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A novel approach to gravitation from fluid theory: Titius-Bode structures, flat rotation rate of galaxies, and other predictions

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Abstract. Following the discovery of quantum phenomena at laboratory scale (Couder & Fort 2006), de Broglie pilot wave theory (De Broglie 1962) has been revived under a hydrodynamic guise (Bush 2015). Theoretically, it boils down to solving the transport equations for the energy and linear momentum densities of a postulated fundamental fluid in terms of classical wave equations, which inherently are Lorentz-invariant and scale-invariant. Instead of the conventional harmonic solutions, for astronomical and gravitational problems the novel solutions for the homogeneous wave equation in spherical coordinates are more suitable (Munera *et al.* 1995, Munera & Guzman 1997, and Munera 2000). Two groups of solutions are particularly relevant: (a) The inherently-quantized helicoidal solutions that may be applicable to describe spiral galaxies, and (b) The non-harmonic solutions with time (t) and distance (r) entangled in the single variable $q = Ct/r$ (C is the two-way local electromagnetic speed). When these functions are plotted against $1/q$ they manifestly depict quantum effects in the near field, and Newtonian-like gravity in the far-field. The near-field predicts quantized effects similar to ring structures and to Titius-Bode structures, both in our own solar system and in exoplanets, the correlation between predicted and observed structures being typically larger than 99 per cent. In the far-field, some non-harmonic functions have a rate of decrement with distance slower than inverse-square thus explaining the flat rotation rate of galaxies. Additional implications for Trojan orbits, and quantized effects in photon deflection were also noted.

Keywords. Dark energy, dark matter, galaxies: spiral, gravitation, hydrodynamics, large-scale structure of universe, minor planets, asteroids: general, planetary systems, relativistic processes

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