GR equation for gravitational-capillary waves of deep water

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Abstract: The equation of gravitational-capillary waves of deep water can be represented in form of Einstein field equation in general theory of relativity. In this case, waves with a minimum speed on surface of water will be a physical model of gravitational waves with the speed of light.

Introduction

Attempts to estimate the speed of gravitational waves are much more than to measure. I am impressed by the estimates in which gravitational waves are some surface waves with dispersion, such as capillary or Rayleigh waves on surface of the water. Such waves as a special form of thermal motion were considered by Jacob Frenkel [1]. He was one of the first to look at the nucleus of an atom as a drop and describe its decay in terms of a capillary phenomenon.

If the model of surface phenomena turned out to be useful on a nuclear scale that is one and a half dozen orders of magnitude away from ours, then why not work the other way — why not look at our bright baryon world as a film on the surface of the dark world. Then, by analogy with water, the velocity spectrum of surface gravitational waves will fit in the interval from 1*c to n*c, where n ~ 10^4. For water, at least this is the case - from 0.23 m/s to 1,500 m/s. The given assessment is based on similarity of analogies.

Model

The equation for speed of gravitational-capillary waves of deep water has the form:

$$u_w := \sqrt{\frac{g}{\kappa} + \frac{\sigma_w}{\rho_w}\cdot\kappa} \qquad (1) \qquad\qquad u_w = 0.231\ \frac{m}{s}$$

The minimum speed of gravitational-capillary waves of deep water u_w = 0.231 m/s at 20°C and atmospheric pressure is obtained using the following parameters:

$$\sigma_w := 0.073\,\frac{N}{m} \qquad \lambda_w := 1.73\text{cm} \qquad \kappa := \frac{2\cdot\pi}{\lambda_w} \qquad \kappa = 363.19\ \frac{1}{m} \qquad \rho_w := 0.998\,\frac{gm}{cm^3}$$

Equation (1) can be converted to the form of the Einstein field equation in the general theory of relativity (2).

$$G_{\mu\nu} := \kappa \qquad \Lambda := \frac{g\cdot\rho_w}{\kappa} \qquad g_{\mu\nu} := \frac{1}{\sigma_w} \qquad T_{\mu\nu} := \sigma_w$$

$$G_{\mu\nu} = 363.19\ \frac{1}{m} \qquad \Lambda = 26.947\ \text{Pa} \qquad g_{\mu\nu} = 13.699\,\frac{m}{N} \qquad T_{\mu\nu} = 0.073\,\text{Pa}\cdot\text{m}$$

$$z := \left(\frac{1}{\kappa\cdot\lambda_w}\right)\cdot\left(\frac{u_w^{\,2}}{\sigma_w}\right)\cdot\left(\frac{m_{ear}}{r_{ear}^{\,2}}\right) \qquad z = 1.718\times10^{10}$$

Correction factor

$$m_{ear} = 5.972\times10^{24}\ \text{kg}$$

$$r_{ear} = 6.371\times10^{3}\,\text{km}$$

$$G_{\mu\nu} + \Lambda\cdot g_{\mu\nu} = z\cdot\frac{8\cdot\pi\cdot G_N}{u_w^{\,4}}\cdot T_{\mu\nu} \qquad (2) \qquad\qquad G_N = 6.674\times10^{-11}\ \frac{m^3}{kg\cdot s^2}$$

$$G_{\mu\nu} + \Lambda\cdot g_{\mu\nu} = 732.333\ \frac{1}{m} \qquad z\cdot\frac{8\cdot\pi\cdot G_N}{u_w^{\,4}}\cdot T_{\mu\nu} = 733.268\ \frac{1}{m}$$

References

[1]. Frenkel, Y.I. (1975) Kinetic Theory of Liquids. Nauka, Leningrad.(VI. Surface and Allied Phenomena) https://archive.org/details/in.ernet.dli.2015.53485/page/n5