can accurately predict where the lines of hydrogen spectrum should appear. These equations however fail to calculate the entire line spectrum of more complex heavier atoms.   There is a gap in the ability to predict heavier atoms spectra.

4101.74   4340.47   4861.33

6562.852

Photo 1. Hydrogen emission spectrum in Å (Angstroms)

The purpose of this work is to fill in gaps in the source of many atomic spectra lines. Presently atomic energy levels are calculated using energy level values. In order to calculate them it is necessary to convert wavelengths to frequencies then multiplied by Planck's constant, converting the wavelengths to frequencies, then to energy levels results in the correct energy levels. The Schrodinger wave equation calculates the energy levels but not the spectra wavelengths. Present methods cannot reproduce the entire set of the emission spectrum of complex atoms.

  The process shown herein revels many of the complex spectra are the result of the addition and or subtraction of wavelengths. The method is nearly the reverse or opposite of the process of Schrodinger wave equation. The Schrodinger equation solves for energy levels which then are matched to energy difference between two line spectra or a transition. The Schrodinger wave equation calculates the atomic structure but does not calculate the wavelengths of the spectra itself leaving many spectra lines unaccounted for.

  This paper reveals the source of the unaccounted line spectra by means of the existing line spectra wavelengths. The process discussed herein is as follows: The simple addition and subtraction of any two given numbers results in two answers. One resultant derived from addition and the other from subtraction. These two resultants can be used to look back to determine what their two source numbers were. In order to accomplish this, two equations #2 and #3 are derived from the simple addition and subtraction of two numbers.

  Not to be confused with frequency, the derived equations are labeled *F1* and *F2,* Fundamental 1, and Fundamental 2 respectively. The two equations 2 and 3 are applied to a computational evaluation to complex atomic spectra of the sulfur atom[1]. Using the derived equations, trial and error calculations are performed on spectra of sulfur. A sample set initially is employed to clarify exactly how the process will later be applied to actual emission line spectra.
The process appears to be similar to heterodyning except only frequencies can heterodyne (add and subtract). Here however the results clearly show proof of the addition and or subtraction of the spectra line wavelengths, not frequencies.

  The author want to make it clear these calculations do not result in energy levels or quantum jumps, instead, presents the possibility many spectra lines presently unaccounted for are the result of the addition and or subtraction of a given atoms spectral wavelengths. The procedure outlined here might be simplified by simple addition and subtraction except the source wavelengths would be unknown thus the extra steps shown herein are taken. The author's hypothesis on the process permitting wavelengths to 'add' or 'sum' will come in a future paper.

2. Derivation Exercise: Adding and Subtracting a 'Sample' Set of Numbers
This exercise is accomplished only to provide an example, later applied to actual spectra values. Four chosen numbers are picked: 3, 7, 13, and 60. 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. The number of Possibilities = N * N -1.

$$\lambda n = \lambda_1 \pm \lambda_2 \qquad\qquad (1)$$

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 the following table I. The complete set is shown below.

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

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

   A total of 16 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 16 numbers in a solve then trial and error search. The number 10 was generated twice but is not a concern.

3. Derivation of the Two Equations
Now assume we have no knowledge of what the original numbers were. But 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 16.   If some are missing we can still make some conclusions of what they might be.

Still working with the 'sample set' the following derives two equations which solve for the original numbers (7 & 3) when only the results from
$\lambda n = \lambda_1 \pm \lambda_2$ (4 & 10) are known.
Given two numbers as examples: 7 and 3 and inserting into the above equation results in the below two numbers.
        $7 \pm 3 = 4$ and 10

Subtracting 4 from 10 and dividing by 2 results in one of the original numbers
        $(10 - 4) / 2 = 3$ Answer

Take the above result (3) and subtract it from the higher number results in the other original number.
        $10 - 3 = 7$ Answer

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

$$F_1 = (\text{PickHi} - \text{PickLo}) / 2 \qquad\qquad (2)$$
$$\textit{and}$$
$$F_2 = \text{PickHi} - (\text{PickHi} - \text{PickLo}) / 2 \qquad\qquad (3)$$

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 (2 & 3) 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 ok but provides an eye opener later
when evaluating spectra.

Assuming we have no idea which numbers generated the full set and no order is known. If the complete set of 16 numbers are available the original numbers 3, 7, 13, and 60 can be located from the jumbled set using the two source equations (2 & 3) derived above. The trial and error procedure as follows untangles the set finding the original set of four numbers.

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 high and low and inserted into the F_1 and F_2 equations
   For example: 57 and 63 $F_1 = (63 - 57) / 2 = 3$ and $F_2 = 63 - (63-57) / 2 = 60$
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.

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 random generated sets provides a good proof to the validity of the concept.

5. Procedure Applied to the Atomic Line Spectra of Sulfur

The author employed a computer program[3] as an aid in 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 F_1, and F_2 equations. 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 under the 'Match' column. Further evaluation (not detailed here) can also be accomplished.

