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A Connection With Newton's Second Law of $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = \mathrm{M}$

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Abstract

I reported the establishment of $\frac{\partial \mathrm{M}}{\partial x^\nu} = \frac{\partial^4 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu \partial x^\nu} = 0$. Proposition3: I made clear that there was the lower limit to a dimensional number from establishment of $\frac{\partial^4 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu \partial x^\nu} = 0$. Proposition4: I clarified that only one dimension with a characteristic unlike other dimensions existed from establishment of $\frac{\partial^4 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu \partial x^\nu} = 0$. I got Proposition5 using a result of Proposition3, Proposition4. I was reporting establishment of $M \propto m$: $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M$, m expresses Mass as a hypothesis, but got proof of the establishment of $M = m$ using Proposition5.

Keywords: tensor, covariant derivative

1. Introduction

I already reported the establishment of $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M$. (Ichidayama, 2021. Property of ⋯) I rewrite $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu}$ using Definision2, Definision3 and get $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = \frac{\partial^3 x^\mu}{\partial x^\mu \partial x^\mu \partial x_\mu}$. Because all the index coming up in $\frac{\partial^3 x^\mu}{\partial x^\mu \partial x^\mu \partial x_\mu}$ is dummy index, $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = \frac{\partial^3 x^\mu}{\partial x^\mu \partial x^\mu \partial x_\mu}$ is scalar in tensor satisfying Binary Law. Scalar M of the right side of $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M$ is expressing that $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu}$ is scalar. By the way, I reported the establishment of $\frac{\partial M}{\partial x^\nu} = \frac{\partial^4 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu \partial x^\nu} = 0$. (Ichidayama, 2021. Property of ⋯) $\frac{\partial x^\mu}{\partial x^\nu} = 0, \frac{\partial^2 x^\mu}{\partial x^\nu \partial x^\nu} = 0, \frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = 0$ isn't decided mathematically each here, but only $\frac{\partial^4 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu \partial x^\nu} = 0$ is established mathematically. Proposition3: I made clear that there was the lower limit to a dimensional number from establishment of $\frac{\partial^4 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu \partial x^\nu} = 0$. Proposition4: I clarified that only one dimension with a characteristic unlike other dimensions existed from establishment of $\frac{\partial^4 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu \partial x^\nu} = 0$. I got Proposition5 using a result of Proposition3,Proposition4. I was reporting establishment of $M \propto m$: $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M$, m expresses Mass as a hypothesis (Ichidayama, 2021. About a Solution of ⋯), but got proof of the establishment of $M = m$ using Proposition5.

2. Definition

Definition1. $\overline{x^{\mu}} \neq x^{\mu}, \overline{x^{\nu}} \neq x^{\nu}, \overline{x^{\mu}} = x^{\nu}, \overline{x^{\nu}} = x^{\mu}$ is established. (Ichidayama, 2017)

I named $\overline{x^{\mu}} \neq x^{\mu}, \overline{x^{\nu}} \neq x^{\nu}, \overline{x^{\mu}} = x^{\nu}, \overline{x^{\nu}} = x^{\mu}$ "Binary Law". (Ichidayama, 2017)

Definition2. If $\overline{x^{\mu}} \neq x^{\mu}, \overline{x^{\nu}} \neq x^{\nu}, \overline{x^{\mu}} = x^{\nu}, \overline{x^{\nu}} = x^{\mu}$ is established, $x^{\mu} = x_{\nu}$ is established. (Ichidayama, 2017)

Definition3. If $\overline{x^{\mu}} \neq x^{\mu}, \overline{x^{\nu}} \neq x^{\nu}, \overline{x^{\mu}} = x^{\nu}, \overline{x^{\nu}} = x^{\mu}$ is established, $x_{\nu} = -x_{\mu}$ is established. (Ichidayama, 2017)

Definition4. $dy = f'(x)dx$ is established from derived function $\frac{dy}{dx} = f'(x)$ of function $y = f(x)$.

