# Modern SpaceTime and General Relativity

Ken S. Tucker

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In the article, "Modern SpaceTime and Mass Definition" is the statement, "consistent with General Principles of Relativity", (GPoR) and needs to be proved.

Referencing http://physics.trak4.com/ in the article "Modern Space Time" (MST) are the equations (6) and (7), I'll reproduce as

$$U_i \;=\; 0 \;=\; g_{i\mu}\, U^{\mu}. \tag{1}$$

A foundational purpose for the 'GPoR' is to show that absolute accelaration does not exist, and to extend the 'Special Principle of Relativity' (SPoR) from application applied to uniform motion to accelerated motion. In MST the equation $U_i = 0$ satisfied the 'SPoR', by the tensor description of the vanishing of absolute uniform motion, so trusting the logic of tensor analysis, we can use an "absolute derivative" I'll denote 'D' and leave out the parameter, commonly denoted 'ds', then it follows,

$$D(U_i) \;=\; 0 \;=\; D\,(g_{i\mu}U^{\mu}). \tag{2}$$

The 'LHS' follows straightforwardly, however, the 'RHS' expands to,

$$0 \;=\; D\,(g_{i\mu})\,U^{\mu} \;+\; g_{i\mu}\,D\,(U^{\mu}). \tag{3}$$

The 1st term on the 'RHS', is generally expressed and commonly accepted by,

$$D(g_{\mu\nu}) \;=\; 0. \tag{4}$$

The rationale for the vanishing of covariant derivative (and thus absolute derivative) of the metric tensor in the 'General Theory of Relativity' is founded in the 'Principle of Equivalence', that will be discussed further on.

We have now the general "geodesic" equation in accord with both 'MST' and the 'GPoR' to be,

$$D(U^\mu) \;=\; 0. \tag{5}$$

That can be expanded for clarity to this form,

$$0 \;=\; dU^\mu/ds \;+\; \Gamma^\mu_{ab}\, U^a\, U^b, \tag{6}$$

of the geodesic equation, commonly the "equation of motion".

As a caveat, some theoreticians hold that

$$D(U^\mu) \;=\; f^\mu \tag{7}$$

where $f^\mu$ is the Lorentz force. That will be addressed in a future article as that properly involves the relation of 'ElectroMagnetism, Quantum Theory and General Relativity' in a dedicated article.

To summarize:
I do find the 'GPoR' and 'MST' to be compatible, seamlessly.