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**Authors:** Mark Titleman[]
**Affiliations:** [1]
**Orcid ids:** 0009-0004-6270-1387[]
**Contact e-mail:** marktitleman@hotmail.com

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# An Explanation for Expansion of the Universe from Whittaker Potential Theory

Mark Titleman

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A recent article found that black holes with posited vacuum energy interior solutions alongside cosmological boundaries have a cosmological coupling constant of k=3, meaning that black holes gain mass proportional to a3 in a parameterization equation within a Robertson-Walker cosmology – thus making black holes a cosmological dark energy species (Farrah et al. 2023). The mechanism for this is unknown. Two papers by E. T. Whittaker in 1903 and 1904 showed that all force potential could be understood as resulting from standing waves (static non-local solution) and propagating waves (local solution changing in time). This unification of gravitational and electromagnetic potential has been neglected even though it opens up new mathematical avenues and physical features. The mass-proportionality and preferred direction of the longitudinal waves within the two underlying Whittaker potentials can explain many features of General Relativity (Titleman 2022). They also offer a simple Newtonian explanation for expansion of the universe stemming from Whittaker potential theory – it is produced as longitudinal motion within the Whittaker potentials only when dynamic electromagnetism is separate from time-static gravity in intergalactic space.

## 1 Introduction

The classic papers of E. T. Whittaker in 1903 and 1904 provided a general harmonic solution to the wave equation and Laplace equation in three dimensions, showing that both potentials could be analyzed into simple plane waves. Even though no action could be set up, it was important work that foresaw the Aharonov-Bohm effect and could be used to replace Dirac spinors in the Dirac equation (Ruse 1937). This "undulatory theory" could also explain several features of General Relativity. For example, gravitational lensing can be understood as resulting from the preferred direction of the potentials and their mass-proportionality (Titleman 2022). More specifically, a more massive observer would experience more longitudinal waves than only the two experienced by an observer as an electromagnetic wave, yet when observed at the speed of light the number of longitudinal waves would collapse into the orthogonal axis (non-local y-axis). This results from the fact that Whittaker's analysis shows gravity and electromagnetism to be orthogonal aspects of potential. This analysis of the wave equation is also physically less arbitrary than the standard approach. The reduction of six degrees of freedom to two degrees of freedom provides a purely physical reason for the preferred directionality of waves and their neutrality.

# 2 A New Explanation for Expansion of the Universe

The new nature of the x, y, z axes permits each to be assigned a free parameter: longitudinal motion or speed in the z is charge-proportional from the perspective of the observer (compressible potentials), number of longitudinal waves is mass-proportional from the perspective of the observer and folds into the y-axis (static) when observed at high speed, and the x-axis or plane wave axis is related to amplitude, intensity, and soliton radius.

Due to the dynamic longitudinal motion in the z-axis being additive, Whittaker's potential theory provides a Newtonian explanation for expansion of the universe - it is merely dynamic light decoupled from static gravity and can only be produced intergalactically. If this is the case, there would be an inverse relation between amplitude, the changing background intensity of the universe, and expansion of the universe. Since the intensity of the universe is double that of all predicted stars (Lauer et al., 2022), the relation would be on the order of 3/2.

$$\sqrt{\frac{\Delta I_v}{2}} = \frac{Expansion\ (yz\ plane)}{3} \tag{1}$$

The cosmological constant in the context of spacetime can potentially be found by implicating luminosity in (1). The 3 is the result of the new interpretation of three dimensions or three axes afforded by Whittaker's undulatory theory. Longitudinal waves are additive in two directions – phase and antiphase z-directions. It is conjectured that black holes produce these longitudinal waves as scalar potentials, providing cosmological coupling, a third additive "direction" (y), another dynamic component, an important center for the scalar potentials, and a new understanding of waves as vorticity at the interface of plane and spherical rotations. This understanding replaces black hole singularities with vacuum energy interior solutions within a Robertson-Walker cosmology.

# 3 A Relation to MOND?

If black holes produce longitudinal waves as scalar potentials, it is via beam splitting within scalar interferometry. This reduces the four degrees of freedom inherent to Whittaker's general solution of the Laplace equation (x,y,z, non-local y or i) to the two local degrees of freedom inherent to Whittaker's general solution of the wave equation. This halving can also be understood in statistical terms as the potential for normality. Notably, critical density is traditionally arrived at by adjusting the Hubble parameter. This theory implies that black holes keep absolute time as a simple geometry and that statistics and ultimately probability are primordial. Indeed, the scale factor of the universe is the inverse mathematical and physical operation of equation (1).

$$a(t) = (\frac{t_{\frac{1}{2}}}{t})^{\frac{2}{3}} \tag{2}$$

The average kinetic energy of the cosmic microwave background is measurable in terms of "half-time" $kb\Delta T$ and could be related to a non-local force applied on galaxies - the Whittaker potential force - towards the computation of the MOND acceleration constant (Titleman 2020). It is possible that the fine structure constant is adjustable along the lines of the Tully-Fischer relation according to galactic brightness, shape and gravity.

Additionally, this theory can explain the relation of the MOND acceleration constant to the Hubble constant or dark energy understood as an energy density.

$$a_0 = \sqrt{\frac{\Lambda}{3}} \tag{3}$$

According to the new understanding of the three axes, the mass-proportional, static gravitational y-axis is related to the charge-proportional, dynamic electromagnetic z-axis by squaring. Two directions of dynamism are in the z, but one source of dynamism (black hole growth) is in all directions locally. Time-static gravity is only in the mass-proportional and thus limited-range observed y-axis. The potentials are non-local in most senses. As such, the dynamism at the interface of the cosmologically coupled z-axis and observed y-axis are related by squaring only within the limited range of nearby matter. Outside of this limited range there is simply expansion of the universe. Squaring must also be used for the cosmological constant in the context of spacetime – where the interface between dynamic z-axis and static y-axis is constantly implied. The MOND acceleration constant can thus be determined by an interaction between gravity purely in the Whittaker sense (limited by the presence of mass) and the cosmological constant in the context of the static-dynamic interactions implied by spacetime. The external field effect is the result of these interactions in conjunction with black hole cosmological coupling.

# 4 Conclusion

This understanding of Whittaker's analytical papers in classical physics can provide a new understanding of expansion as simply purely dynamic longitudinal motion decoupled from static gravity. There would be a relation between expansion in some sense and either intensity or luminosity. This may also explain the relation between the cosmological constant in the context of spacetime and the MOND acceleration constant.

Ultimately, the gauge used by Whittaker in his 1904 paper to reduce the standard electromagnetic potentials to only two scalar potentials was oversimplified. It can be expanded through advances in computation and the Wick rotation which already links statistical mechanics to quantum mechanics and 4d Euclidean space to spacetime. Reactive probability, statistical mechanics and information (ternary) are of central importance. A language of Clifford algebra or the geometry of a Clifford torus (with luminosity and a black hole network phase space) can be developed.

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