

Transitivity of "Gravitational Transformations"

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Z. Naturforsch. **40a**, 538 (1985);
received March 30, 1985

Taking into account a "theorem of the addition of gravitational potential differences", gravitational transformations turn out to be transitive.

In my paper "A Phenomenological Theory of Gravitation" [1] reciprocal gravitational transformations had been derived, using the formalism of the theory of special relativity; e.g. the gravitational time dilatation turned out to be

$$t' = t \frac{1 + \Delta U/c^2}{\sqrt{1 - \Delta U^2/c^4}}. \quad (1)$$

If the transitivity of such a transformation shall be considered, one should have in mind that the transitivity of the Lorentz transformation is based on the theorem of the addition of velocities (u and v),

$$w = \frac{u + v}{1 + uv/c^2}. \quad (2)$$

Therefore, the gravitational potential differences $\Delta U \equiv \Delta U_{(01)}$ and ΔU_{12} , too, will obey a corresponding theorem, namely

$$\frac{\Delta U_{02}}{c^2} = \frac{\Delta U_{(01)}/c^2 + \Delta U_{12}/c'^2}{1 + \frac{\Delta U_{(01)}}{c^2} \cdot \frac{\Delta U_{12}}{c'^2}}. \quad (3)$$

That means, the gravitational transformations concerning the increase of time, mass and momentum, respectively the decrease of length, frequency, energy, velocity, current and voltage, as given in Sect. 3.21 of paper [1], turn out to be transitive; e.g. it is

$$\begin{aligned} t'' &= t' \cdot \frac{1 + \Delta U_{12}/c'^2}{\sqrt{1 - \Delta U_{12}^2/c'^4}} \\ &= t \cdot \frac{1 + \Delta U/c^2}{\sqrt{1 - \Delta U^2/c^4}} \cdot \frac{1 + \Delta U_{12}/c'^2}{\sqrt{1 - \Delta U_{12}^2/c'^4}} \\ &= t \cdot \frac{1 + \Delta U_{02}/c^2}{\sqrt{1 - \Delta U_{02}^2/c^4}}. \end{aligned} \quad (4)$$

[1] F. Spieweck, Z. Naturforsch. **40a**, 173 (1985).

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