Definition5. If $\overline{x^{\mu}} \neq x^{\mu}, \overline{x^{\nu}} \neq x^{\nu}, \overline{x^{\mu}} = x^{\nu}, \overline{x^{\nu}} = x^{\mu}$ is established, $\frac{\partial M}{\partial x^{\nu}} = 0$ is established. “M” expresses $\frac{\partial^3 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}} = M$.(Ichidayama, 2021. Property of ⋯)

Definition6. $F^{\mu} = m\frac{d^2 x^{\mu}}{dtdt}$ {Newton's Second Law} is established. F^{μ} is components of the external force Vector. $\frac{d^2 x^{\mu}}{dtdt}$ is components of the acceleration Vector. “m” is Mass.(Kittel, Knight, Ruderman, 1982)

3. About a Dimensional Number in Tensor Satisfying Binary Law

Proposition1. When $\frac{dy}{dx} = 0$ is established, $dy = 0$ is established. When $\frac{d^2y}{dxdx} = 0$ and $\frac{dy}{dx} \neq 0$ are established, $dy = \frac{dy}{dx}dx$ is established. When $\frac{d^3y}{dxdxdx} = 0$ and $\frac{d^2y}{dxdx} \neq 0$ are established, $\frac{dy}{dx} = \frac{d^2y}{dxdx}dx$ is established. When $\frac{d^4y}{dxdxdxdx} = 0$ and $\frac{d^3y}{dxdxdx} \neq 0$ are established, $\frac{d^2y}{dxdx} = \frac{d^3y}{dxdxdx}dx$ is established. $y = f(x)$ is established here.

Proof. When $\frac{d^2y}{dxdx} = 0$ and $\frac{dy}{dx} \neq 0$ are established, I get

$$\frac{dy}{dx} = C_x \neq 0 \tag{1}$$

from $\frac{d^2y}{dxdx} = 0$ and $\frac{dy}{dx} \neq 0$. $y = f(x)$ is established here. C_x expresses that it is a constant value for x. I rewrite (1) in consideration of Definision4 and get

$$dy = \frac{dy}{dx}dx. \tag{2}$$

When $\frac{d^3y}{dxdxdx} = 0$ and $\frac{d^2y}{dxdx} \neq 0$ are established, I get

$$\frac{d^2y}{dxdx} = C_x \neq 0 \tag{3}$$

from $\frac{d^3y}{dxdxdx} = 0$ and $\frac{d^2y}{dxdx} \neq 0$. I rewrite (3) in consideration of Definision4 and get

$$\frac{dy}{dx} = \frac{d^2y}{dxdx}dx. \tag{4}$$

When $\frac{d^4y}{dxdxdxdx} = 0$ and $\frac{d^3y}{dxdxdx} \neq 0$ are established, I get

$$\frac{d^3y}{dxdxdx} = C_x \neq 0 \tag{5}$$

from $\frac{d^4y}{dxdxdxdx} = 0$ and $\frac{d^3y}{dxdxdx} \neq 0$. I rewrite (5) in consideration of Definision4 and get

$$\frac{d^2y}{dxdx} = \frac{d^3y}{dxdxdx}dx. \tag{6}$$

When $\frac{dy}{dx} = 0$ is established, I get

$$dy = 0 \tag{7}$$

from (2) in consideration of $\frac{dy}{dx} = 0$.

