the general science journal

On the Multiple Interpretations of Gravity

Petr Křen © 2012
pkren@cmi.cz

The Whitehead's field/potential interpretation (PT) of gravitation (Whitehead, 1922) uses the Liénard-Wiechert retarded potentials (as a transformation of particle sources via the wave equation) and the "classical" flat space (Minkowski metric *G*). The equation for the Whitehead's potential mass impetus tensor *J* is

$$dJ^2 = dG_m^2 - \frac{2}{c^2}\sum_M \psi_M^- dG_M^2$$

where retarded potentials of sources *M* are given by

$$\psi_M^- = \frac{\gamma M}{w_M^-}$$

where w_M^- are retarded Lorentz-invariant distances between masses *m* (test mass) and *M* (and corresponds to classical distances r_M). This solution (approximated using r_M) is equivalent to the Schwarzschild geometric interpretation (Eddington, 1924) using the (correct) following transformation

$$t_1 = t + \frac{2\gamma M}{c^3}\ln\left(r - \frac{2\gamma M}{c^2}\right) \qquad dt_1 = dt + \frac{2\gamma M}{rc^2 - 2\gamma M}\frac{dr}{c}$$

(corresponding to the Shapiro time delay) and for a static point mass we will obtain the same solution as the general theory of relativity (GTR). Thus the Whitehead's theory predicts effects tested by measurements of the perihelion shift, the light bending, the Shapiro time delay and the gravitational red shift. A factor 2 for summed potentials is chosen for a correspondence with the Newton's law of gravitation (this derivation is available in [1]). Nevertheless we can introduce two kinds of potential (now each with a factor 1) due to the symmetry reasons and the need of converging waves [2] (like in the Wheeler–Feynman absorber theory). A violation of conservation (non-zero PPN parameters zeta in the parameterized post-Newtonian formalism correspond to the lunar acceleration and binary acceleration) of the angular/linear momentum (Schild, 1956) is now corrected – resulting in a zero secular acceleration for this combined potential (Schild, 1963). The new term in a following equation for a modified Whitehead's tensor

$$dJ^2 = dG_m^2 - \frac{1}{c^2}\sum_M \psi_M^- dG_M^2 - \frac{1}{c^2}\sum_M \psi_M^+ dG_M^2$$

corresponds to advanced potentials. This combination of retarded and advanced solution also leads to the Schwarzschild solution (which is symmetric in time). However the gravitational dipole radiation effect of Whitehead's solution in a timing of binary pulsars (with opposite sign for an energy loss of advanced solution [3]) is now canceled out in the 1.5PN order (and the theory agrees with observation). Nevertheless the N-body problem is difficult in both theories (GTR and PT) and the two-body problem is solved in an approximation.
The Synge's reformulation of Whitehead's theory (Synge, 1952) introduces additional assumptions and adds a transformation between covariant and contravariant form (while it should be 1 in a value for the Euclidean space interpretation). This is used to disprove PT by a galaxy-induced anisotropy in the local gravitational constant (Will, 1971) and by the Nordtvedt effect (the gravitational self-energy characterized by the PPN parameter eta). However the retardation and the Lorentz factor can not be applied together (as well as Whitehead did it within w_M^- instead of using only a retarded distance r_M^- as it is done in [4] without the "length contraction" ansatz), because the gamma factor (which can not be generally used in simple form for an accelerated source) is already based on retardation (see both - electromagnetic "retarded potential" and "contracted potential" in for example [5]) and thus it can not be used twice (It can not be mixed.). Thus Whitehead's (linear) theory for potentials (without Lorentz-invariant distances)

$$\psi_M^- = \frac{\gamma M}{r_M^-} \text{ and } \psi_M^+ = \frac{\gamma M}{r_M^+}$$

still corresponds to the relativistic Schwarzschild solution and now it does not produce the "Whitehead" potential (and with PPN parameter xi equal zero, the theory agrees in all PPN parameters with GTR) if only the non-instantaneousness of interaction is taken into account (without need of a deformation of space-time).
Nevertheless PT has not the coordinate singularity as GTR has it for the "black hole" with its paradox that not only the electromagnetic field (light) can not (massively) escape from this object but also the gravitational field for attracting of anything outside. However the original Schwarzschild metric (also) begins its radial coordinate at the Schwarzschild radius and thus the problem is only in "existence" (introduction) of singularities and not in GTR.
It must be also noted that gravity may not be a fundamental force (see for the gravity-electric interaction ratio in [6]) and thus any fundamental property can not be attributed to it. Our physical interpretations (a choice of mathematical approach) - source (position, algebra), field (potential, analysis), metric (curvature, geometry) – depend on our believe (Branches of physics are incompatible due to different formalisms.) and they do not exist (They are not real - non-mathematical terms can not be quantified (measured) and thus they are unprovable.).

[1] R. Desmet: Whitehead's Interpretation of Einstein's General Theory of Relativity, 2007, http://www.phil-inst.hu/~szekely/PIRT_Budapest/ft/Desmet_ft.pdf
[2] P. Křen: The (Non-)Mixing of Theories and Time Flow, 2010-2011, www.gsjournal.net/old/eeuro/kren11.pdf
[3] G. Gibbons, C. M. Will: On the Multiple Deaths of Whitehead's Theory of Gravity, 2006, http://arxiv.org/pdf/gr-qc/0611006v1.pdf
[4] J. H. Field, Retarded electric and magnetic fields of a moving charge: Feynman's derivation of Liénard-Wiechert potentials revisited, 2008, http://arxiv.org/pdf/0704.1574v2.pdf
[5] H. de Vries, Understanding Relativistic Quantum Field Theory, Chapter 2 Lorentz contraction from the classical wave equation, 2008, http://physics-quest.org/Book_Chapter_EM_LorentzContr.pdf
[6] P. Křen: The Source, the Field or the Metric? (Part II), 2009, www.gsjournal.net/old/science/kren10.pdf