REVISED SCHWARZSCHILD SOLUTION TO ACCOMMODATE SPACE-TIME EXPANSION

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Our inability to detect dark matter in the laboratory increasingly highlights the need for a deeper theory of gravity to explain and model spiral galaxy rotation flattening and other anomalous astrophysical phenomena. From Mordehai Milgrom's "Deep MOND" correlation of measured spiral galaxy rotational flattening we know that far-field gravitation must decline inversely with radius. This would require a logarithmic gravitational potential, which does not emerge within orthodox theory. However, the required inverse-r dependence is given by a new candidate theory that is closely associated with the field equations of general relativity but has a different understanding of special relativity at the core. The fundamental aspect of this difference is replacement of Einstein's (stipulated) constant light speed by inwardly infinite light speed (while outward light speed is c/2), a difference which by itself introduces nothing new in physics as an empirical science.

However, something new and potentially important emerges when inwardly infinite light speed, taken to be ontologically significant, is combined with Hubble space-expansion. Here we first recognize that a fundamental observer at r=0 could, using a sufficiently powerful telescope, virtually see a remote fundamental observer with a nearby (fundamental) clock, both moving outward at $v=r_H H$, and witness the clock-time dilating at $d\Delta\tau/dt = -v/c = -r_H H/c$. This result combined with orthodox gravitational time dilation due to a massive entity centered at r=0—obtained from the Schwarzschild solution—then reveals a new, invariant time-dilation surrounding the entity, $d\Delta\tau/dt = -([GM/r_S][r_H cH_0])^{1/2}/c^2$, where the radii cancel. The radial derivative when non-accelerating Hubble expansion is stipulated now exhibits the inverse-radius gravitational acceleration—i.e., $a = d([GM/r_S][r_H cH])^{1/2}/dr = -1/2\,(GMcH_0)^{1/2}/r$—necessary to model the asymptotically uniform spiral-galaxy rotation in the far field.

Although relativity physics is fundamentally changed at its core—by, as mentioned, replacing stipulated isotropic light-speed with (ontologically meaningful) inwardly infinite light-speed—it does appear that the Einstein field equations may be (prospectively) applied across the cosmos on the basis of various adjustments. Thinking only of adjustments within the Schwarzschild geometry, for which scale factor a(t)=1 may be assumed and employing the elementary equation of state, one is to adopt

$$(1) \qquad ds^2 = -\,(1-(GMcH)^{1/2}/c^2)^2\, c^2dt^2 + (1-(GMcH)^{1/2}/c^2)^{-2}dr^2 + r^2d\theta^2 + r^2\sin^2\theta d\phi^2$$

as the fundamental metric, where both uniform time-dilation across any given epoch and the corresponding inverse-radius gravitation upon differentiation (i.e., within a non-accelerating Hubble expansion) are modeled. Satisfaction of the Einstein field equations is demonstrated by substitution, and the solution for the Schwarzschild geometry accounting for far-field gravity can be acquired when Equation (1) is analytically accommodated. The resulting additive solution for the Solar System gives a progressive breakdown of Newtonian gravitation and general relativity—realized initially at Mercury orbit where far-field gravitation adds one part in ~10,000, to approximate parity between standard theory and far-field gravity at about ~7000 AU, and finally to the 1/r far-field gravity where standard$1/r^2$ gravity has effectively vanished. Because this new component of gravity changes orbital dynamics across the Solar System, the Solar and planetary masses within the JPL DE shift in magnitude which then reduces the ephemerid residuals. A rigorous determination of the residuals can reveal the need for deeper theory.

Einstein and Straus (1945), it should be noted, concluded "no influence" of space expansion on star gravitation. However, isotropic/invariant light-speed was assumed, as has been standard practice since 1905, whereas inwardly infinite light-speed was (heuristically) assumed in the present work. This assumption, along with Milgrom's semi-empirical correlation of spiral galaxy far-field rotation measurements as guidance (See Famaey and McGaugh, 2012), permitted the present advances.

Dark Matter. One perspective on the present work is that it stands as counterpoint to dark matter, at least regarding spiral galaxy dynamics, in that rotation flattening in the far field can be explained by the present theory in the absence of dark matter, or the reverse. Because the present theory introduces a fundamental change at the foundation of general relativity, we might conclude that it is on track to "eclipse" dark matter in favor of conceptual/mathematical attributes leading to deeper findings.

While the completed paper, now well along, may be posted sooner, initial presentation is expected at the June 2017 AAAS-PD annual conference in Hawaii.