Proposition2. If $\overline{x^\mu} \neq x^\mu, \overline{x^\nu} \neq x^\nu, \overline{x^\mu} = x^\nu, \overline{x^\nu} = x^\mu$ is established, When $\frac{\partial x^\mu}{\partial x^\nu} = 0$ is established, $\partial x^\mu = 0$ is established. When $\frac{\partial^2 x^\mu}{\partial x^\nu \partial x^\nu} = 0$ and $\frac{\partial x^\mu}{\partial x^\nu} \neq 0$ are established, $\partial x^\mu = \frac{\partial x^\mu}{\partial x^\nu}\partial x^\nu$ is established. When $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = 0$ and $\frac{\partial^2 x^\mu}{\partial x^\nu \partial x^\nu} \neq 0$ are established, $\frac{\partial x^\mu}{\partial x^\nu} = \frac{\partial^2 x^\mu}{\partial x^\nu \partial x^\nu}\partial x^\nu$ is established. When $\frac{\partial^4 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu \partial x^\nu} = 0$ and $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} \neq 0$ are established, $\frac{\partial^2 x^\mu}{\partial x^\nu \partial x^\nu} = \frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu}\partial x^\nu$ is established.

Proof. If $\overline{x^\mu} \neq x^\mu, \overline{x^\nu} \neq x^\nu, \overline{x^\mu} = x^\nu, \overline{x^\nu} = x^\mu$ is established,

$$\frac{\partial M}{\partial x^\nu} = \frac{\partial^4 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu \partial x^\nu} = 0 \tag{8}$$

is established from Definision5. I get

$$\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = C_{x^\nu} \tag{9}$$

from (8). C_{x^ν} expresses that it is a constant value for x^ν. I decide establishment of

$$\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = C_{x^\nu} \neq 0 \tag{10}$$

for (9) here. When (8) and (10) are established, I rewrite (10) in consideration of Proposition1 and get

$$\frac{\partial^2 x^\mu}{\partial x^\nu \partial x^\nu} = \frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu}\partial x^\nu. \tag{11}$$

Similarly, I decide establishment of

$$\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = C_{x^\nu} = 0 \tag{12}$$

for (10). I get

$$\frac{\partial^2 x^\mu}{\partial x^\nu \partial x^\nu} = C_{x^\nu}[2] \tag{13}$$

from (12). I decide establishment of

$$\frac{\partial^2 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}} = C_{x^{\nu}}[2] \neq 0 \tag{14}$$

for (13) here. When (12) and (14) are established, I rewrite (14) in consideration of Proposition1 and get

$$\frac{\partial x^{\mu}}{\partial x^{\nu}} = \frac{\partial^2 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}}\partial x^{\nu}. \tag{15}$$

Similarly, I decide establishment of

$$\frac{\partial^2 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}} = C_{x^{\nu}}[2] = 0 \tag{16}$$

for (14). I get

$$\frac{\partial x^{\mu}}{\partial x^{\nu}} = C_{x^{\nu}}[3] \tag{17}$$

from (16). I decide establishment of

$$\frac{\partial x^{\mu}}{\partial x^{\nu}} = C_{x^{\nu}}[3] \neq 0 \tag{18}$$

for (17) here. When (16) and (18) are established, I rewrite (18) in consideration of Proposition1 and get

$$\partial x^{\mu} = \frac{\partial x^{\mu}}{\partial x^{\nu}}\partial x^{\nu}. \tag{19}$$

Similarly, I decide establishment of

$$\frac{\partial x^{\mu}}{\partial x^{\nu}} = C_{x^{\nu}}[3] = 0 \tag{20}$$

for (18). When (20) is established,

$$\partial x^{\mu} = 0 \tag{21}$$

is established in consideration of Proposition1. Furthermore, I get

$$\frac{\partial^5 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}} = 0, \frac{\partial^6 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}} = 0, \cdots \tag{22}$$

from (8). Because it isn't compatible with $\frac{\partial^4 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}} \neq 0$ and (8) when $\frac{\partial^5 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}} = 0$ and $\frac{\partial^4 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}} \neq 0$ are established, I get the conclusion that in this case can't exist. Because it isn't compatible with $\frac{\partial^5 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}} \neq 0$ and (22) when $\frac{\partial^6 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}} = 0$ and $\frac{\partial^5 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}} \neq 0$ are established, I get the conclusion that in this case can't exist. Similarly, I get the conclusion that can't exist when $\frac{\partial^6 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}} = 0, \cdots$ and $\frac{\partial^5 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}} \neq 0, \cdots$ are established each. Condition $\frac{\partial x^{\mu}}{\partial x^{\nu}} = 0$ isn't established with condition $\frac{\partial^2 x^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}} = 0, \frac{\partial x^{\mu}}{\partial x^{\nu}} \neq 0$ here. Thus, equation (21) and equation (19) must be independent relations. By a similar reason, equation (21),(19),(15),(11) must be independent relations each other.