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

$$F_1 = (1316.618 - 437.4) / 2$$
$$F_1 = 439.609 \qquad \text{Result matches sulfur spectra 439.60 Angstroms.}$$

$$\text{Error} = 439.609 - 439.6 = .009$$

   The source for the sulfur spectra wavelengths is, the "CRC Handbook of Chemistry and Physics". [1] Shown in Table II are 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 tolerance of .01 Angstroms.   Sulfurs spectra exhibits 2.6 to 3.9 times more matches than random generated sets with similar limits. Sulfur exhibits an astonishing 56 results with a zero error (perfect matches) of a total of 88 matches. Comparable random generated sets only generate 0 to 1 matches with a zero error. The error average of random generated sets is approximately .005 when compared to sulfur .00092, 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 on this short table. The long table[2] designates these results as 'ADD' in the 'Equ.' column.*

Table II. Sulfur spectra calculation results. Ion levels I-V 252 Entries Range 83.4 to 10459 Å. Error Tolerance .01 Å.					
Cnt.	Match	PickLo	PickHi	Equ.	Error
1	83.400	520.100	686.900	F1	0.0000
2	439.600	437.400	1316.618	F1	0.0090
3	522.000	2665.400	3709.400	F1	0.0000
4	522.500	3117.700	4162.700	F1	0.0001
5	522.500	8694.700	9739.700	F1	0.0000
6	652.500	551.200	753.800	F2	0.0000
7	653.600	7930.300	9237.500	F1	0.0001
8	653.600	1201.000	2508.200	F1	0.0000
9	655.900	6384.900	7696.700	F1	0.0001
10	659.800	655.900	663.700	F2	0.0001
11	660.900	1077.100	2398.900	F1	-0.0001
12	660.900	438.200	883.600	F2	0.0000
13	661.400	1396.112	2718.900	F1	-0.0061
14	666.100	522.500	809.700	F2	0.0000
15	677.300	664.800	689.800	F2	0.0000
16	678.100	519.300	836.900	F2	0.0000
17	680.300	83.400	1277.216	F2	0.0080

18	680.900	4925.300	6287.100	F1	0.0001
19	686.900	680.300	693.500	F2	0.0000
20	691.700	1077.100	2460.500	F1	0.0000
21	693.500	1073.500	2460.500	F1	0.0000
22	738.500	680.300	796.700	F2	0.0000
23	786.500	666.100	906.900	F2	0.0000
24	786.500	8882.500	10455.500	F1	0.0000
25	789.000	693.500	884.500	F2	0.0000
26	796.700	902.800	2496.200	F1	-0.0001
27	796.700	1392.588	2986.000	F1	0.0060
28	798.300	3097.500	4694.100	F1	0.0001
29	804.000	1110.900	2718.900	F1	-0.0001
30	804.000	798.300	809.700	F2	0.0000
31	816.000	748.400	883.600	F2	0.0000
32	849.200	4120.800	5819.200	F1	0.0002
33	860.500	658.300	1062.700	F2	0.0000
34	883.600	902.800	2670.000	F1	0.0000
35	885.800	663.200	1108.400	F2	0.0001
36	902.800	693.500	2499.100	F1	0.0001
37	905.900	1305.883	3117.700	F1	0.0084
38	910.500	883.600	937.400	F2	0.0000
39	910.500	678.100	2499.100	F1	0.0001
40	912.700	824.900	1000.500	F2	0.0000
41	937.700	798.300	1077.100	F2	-0.0001
42	996.000	883.600	1108.400	F2	0.0000
43	1073.000	1014.400	1131.600	F2	0.0000
44	1073.000	522.000	1624.000	F2	0.0000
45	1077.100	693.500	2847.700	F1	0.0000
46	1102.300	1073.000	1131.600	F2	0.0000
47	1108.400	900.900	3117.700	F1	-0.0001
48	1131.000	6052.700	8314.700	F1	0.0000
49	1131.600	1234.100	3497.300	F1	0.0001
50	1131.600	439.600	2702.800	F1	0.0000
51	1234.100	660.900	1807.311	F2	0.0055
52	1250.500	1108.400	1392.588	F2	-0.0060
53	1250.500	1131.000	3632.000	F1	0.0000
54	1253.800	883.600	1624.000	F2	0.0000
55	1303.430	786.500	1820.343	F2	-0.0085
56	1388.435	1302.863	1473.995	F2	-0.0061
57	1624.000	654.000	3902.000	F1	0.0000
58	1629.200	750.200	2508.200	F2	0.0000
59	1820.343	522.000	4162.700	F1	0.0071
60	1826.245	789.000	2863.500	F2	0.0050
61	2387.000	1624.000	6398.000	F1	0.0000
62	2398.900	849.200	5647.000	F1	0.0000
63	2489.600	1073.500	6052.700	F1	0.0000

