A spatially-VSL scalar gravity model with 1-PN limit of GRT

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Abstract

A scalar gravity model is developed according the *geometric conventionalist* approach introduced by Poincaré (Einstein 1921, Poincaré 1905, Reichenbach 1957, Grünbaum 1973). In principle this approach allows an alternative interpretation and formulation of General Relativity Theory (GRT), with distinct i) physical congruence standard, and ii) gravitation dynamics according Hamilton-Lagrange mechanics, while iii) retaining empirical indistinguishability with GRT. In this scalar model the congruence standards have been expressed as gravitationally modified Lorentz Transformations (GMLT), due the introduction of isotropic scaling functions $\Phi(\mathbf{r})^n$, $0 \leq \Phi(\mathbf{r}) \leq 1$, with power n depending on the considered physical quantity (Broekaert 2002). The first type of these transformations relate quantities observed by gravitationally *affected* (natural geometry) and *unaffected* (coordinate geometry) observers and explicitly reveal a spatially variable speed of light (VSL). The second type shunts the unaffected perspective and relates affected observers, recovering i) the invariance of the locally observed velocity of light, and ii) the local Minkowski metric (Broekaert, 2003). In the case of a static gravitation field the model retrieves the phenomenology implied by the Schwarzschild metric. The case with proper source kinematics is described by introduction of a *sweep velocity* field $\mathbf{w}$: the model then provides a hamiltonian description for particles and photons in full accordance with the first Post-Newtonian (1-PN) approximation of GRT (Weinberg, 1972, Will 1993). This requires the implementation of Poincaré's Principle of Relativity, *i.e.* the unobservability of 'preferred' frame movement (Poincaré 1902, Keswani 1964, Sjodin1980, Ivert & Sjodin 1980). This principle fixes the amplitude of the sweep velocity field of the dynamic source (or the 'vector potential' ζ, (Weinberg 1972)), and subsequently renders numerically exact the 1-PN limit of GRT. In spite of the 1-PN equivalence with GRT, the model does not satisfy the Weak Equivalence Principle in the gravitationally affected perspective. A critique of the model is made concerning its present scope, *i.e.* weak field GRT. Its merits in terms of Lorentz-Poincaré-type intuitive interpretation are explained (e.g. for 'frame dragging', 'harmonic coordinate condition').

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