Proposition3. $dim.number \geq 4$ is established for a dimensional number in the tensor satisfying Binary Law.

Proof. When $\mu = \nu$ is established, (21),(19),(15),(11) becomes (23),(24),(25),(26). When $\frac{\partial x^{\mu}}{\partial x^{\mu}} = 0$ is established,

$$\partial x^{\mu} = 0 \tag{23}$$

is established. When $\frac{\partial^2 x^{\mu}}{\partial x^{\mu} \partial x^{\mu}} = 0$ and $\frac{\partial x^{\mu}}{\partial x^{\mu}} \neq 0$ are established,

$$\partial x^{\mu} = \frac{\partial x^{\mu}}{\partial x^{\mu}} \partial x^{\mu} \tag{24}$$

is established. When $\frac{\partial^3 x^{\mu}}{\partial x^{\mu} \partial x^{\mu} \partial x^{\mu}} = 0$ and $\frac{\partial^2 x^{\mu}}{\partial x^{\mu} \partial x^{\mu}} \neq 0$ are established,

$$\frac{\partial x^{\mu}}{\partial x^{\mu}} = \frac{\partial^2 x^{\mu}}{\partial x^{\mu} \partial x^{\mu}} \partial x^{\mu} \tag{25}$$

is established. When $\frac{\partial^4 x^{\mu}}{\partial x^{\mu} \partial x^{\mu} \partial x^{\mu} \partial x^{\mu}} = 0$ and $\frac{\partial^3 x^{\mu}}{\partial x^{\mu} \partial x^{\mu} \partial x^{\mu}} \neq 0$ are established,

$$\frac{\partial^2 x^{\mu}}{\partial x^{\mu} \partial x^{\mu}} = \frac{\partial^3 x^{\mu}}{\partial x^{\mu} \partial x^{\mu} \partial x^{\mu}} \partial x^{\mu} \tag{26}$$

is established. All the index coming up in $\frac{\partial x^{\mu}}{\partial x^{\mu}}$ here is dummy index. On the other hand, all the index coming up in $\frac{\partial^2 x^{\mu}}{\partial x^{\mu} \partial x^{\mu}}, \frac{\partial^3 x^{\mu}}{\partial x^{\mu} \partial x^{\mu} \partial x^{\mu}}$ isn't dummy index. (23),(24) is expressed as $\mu = 1$ like

$$dx^1 = 0, \tag{27}$$

$$dx^1 = \frac{dx^1}{dx^1} dx^1 \tag{28}$$

if I suppose that there can be the number of the dimensions only in one. It is a problem in (28) being subordination to (27). (23),(24) is expressed as $\mu = 1, \mu = 2$ like

$$dx^1 = 0, \tag{29}$$

$$dx^2 = \frac{dx^2}{dx^2} dx^2 \tag{30}$$

if I suppose that there can be the number of the dimensions in two. (29) is independence to (30). Thus, this problem can dissolve if I assume a dimensional number 2. Similarly, (23),(24),(25),(26) is expressed as $\mu = 1, \mu = 2, \mu = 3, \mu = 4$ like

$$dx^1 = 0, \tag{31}$$

$$dx^2 = \frac{dx^2}{dx^2} dx^2, \tag{32}$$

$$\frac{dx^3}{dx^3} = \frac{d^2 x^3}{dx^3 dx^3} dx^3, \tag{33}$$

$$\frac{d^2 x^4}{dx^4 dx^4} = \frac{d^3 x^4}{dx^4 dx^4 dx^4} dx^4 \tag{34}$$

If I suppose that there can be the number of the dimensions in four. When a dimensional number is less than four, a problem occurs here. On the other hand, the problem doesn't occur when dimensional numbers are more than four. Therefore, $dim.number \geq 4$ is established for the dimensional number. In addition, at least four are necessary for the dimensional number so that (23), (24), (25), (26) is expressed independently each.