64	2489.600	836.900	4142.300	F2	-0.0002
65	2508.200	437.400	5453.800	F1	0.0000
66	2680.500	4332.700	9693.700	F1	0.0000
67	2680.500	664.800	4696.200	F2	0.0000
68	2680.500	691.700	6052.700	F1	0.0000
69	2691.800	902.800	6286.400	F1	0.0000
70	2691.800	1014.400	6398.000	F1	0.0000
71	2731.100	824.900	6287.100	F1	0.0000
72	2785.500	854.800	4716.200	F2	0.0000
73	2797.400	1473.995	4120.800	F2	-0.0024
74	2863.500	2741.000	2986.000	F2	0.0000
75	2904.300	3933.300	9741.900	F1	0.0002
76	2904.300	884.500	4924.100	F2	0.0000
77	3497.300	2741.000	4253.600	F2	0.0000
78	3632.000	1624.000	5640.000	F2	0.0000
79	3632.000	664.800	7928.800	F1	0.0000
80	3867.600	1914.698	9649.900	F1	0.0010
81	3928.600	1108.400	6748.800	F2	-0.0002
82	4142.300	2856.000	5428.600	F2	0.0000
83	4285.000	1102.300	9672.300	F1	0.0000
84	4694.100	693.500	8694.700	F2	0.0000
85	4694.100	1073.500	8314.700	F2	0.0000
86	5640.300	4993.500	6287.100	F2	0.0000
87	5706.100	3097.500	8314.700	F2	0.0000
88	6384.900	3097.500	9672.300	F2	0.0000

Error Average: 0.00092

   Note the multiple hits (matches that came from more than one pair). See Table II. (short table)
Line count: (3,4,5) (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 (including the two with three separate sources). Random sets[2]
display only 1-4 of these and none from three separate sources. **It is highly unlikely these
findings are coincidental.**   The results of other elements can be found on page 1 at
synodicgravity.com.

6. Application of Quantum-Mechanical Vibration Data to LENR
With proper due diligence this knowledge may assist in driving and controlling LENR cells. The
results show which wavelengths are most active in building other spectra wavelengths, the author
believes these most active frequencies may assist in driving and controlling LENR pulsing
circuitry. Preliminary application of data to LENR experiments (in a simplified manner) the
author suggests tuning the cell and accompanying components to harmonic frequencies of known
transitions. In the case of hydrogen choose a prominent spectra line such as 4861.33 Angstroms.
Since spectra frequencies are near the petahertz range the author suggests dividing the spectra
frequency by a suitable whole number. This frequency is then used to repeatedly pulse the cell
heater.

Converting Angstroms to frequency, the results for the 4861.33 hydrogen line are as follows:

$$f = c / \lambda$$
$$f = c / (4861.33 \text{ Å} / 10e{+}10) \quad f = 6.1669e{+}14 \text{ Hz.}$$

Where f = frequency, 1 meter = 10e+10 Angstroms, c = 299,792,458 meters per second, λ = wavelength.
To make the frequency useable for driving a LENR cell we must use a whole number divisor of 6.1669e+14: So dividing by 10e+8 = 616,690 Hz.

   Driver frequencies of elements within an LENR cell may combine or add in such a way as to match one or more absorption spectra wavelengths of the catalyst and or cell components. Pulsing ultrasonic or radio frequencies on and off while producing a repeating ringing and phase, of increasing frequency. Example is similar to sweeping a frequency generator from just below the calculated frequency to just above 616,400 to 617,000 Hz without digital stepping (analog only). The process is similar to pushing a person on a swing. The key is to carefully tune on the harmonics of one or more atomic wavelengths. A circuit that repeatedly rings up in frequency is suggested. A phase shift might be considered as well. Other methods for driving and controlling LENR may simply be amplifying the existing natural harmonics found within the cell. Here a pulsing on and off of in-phase amplification should increase the output while out of phase (wave cancellation) should reduce cell output.

7. Conclusion
As previously covered in the introduction, frequencies not wavelengths must be used to calculate atomic structure. Here however something unusual is occurring as here is evidence that spectra wavelengths are adding. The results show clear indication that simple addition and subtraction is creating many of the atomic spectra wavelengths. The importance of the large amount of computational results showing zero error within the sulfur spectra is overwhelming. When the tolerance is increased to .1 Angstroms all but five 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] are engaged. Comparable random sets[2] generate approx. 960 matches when tolerance is set at .25. Other elements checked thus far, helium, carbon and lead exhibit similar results.[2] Hydrogen requires harmonic divisors incorporated into the equations to complete the set of spectra 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[2]. There seems to be some significance why there are so many exclusions to the use of only one equation at a time. The author has further work with regards to the addition and subtraction of waves.[2] normally frequency difference (quantum transitions) not wavelengths are incorporated. All elements of all atomic weights complex spectra might be derived by incorporating both the Schrodinger wave equation and the addition of wavelengths shown here.
   Combining two elements such as hydrogen and nickel that share the same transition level as a harmonic match between each of the two elements is suggested. The results show which wavelengths are most active in forming other wavelengths, the author believes harmonics of

transitions based on these wavelengths may assist in driving and controlling LENR pulsing circuitry. The mechanism creating the addition of wavelengths will be covered in a future paper.

[1]   David R. Lide, CRC Handbook of Chemistry and Physics 1st Student Edition
        ISBN 0-8493-0740-6
[2]   http:\\synodicgravity.com   (pg. 1.)
[3]   Todd W. Grigsby, Rainbow computer program

About the Author
Todd Grigsby graduated in 1972 from PCC in mechanical engineering technology.
President Fourier Spectrum