Report on the Evaluation of Chapter 2 in "The Grand Unified Theory of Classical Physics" by Dr. Randell L. Mills

Prepared by

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Executive Summary

In my analysis, I conducted calculations on the Lamb shift, Knight shift, fine structure splitting (spin-orbit coupling), and spin flip transitions of hydrogen and muonium. I also replicated calculations found in Table 2.1 and Tables 2.3-2.18 in the book “The Grand Unified Theory of Classical Physics” by Dr. Randell L. Mills. In the course of these calculations, I replicated 90% of his results, to a very high degree of accuracy. There were some results that differed by a small amount, possibly due to rounding errors in my calculations or my use of different values of constants than Dr. Mills used. I was able to verify the muonium calculations since I did have a value for the magnetic moment of the muon (unlike my 2005 report where I did not have such a value available).

Purpose

The physics being modeled here are numerous. First, quantities associated with the ground and excited states for the hydrogen atom are calculated. This is a very important class of states to understand. Hydrogen is the simplest atomic system and is the most abundant element in the universe. It’s extremely important to understand the ground and excited states of hydrogen.

Next, the splitting of the energy levels due to the Stark Effect are calculated. This is where an applied external Electric field can split energy levels and remove the degeneracy of the energy levels of hydrogen.

Next, the Lamb Shift of hydrogen lines are calculated. As an emitted photon reacts with the atom it is emitted from, there is a small shift in the energy levels of the atom due to the recoil of the atom. This effect was first observed by Lamb in 1947.

Next the spin-orbit coupling effects are calculated. This is where the orbiting electron produces an internal magnetic field inside the atom and the spin of the electron then interacts with this internal magnetic field. This fine structure splitting can be observed in the lines emitted from the hydrogen atom.

The Knight Shift can also be calculated. This is the shift of the NMR frequency of a nucleus by an unpaired electron. Next the spin flip interaction between the spin of the nucleus and the spin of the electron can be calculated. The spin flip transition of hydrogen is at 21 cm wavelength and has been detected in our galaxy. It indicates cold, neutral hydrogen in our galaxy and is a marker used to denote the spiral arms of our Milky Way galaxy.

Also the spin flip transition of muonium can be calculated. Muonium is a hydrogen-like atomic system where an electron is bound to a positive muon. The muon here serves as the nucleus, replacing the proton nucleus of the hydrogen atom.

Calculation

In Table 2.1, I verified all of the values in the table exactly as CP predicted them. All of the values in the first six columns were verified from my calculations. The seventh column was a column of experimental values, which I did not attempt to verify. There was excellent agreement between the ionization energies predicted from CP for the ground and excited states of hydrogen and the experimental values of these ionization energies.

Table 2.3 is easily verified for the Stark Effect. Each energy level is split into (2n – 1) equally divided sub-levels. Hence, for n = 1, there are 2n-1 = 1 level. For n = 2, there are 2n-1 = 2(2)-1 = 3 levels. For n = 3, there are 2n-1 = 2(3)-1 = 5 levels. For n = 4, there are 2n-1=2(4)-1 = 7 levels. For n = 5, there are 2(5)-1=9 levels. And for n = 6, there are 2(6)-1=11 levels. This is verified by the entries in Table 2.3.

As for the energy splittings in Table 2.3, they come from the equation:

$E_{Stark} = m_l(3/2)(ena_o/Z)E_{applied} = m_l(n/Z)a$ where $a = (3/2)ea_oE$.

Here in Table 2.3, Z=1 for hydrogen. So all of the entries in the last column of Table 2.3 are given by m_l x n times a. Thus all of the values in the last column are verified by this simple equation. I get all of the values in Table 2.3 very easily. For example, for n=5, l=4, we have 2n-1 = 2(5)-1 = 9 values.

m_l	ΔE
4	4x5a = 20a
3	3x5a = 15a
2	2x5a = 10a
1	1x5a = 5a
0	0x5a = 0
-1	-1x5a = -5a
-2	-2x5a = -10a
-3	-3x5a = -15a
-4	-4x5a = -20a

I also verified all the entries in Tables 2.4-2.16. Tables 2.5-2.16 are calculated in Excel spreadsheet files and they will be attached to the email that contains this report. All of the values in these tables are found to be correct.

I've also verified that all the entries in Tables 2.17 and 2.18 are correct.

I verified the equations 2.1-2.6, 2.8-2.11, 2.16, 2.18-2.22, and 2.25.

I also verified the equations 2.66-2.68, 2.70, 2.72, 2.73, and 2.75-2.79.

I verified as correct the equations 2.83, 2.86, 2.91, 2.92, 2.100, and 2.101.

I verified as correct the values found in equations 2.108 and 2.110.

I verified equations 2.109, 2.112, and 2.113 as being correct.

I verified as correct the values found in equations 2.115 and 2.116.

In Box 2.1, I verified as correct the equations (1)-(3), (5), (6), (8), and (9).

I verified equations 2.122, 2.123, 2.126, 2.128, and 2.129 as being correct.

I verified as correct the equations 2.141-2.150, 2.151-2.154, 2.156, and 2.158-2.160.

I verified as correct the equations 2.169, 2.174-2.180, 2.188, 2.190-2.191, 2.194-2.196, and 2.202.

I verified as correct the equations 2.204, 2.205, 2.208, and 2.212-2.214.

I verified equations 2.217-2.226, 2.228-2.233, 2.235-2.242 as being correct.

I also verified as correct the equations 2.244 and 2.246-2.248.

Conclusion

I have successfully verified the CP results in very good agreement with my own calculations and algebra derivations. I was able to successfully verify all of the entries in Tables 2.1 and Tables 2.3-2.18.

Overall, I find this agreement between my calculations and the ones in the book to be confirmation that the calculations included in Chapter 2 are valid. Some of my results had some discrepancies from the CP values. However, this could be due to rounding errors or to differing values of constants used or maybe the number of decimal places I used for the constants involved in these equations on my part. Overall, the agreement between my calculations and the ones in the book are remarkably in agreement.