Report on the Evaluation of Appendix I Non-Radiation Condition in "The Grand Unified Theory of Classical Physics" by Dr. Randell L. Mills

Prepared by

Randy A. Booker, Ph.D.
57 Azalea Drive
Weaverville, NC 28787
(828) 251-6269
Booker@unca.edu

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Executive Summary

In my analysis, I verified calculations and equations involving the Haus non-radiation condition found in Appendix I of the book "The Grand Unified Theory of Classical Physics" (January 2020 edition) by Dr. Randell L. Mills. That is, excited states can radiate since the Fourier transform of their charge distribution contains components that are synchronous with waves traveling at the speed of light. However, non-radiative states also exist in the Hydrogen Atom, namely the ground state and the hydrino states below the ground state. They don't radiate since their charge distribution Fourier transforms don't contain components that are synchronous with waves traveling at the speed of light.

There is a remarkable agreement between the equations found in the chapter and the equations I get from my calculations. I verified that all the equations found in the chapter from Equation (1) through Equation (88) were in fact true.

Purpose

Appendix I starts by stating the condition for radiation by a moving point charge that is given by Haus: Radiation occurs when a charge distribution's spacetime Fourier transform does possess components that are synchronous with waves traveling at the speed of light.

The converse of this condition is the Condition for Non-Radiation: An ensemble of moving charges that comprise a charge-density function DOES NOT RADIATE if its spacetime Fourier transform does NOT possess components that are synchronous with waves traveling at the speed of light.

The derivation of the condition for non-radiation is presented in this Appendix. $G_1^1(s,\Theta)$ and $H_1^1(s,\Theta,\Phi)$ are found, where the former is the space Fourier transform of $g(\theta)=\sin\theta$ and the latter is the Hankel transform, i.e. the space Fourier transform of $h(\phi)=\sin\phi$. The spherical harmonics are introduced next, giving $G_l^{m_l}(s,\Theta)$ and $H_l^{m_l}(s,\Theta,\Phi)$.

Next, the non-radiation condition based on electromagnetic fields and the Poynting Power Vector is discussed in this Appendix. Although an accelerated <u>point</u> charge radiates, an <u>extended distribution</u> of accelerating charges doesn't have to radiate. It's possible to create destructive interference or nodes in all directions, which can also be seen in phased array antenna design. In the electromagnetic far field, the electron satisfies the non-radiation condition, in such a case. For the non-radiative n=1, l=0 ground state of atomic hydrogen, there is a centripetal acceleration of the atomic orbital without radiation. A static charge distribution exists even though each point on the surface of the atomic orbital is accelerating in a circle. Haus' condition predicts no radiation in this case. And the same result is predicted from consideration of the Electric and Magnetic fields and the radiated power, which turn out to be just the familiar electrostatic and magnetostatic cases, leading to no radiation.

In cases of orbitals of heavier elements and excited states of one electron-atoms, the constant spin function is modulated by a time and spherical harmonic function. This modulation corresponds to an orbital angular momentum in addition to a spin angular momentum, in states referred to as p,d,f,etc. orbitals – the ones that correspond to an l quantum number not equal to zero. In the case where the excited state comes about due to photon absorption, it is radiative due to a radial dipole term in its current-density function as a result of spacetime Fourier transform components that are synchronous with waves traveling at the speed of light.

Furthermore, the non-radiation condition can be derived based on Maxwell's Equations, as the remainder of this Appendix shows. Figure AI.1 shows a diagram of the general spherical coordinates in the far-field approximation used in this analysis. The coefficients $a_E(l,m)$ and $a_M(l,m)$ are found, giving the amounts of Electric and Magnetic multipole fields, based on Maxwell's Equations. Next the far field Electric and Magnetic fields are found and applied to the power density given by the Poynting power vector P(t). a_M is focused on in particular and its equation is derived. Applying certain conditions to a_M that are reasonable, it is shown that $a_M=0$, and so the time-averaged power radiated per solid angle $dP(l,m)/d\Omega$ is also equal to zero. And so there is no radiation, based on electromagnetism and Maxwell's Equations.

Calculations

I have verified that Equation (1) is correct.

I have also verified that Equations (3)-(9) are correct.

I have shown that Equations (11)-(22) are correct.

I have shown that Equations (25)-(29) are correct as written.

Next, I have verified that Equations (33)-(44) are right.

Likewise, I have shown that Equations (46)-(47) are correct, as well as Equations (49)-(60).

Equations (62)-(69) have also been shown to be correct.

I have shown that Equations (70)-(78) are correct.

And I have shown that Equations (79)-(88) are correct as written.

Conclusion

I was able to verify the results of Appendix I in excellent agreement with my own calculations and derivations of equations. I successfully reproduced all of the equations, derivations, and calculations found in Appendix I, up through Equation (88). This appendix concerned itself with the Haus non-radiation condition. That is, excited states can radiate since the Fourier transform of their charge distribution contains components that are synchronous with waves traveling at the speed of light. However, non-radiative states also exist in the Hydrogen Atom, namely the ground state and the hydrino states below the ground state. They don’t radiate since their charge distribution Fourier transforms don’t contain components that are synchronous with waves traveling at the speed of light.

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