4. About a Dimension With a Specific Property in Tensor Satisfying Binary Law

Proposition4. If $\overline{x^\mu} \neq x^\mu, \overline{x^\nu} \neq x^\nu, \overline{x^\mu} = x^\nu, \overline{x^\nu} = x^\mu$ is established, Components of $x^\mu(x^1, x^2, x^3, x^4)$ is expressed in (x^1, t, x^3, x^4).

Proof. If a dimensional number is 2, I get

$$\frac{\partial x^1}{\partial \dot{x}^1} \neq 1, \frac{\partial x^1}{\partial \dot{x}^2} \neq 1, \frac{\partial x^2}{\partial \dot{x}^1} \neq 1, \frac{\partial x^2}{\partial \dot{x}^2} \neq 1 \tag{35}$$

from $\frac{\partial x^\mu}{\partial x^\nu}$. I get

$$\frac{\partial x^\mu}{\partial x^\nu} \neq 1 \tag{36}$$

from (35). When $\mu = \nu$ is established, (36) becomes

$$\frac{\partial x^\mu}{\partial x^\nu} = \frac{\partial x^\mu}{\partial x^\mu} \neq 1. \tag{37}$$

I rewrite (24) in consideration of (37) and get

$$\partial x^\mu = \frac{\partial x^\mu}{\partial x^\mu} \partial x^\mu = \partial t^\mu. \tag{38}$$

(23),(38),(25),(26) is expressed as $\mu = 1, \mu = 2, \mu = 3, \mu = 4$ like

$$dx^1 = 0, \tag{39}$$

$$dx^2 = dt^2, \tag{40}$$

$$\frac{dx^3}{dx^3} = \frac{d^2 x^3}{dx^3 dx^3} dx^3, \tag{41}$$

$$\frac{d^2 x^4}{dx^4 dx^4} = \frac{d^3 x^4}{dx^4 dx^4 dx^4} dx^4 \tag{42}$$

If I suppose that there can be the number of the dimensions in four. It is only (24) that I can express it as (38) here. Therefore, t^2 is scalar because t^1, t^3, t^4 doesn't exist from (39),(40),(41),(42). In other words, I rewrite (40) and get

$$x^2 = t. \tag{43}$$

Components of $x^\mu(x^1, x^2, x^3, x^4)$ is expressed in (x^1, t, x^3, x^4) by consideration of (43).

Proposition5. If $\overline{x^\mu} \neq x^\mu, \overline{x^\nu} \neq x^\nu, \overline{x^\mu} = x^\nu, \overline{x^\nu} = x^\mu$ is established, $\frac{\partial x^\mu}{\partial x^\mu}$ is interchangeable with $\frac{dx^\mu}{dt}$, $\frac{\partial^2 x^\mu}{\partial x^\mu \partial x^\mu}$ is interchangeable with $\frac{d^2 x^\mu}{dtdt}$.

