Report on the Evaluation
of Chapter 27
Aharonov-Bohm Effect
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 verified calculations and equations involving the Aharonov-Bohm Effect found in Chapter 27 of the book “The Grand Unified Theory of Classical Physics” (January 2020 edition) by Dr. Randell L. Mills. I verified equations and calculations to a high degree of accuracy that are associated with this effect. There is a remarkable agreement between the GUTCP calculated equations and the equations I get from my calculations. I verified all the equations from 27.1 through 27.13.

Purpose

In Chapter 27, the Aharonov-Bohm Effect is discussed. This is a quantum mechanical effect where a charged electron is affected by the magnetic vector potential **A** even though it is in a region where both the magnetic field B=0 and electric field E=0. Consider a charged electron moving in a circle around a long solenoid. Then it can experience a phase shift due to the magnetic vector potential **A,** even though B may be almost zero there.

The chapter considers the case where a magnetic field is applied so that the magnetic field lines are perpendicular to the plane of a current-carrying ring. The current-carrying electrons will actually lose energy due to the effect of the B-field on the current. Here, the magnetic field gives rise to a changing magnetic flux through the ring. And this changing magnetic flux gives rise to an Electric field that opposes the current in the ring, which reduces the current in the ring by causing a change in the resistance of the ring. A term called magnetoresistance is added to the resistance of the ring. This change in resistance is derived in Chapter 27.

Plus an additional oscillatory resistance term can arise due to the magnetoresistance and **A**. The system can be operated at a temperature, current, and applied B-field such that a resonance occurs between the magnetic vector potential **A** of the current-carrying electron and the flux of the applied B-field. It is shown in the chapter that this gives rise to an extra term in the resistance, which behaves as an oscillator. However, it is shown that each electron can only link flux in units of the magnetic flux quantum $\Phi_o = h/(2e)$.

The oscillatory term is derived in Chapter 27 and is added to the initial magnetoresistance to give the corresponding total magnetoresistance.

This type of contribution to the resistance that is an oscillatory function of the applied flux with a period of $\Phi_o = h/(2e)$ is known as the Aharonov-Bohm Effect.

The resistance change, including the oscillatory contribution derived in Chapter 27, is consistent with observed experimental behavior. See Figure 27.1 in the book. Since it is consistent with observed behavior, it describes this known behavior.

Calculations

I have verified that Equations 27.1-27.11 are true and correct.

I have verified that Equation 27.13 is also correct.

Conclusion

I was able to verify the GUTCP results of Chapter 27 in excellent agreement with my own calculations and derivations of equations. I successfully reproduced all of the equations and derivations found in Chapter 27. This chapter demonstrates that the GUTCP theory is successful at describing the Aharonov-Bohm Effect to a high degree of accuracy.

I find my results and calculations to be confirmation that the derivations and equations of Chapter 27 are indeed valid, reproducible, and accurate.