Report on the Evaluation of Chapter 25 Superconductivity 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 Fermi Energies, Superconductors, and Critical Temperatures T_C found in Chapter 25 Superconductivity 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 systems that exhibit zero electrical resistance when the systems are less than T_C, namely superconductors. There is a remarkable agreement between the GUTCP calculated equations and the equations I get from my calculations. I verified all the equations from 25.1 through 25.35. Plus I verified that all the equations in Box 25.1 were true, which were equations (1)-(38).

Purpose

In Chapter 25, it is stated that for a superconductor, an applied voltage polarizes the material into a superconducting current composed of magnetic dipoles. The magnetic field H(x,y,z) is found for this case.

In Box 25.1, the Fourier Transform of this function is derived. This procedure uses the Bessel Functions J and K, and is a rather technical derivation. As a result of this, the Fourier Transform $H[k_x,k_y,k_z]$ is found for a magnetic dipole oriented in the z-direction. Next, the special case of $k_p=k_z$ is investigated.

We know that Fermi-Dirac Statistics applies to electrons, and there are electron supercurrents in superconductors. So a formula for the Fermi Energy E_F for superconductors is derived. From this, an equation for T_C that depends on E_F is found. This formula can be used to derive T_C for three cases: electrons in 3-dimensions (f=3), electrons in 2-dimensions (f=2), and electrons confined to 1-dimension (f=1) in a superconductor.

Electron supercurrents confined to 2-dimensions are shown pictorially in Figure 25.2, A-F.

T_C for conventional 3-dimensional metallic superconductors is found from the theory, and agrees pretty close to the measured T_C for a real system, Nb_3Ge.

T_C for one, two, and three-dimensional ceramic oxide superconductors are also found from the theory. They agree pretty close to three real systems, namely Li_2TiO_3 (3-dimensions), BaLaCuO (2-dimensions), and TlCaBaCuO (1-dimension).

The chapter ends with a discussion of the Josephson Junction, Weak Link case. This introduces the magnetic flux quantum $\Phi o = h/(2e)$. Mills uses this opportunity to say that the 2e on the bottom doesn't indicate that electrons form Cooper pairs here, as erroneously stated in the BCS theory of superconductors.

Calculations

I have verified that Equations 25.1-25.4 are true.

In Box 25.1, I have verified that Equations (1)-(5), (8), (11)-(17), (20)-(21), and (23)-(38) are true and correct.

I have verified that Equations 25.5-25.7 are also correct.

I have verified that Equations 25.9-25.11 are correct as listed.

I have verified that Equations 25.13-25.27 are correct.

I have verified that Equations 25.29-25.35 are correct as listed.

I have verified as correct the first value of T_C on page 1433.

I have also verified as correct the next three values of T_C on page 1433.

Conclusion

I was able to verify the GUTCP results of Chapter 25 in excellent agreement with my own calculations and derivations of equations. I successfully reproduced all of the equations found in Chapter 25. In addition, I verified that all of the equations in Box 25.1 were correct. This chapter demonstrates that the GUTCP theory is successful at describing Fermi Energies and Critical Temperatures of Superconductors, to a high degree of accuracy.

I find my results and calculations to be confirmation that the derivations and equations of Chapter 25 are indeed reproducible, accurate, and valid.