Proof. I get

$$\partial x^1 = \frac{\partial x^1}{\partial \dot{x}^1} \partial \dot{x}^1 + \frac{\partial x^1}{\partial \dot{x}^2} \partial \dot{x}^2 + \frac{\partial x^1}{\partial \dot{x}^3} \partial \dot{x}^3 + \frac{\partial x^1}{\partial \dot{x}^4} \partial \dot{x}^4, \ \partial x^2 = \frac{\partial x^2}{\partial \dot{x}^1} \partial \dot{x}^1 + \frac{\partial x^2}{\partial \dot{x}^2} \partial \dot{x}^2 + \frac{\partial x^2}{\partial \dot{x}^3} \partial \dot{x}^3 + \frac{\partial x^2}{\partial \dot{x}^4} \partial \dot{x}^4,$$

$$\partial x^3 = \frac{\partial x^3}{\partial \dot{x}^1} \partial \dot{x}^1 + \frac{\partial x^3}{\partial \dot{x}^2} \partial \dot{x}^2 + \frac{\partial x^3}{\partial \dot{x}^3} \partial \dot{x}^3 + \frac{\partial x^3}{\partial \dot{x}^4} \partial \dot{x}^4, \ \partial x^4 = \frac{\partial x^4}{\partial \dot{x}^1} \partial \dot{x}^1 + \frac{\partial x^4}{\partial \dot{x}^2} \partial \dot{x}^2 + \frac{\partial x^4}{\partial \dot{x}^3} \partial \dot{x}^3 + \frac{\partial x^4}{\partial \dot{x}^4} \partial \dot{x}^4 \tag{44}$$

from (19) if I assume a dimensional number four. I get

$$\partial x^1=\frac{\partial x^1}{\partial x^1}\partial x^1+\frac{\partial x^1}{\partial x^2}\partial x^2+\frac{\partial x^1}{\partial x^3}\partial x^3+\frac{\partial x^1}{\partial x^4}\partial x^4,\ \partial x^2=\frac{\partial x^2}{\partial x^1}\partial x^1+\frac{\partial x^2}{\partial x^2}\partial x^2+\frac{\partial x^2}{\partial x^3}\partial x^3+\frac{\partial x^2}{\partial x^4}\partial x^4,$$

$$\partial x^3=\frac{\partial x^3}{\partial x^1}\partial x^1+\frac{\partial x^3}{\partial x^2}\partial x^2+\frac{\partial x^3}{\partial x^3}\partial x^3+\frac{\partial x^3}{\partial x^4}\partial x^4,\ \partial x^4=\frac{\partial x^4}{\partial x^1}\partial x^1+\frac{\partial x^4}{\partial x^2}\partial x^2+\frac{\partial x^4}{\partial x^3}\partial x^3+\frac{\partial x^4}{\partial x^4}\partial x^4 \quad (45)$$

as $\mu=\nu$ for (44). I get

$$dx^1=dx^1\{t=0\}+\frac{dx^1}{dt}dt,\ dx^2=\frac{dx^2}{dt}dt=dt,$$

$$dx^3=\frac{dx^3}{dt}dt+dx^3\{t=0\},\ dx^4=\frac{dx^4}{dt}dt+dx^4\{t=0\} \quad (46)$$

from (45) in consideration of (43), $\frac{\partial x^1}{\partial x^3}=0,\frac{\partial x^1}{\partial x^4}=0,\frac{\partial x^2}{\partial x^1}=0,\frac{\partial x^2}{\partial x^3}=0,\frac{\partial x^2}{\partial x^4}=0,\frac{\partial x^3}{\partial x^1}=0,\frac{\partial x^3}{\partial x^4}=0,\frac{\partial x^4}{\partial x^1}=0,\frac{\partial x^4}{\partial x^3}=0.$ I rewrite (46) as $x^1\{t=0\}=C_t, x^3\{t=0\}=C_t, x^4\{t=0\}=C_t$ and get

$$\frac{dx^1}{dt}=\frac{dx^1}{dt},\ \frac{dx^2}{dt}=\frac{dx^2}{dt}=1,$$

$$\frac{dx^3}{dt}=\frac{dx^3}{dt},\ \frac{dx^4}{dt}=\frac{dx^4}{dt}. \quad (47)$$

C_t expresses that it is a constant value for t. I get

$$\frac{dx^\mu}{dt}=\frac{dx^\mu}{dt} \quad (48)$$

from (47). I rewrite (45) and get

$$\frac{\partial x^\mu}{\partial x^\mu}=\frac{\partial x^\mu}{\partial x^\mu}. \quad (49)$$

