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# Ether is alive! New derivation of the cosmological constant

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General theory of relativity (GR) can be regarded as a phenomenological theory because there are no mediums in GR. Einstein's equations is a basic assumption in GR. Many attempts to reconcile the theory of general relativity and quantum mechanics by using the techniques in quantum electrodynamics failed. Therefore, it seems that new considerations on the ether theories of gravitation is needed. Since Newton's law of gravitation was published in 1687, this action-at-a-distance theory was criticized by the French Cartesian. Sir I. Newton pointed out that his inverse-square law of gravitation did not touch on the mechanism of gravitation. He tried to obtain a derivation of his law based on Descartes' scientific research program. At last, he proved that Descartes' vortex ether hypothesis could not explain celestial motions properly. Newton himself even suggested an explanation of gravity based on the action of an etherial medium pervading the space. In the years 1905-1916, Einstein abandoned the concepts of ether. However, H. A. Lorentz believed that GR could be reconciled with the concept of an ether at rest and wrote a letter to A. Einstein. Einstein changed his view later and introduced his new concept of ether. In order to compare fluid motions with electric fields, J. C. Maxwell introduced an analogy between source or sink flows and electric charges. B. Riemann speculates that that space is filled with a substance which continually flows into ponderable atoms, and vanishes there from the world of phenomena, the corporeal world. H. Poincaré also suggests that matters may be holes in fluidic ether. A. Einstein and L. Infeld think that what impresses our senses as matter is really a great concentration of energy into a comparatively small space. They regard matter as the regions in space where the field is extremely strong. We suppose that the universe may be filled with a kind of fluid which may be called the $\Omega(0)$ substratum, or we say the gravitational ether. Particles are modeled as sink flows in the $\Omega(0)$ substratum. Thus, Newton's inverse-square law of gravitation is derived by methods of hydrodynamics based on a sink flow model of particles. Generalized Einstein's equations in Fock coordinate systems are derived. If the field is weak and the reference frame is quasi-inertial, these generalized Einstein's equations reduce to Einstein's equations. For convenience, we may call these theories as the theory of vacuum mechanics (VM). The Einstein's equations are rigorous in GR. In VM, however, they are only valid approximately under three conditions. Another feature of VM is that the gravitational constant and masses of particles are variable with time and position in space. In 1990-1999 two groups discovered the cosmic vacuum, or dark energy, by studying remote supernova explosions. They discovered that some high redshift supernovae appeared fainter and thus more distant than they should be in a gravitationally decelerating universe. This discovery gives the first indication that the universe is accelerating. A possible explanation is that vacuum may contain some kind of ethers which behave like Einstein's antigravity cosmological constant. Lord Kelvin believed that the electromagnetic ether must also generate gravity. Presently, we have no methods to determine the density of the electromagnetic ether, or we say the $\Omega(1)$ substratum. Thus, we also suppose that vacuum is filled with another kind of continuously distributed substance, which may be called the $\Omega(2)$ substratum. Thus, the cosmological constant is calculated theoretically. The predicted cosmological constant $\Lambda_{\rm the} = 1.093(65) \times 10^{-52}{\rm m}^{-2}$ is consistent with the observational value of the cosmological constant $\Lambda_{\rm obs} = 1.088(30) \times 10^{-52}{\rm m}^{-2}$. The $\Omega(1)$ and $\Omega(2)$ substrata may be a possible candidate of the dark energy. According to VM, only those energy-momentum tensors of sinks in the $\Omega(0)$ substratum are permitted to act as the source terms in the generalized Einstein's equations. Thus, the zero-point energy of electromagnetic fields is not qualified for a source term in the generalized Einstein's equations.

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