A Fluid Dynamics Approach to Cosmology Incorporating a Unified Theory of Acoustics and Electromagnetic Radiation*

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The present paper is a revised and shortened version of that presented to the Seventh International Congress on Sound and Vibration held in Garmisch-Partenkirchen, Germany. It presents speculative and controversial ideas on a possible fluid mechanics model for 'dark matter' in the Universe and the impact it would have on the established theory of light propagation and its relation to sound propagation. Since 'dark matter' has escaped all observations on Earth it must be assumed that should it be a particulate its particle mass and size will be almost infinitesimal compared with all existing atomic and subatomic matter. Thus, its thermodynamic properties of mean particle speed and wave propagation speed will approach that of light, and therefore provide the medium for the propagation of electromagnetic radiation. The model satisfies the 'Principle of Relativity' and the classical theories of fluid mechanics, gas dynamics, and thermodynamics, and reopens discussion on the hypotheses introduced by Einstein concerning laws of nature, the propagation of wave motion in a void, and the absolute speed of light. The presence of this form of 'dark matter' is shown to unify the theories of sound and light propagation even though their speeds of wave propagation differ by an order of a million times. Hence both disciplines obey the laws of space-time for they are solutions of the same homogeneous 'unique' wave equation, and the corresponding convected wave equation for the case of moving sources. These equations satisfy covariant and coordinate invariance and are therefore laws of nature for all speed ratios. When this model of 'dark matter' is applied to cosmology, it provides a model for the expanding Universe. The results of electromagnetic and acoustic wave motion generated by bodies and electric charges in motion, for the same speed ratio with respect to wave propagation speed, are found, as expected, to be similar to the propagation of capillary waves in a ripple tank.

* This article contains some ideas that may be controversial in nature. It is being published in the interest of giving these ideas more exposure and promoting further discussion on this subject. These ideas are the author's and not necessarily those of IJAV. The author's original article was reviewed by three referees. The author has responded to the reviewers' comments in preparing the revised version of the article published here. IJAV Editor-in-Chief.

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1. INTRODUCTION

My investigation into the wave characteristics of electromagnetic and acoustic radiation commenced with the familiar statement that for all practical purposes light, together with all electromagnetic radiation, unlike sound, propagates in a void. It is known that sound propagation arises from a disturbance to the thermal equilibrium of ordinary molecular and atomic matter, whereas the structure of ordinary matter is almost transparent to electromagnetic radiation. This results from the enormous difference between the propagation speeds of sound and light and the resulting differences in their wavelengths for a given frequency. The void, by definition, means space devoid of all matter. Since observers on Earth are able to see distant stars and galaxies from which radiation has travelled billions of kilometres and over time intervals of the order of the age of the Universe, it is compelling to argue that between Earth and distant stars and galaxies this intergalactic space is almost a void through which electromagnetic radiation propagates at the constant speed of light. Indeed these two assumptions formed the basis for the two hypotheses that Einstein[1,2] introduced, a hundred years ago, on which to build his theories of Special and General Relativity, and on which all modern physics is based.

From a study of Einstein's work, we learn that these assumptions were not accepted without considerable debate, with respect to both the theoretical and experimental implications, since they were in conflict with the recognised view held by all scientists that the Universe contained a massless ether which could support action at a distance, as required by Newton in his work on gravitation, and the propagation of electromagnetic waves, as required by Maxwell.[3] Indeed Einstein recognised that although powerful arguments existed for the nonexistence of an ether, he was convinced some form of nonphysical ether existed in a void. A modern view, as expressed by Pismen,[4] is 'After being abolished by modern physics, the ether has been incarnated in post-modernity as the field theoretical vacuum, which far from being void, is envisaged as a non-linear medium of a complex, and as yet unknown, nature. The structure of the vacuum may hold the key to the structure of both the elementary particles and the universe as a whole.'

Figure 1 shows the visible matter in the early Universe. The conjecture is that the space between the galaxies is rarefied matter, including 'dark matter'. This, I believe, reopens the discussion on the presence throughout space of a very rarefied, but not necessarily uniform, medium, which in the past was thought of as the 'ether'. However, that was massless, whereas here we refer to 'dark matter', which not only