Because I got (48) from (49), I get the conclusion that can replace $\frac{\partial x^\mu}{\partial x^\mu}$ with $\frac{dx^\mu}{dt}$. Similarly, I get

$$\frac{\partial x^1}{\partial x^\nu}=\frac{\partial^2 x^1}{\partial x^\nu\partial \dot{x}^1}\partial \dot{x}^1+\frac{\partial^2 x^1}{\partial x^\nu\partial \dot{x}^2}\partial \dot{x}^2+\frac{\partial^2 x^1}{\partial x^\nu\partial \dot{x}^3}\partial \dot{x}^3+\frac{\partial^2 x^1}{\partial x^\nu\partial \dot{x}^4}\partial \dot{x}^4,$$

$$\frac{\partial x^2}{\partial x^\nu}=\frac{\partial^2 x^2}{\partial x^\nu\partial \dot{x}^1}\partial \dot{x}^1+\frac{\partial^2 x^2}{\partial x^\nu\partial \dot{x}^2}\partial \dot{x}^2+\frac{\partial^2 x^2}{\partial x^\nu\partial \dot{x}^3}\partial \dot{x}^3+\frac{\partial^2 x^2}{\partial x^\nu\partial \dot{x}^4}\partial \dot{x}^4,$$

$$\frac{\partial x^3}{\partial x^\nu}=\frac{\partial^2 x^3}{\partial x^\nu\partial \dot{x}^1}\partial \dot{x}^1+\frac{\partial^2 x^3}{\partial x^\nu\partial \dot{x}^2}\partial \dot{x}^2+\frac{\partial^2 x^3}{\partial x^\nu\partial \dot{x}^3}\partial \dot{x}^3+\frac{\partial^2 x^3}{\partial x^\nu\partial \dot{x}^4}\partial \dot{x}^4,$$

$$\frac{\partial x^4}{\partial x^\nu}=\frac{\partial^2 x^4}{\partial x^\nu\partial \dot{x}^1}\partial \dot{x}^1+\frac{\partial^2 x^4}{\partial x^\nu\partial \dot{x}^2}\partial \dot{x}^2+\frac{\partial^2 x^4}{\partial x^\nu\partial \dot{x}^3}\partial \dot{x}^3+\frac{\partial^2 x^4}{\partial x^\nu\partial \dot{x}^4}\partial \dot{x}^4 \quad (50)$$

from (15) if I assume a dimensional number four. I get

$$\frac{\partial x^1}{\partial x^\mu}=\frac{\partial^2 x^1}{\partial x^\mu\partial x^1}\partial x^1+\frac{\partial^2 x^1}{\partial x^\mu\partial x^2}\partial x^2+\frac{\partial^2 x^1}{\partial x^\mu\partial x^3}\partial x^3+\frac{\partial^2 x^1}{\partial x^\mu\partial x^4}\partial x^4,$$

$$\frac{\partial x^2}{\partial x^\mu}=\frac{\partial^2 x^2}{\partial x^\mu\partial x^1}\partial x^1+\frac{\partial^2 x^2}{\partial x^\mu\partial x^2}\partial x^2+\frac{\partial^2 x^2}{\partial x^\mu\partial x^3}\partial x^3+\frac{\partial^2 x^2}{\partial x^\mu\partial x^4}\partial x^4,$$

$$\frac{\partial x^3}{\partial x^\mu}=\frac{\partial^2 x^3}{\partial x^\mu \partial x^1}\partial x^1+\frac{\partial^2 x^3}{\partial x^\mu \partial x^2}\partial x^2+\frac{\partial^2 x^3}{\partial x^\mu \partial x^3}\partial x^3+\frac{\partial^2 x^3}{\partial x^\mu \partial x^4}\partial x^4,$$

$$\frac{\partial x^4}{\partial x^\mu}=\frac{\partial^2 x^4}{\partial x^\mu \partial x^1}\partial x^1+\frac{\partial^2 x^4}{\partial x^\mu \partial x^2}\partial x^2+\frac{\partial^2 x^4}{\partial x^\mu \partial x^3}\partial x^3+\frac{\partial^2 x^4}{\partial x^\mu \partial x^4}\partial x^4 \quad (51)$$

as $\mu=\nu$ for (50). I get

$$\frac{\partial x^1}{\partial x^2}=\frac{\partial^2 x^1}{\partial x^2 \partial x^1}\partial x^1+\frac{\partial^2 x^1}{\partial x^2 \partial x^2}\partial x^2+\frac{\partial^2 x^1}{\partial x^2 \partial x^3}\partial x^3+\frac{\partial^2 x^1}{\partial x^2 \partial x^4}\partial x^4,$$

$$\frac{\partial x^2}{\partial x^2}=\frac{\partial^2 x^2}{\partial x^2 \partial x^1}\partial x^1+\frac{\partial^2 x^2}{\partial x^2 \partial x^2}\partial x^2+\frac{\partial^2 x^2}{\partial x^2 \partial x^3}\partial x^3+\frac{\partial^2 x^2}{\partial x^2 \partial x^4}\partial x^4,$$

$$\frac{\partial x^3}{\partial x^2}=\frac{\partial^2 x^3}{\partial x^2 \partial x^1}\partial x^1+\frac{\partial^2 x^3}{\partial x^2 \partial x^2}\partial x^2+\frac{\partial^2 x^3}{\partial x^2 \partial x^3}\partial x^3+\frac{\partial^2 x^3}{\partial x^2 \partial x^4}\partial x^4,$$

$$\frac{\partial x^4}{\partial x^2}=\frac{\partial^2 x^4}{\partial x^2 \partial x^1}\partial x^1+\frac{\partial^2 x^4}{\partial x^2 \partial x^2}\partial x^2+\frac{\partial^2 x^4}{\partial x^2 \partial x^3}\partial x^3+\frac{\partial^2 x^4}{\partial x^2 \partial x^4}\partial x^4 \quad (52)$$

as $\frac{\partial x^\mu}{\partial x^\mu}\to\frac{\partial x^\mu}{\partial x^2}$ for (51). I get

$$\frac{dx^1}{dt}=\frac{dx^1}{dt}\{t=0\}+\frac{d^2x^1}{dtdt}dt,\ \frac{dx^2}{dt}=\frac{dx^2}{dt}=1,$$

$$\frac{dx^3}{dt}=\frac{d^2x^3}{dtdt}dt+\frac{dx^3}{dt}\{t=0\},\ \frac{dx^4}{dt}=\frac{d^2x^4}{dtdt}dt+\frac{dx^4}{dt}\{t=0\} \quad (53)$$

from (52) in consideration of (43), $\frac{\partial^2 x^1}{\partial x^2 \partial x^3}=0,\frac{\partial^2 x^1}{\partial x^2 \partial x^4}=0,\frac{\partial^2 x^2}{\partial x^2 \partial x^1}=0,\frac{\partial^2 x^2}{\partial x^2 \partial x^3}=0,\frac{\partial^2 x^2}{\partial x^2 \partial x^4}=0,\frac{\partial^2 x^3}{\partial x^2 \partial x^1}=0,$ $\frac{\partial^2 x^3}{\partial x^2 \partial x^4}=0,\frac{\partial^2 x^4}{\partial x^2 \partial x^1}=0,\frac{\partial^2 x^4}{\partial x^2 \partial x^3}=0$. I rewrite (53) as $\frac{dx^1}{dt}\{t=0\}=C_t,\frac{dx^3}{dt}\{t=0\}=C_t,\frac{dx^4}{dt}\{t=0\}=C_t$ and get

$$\frac{d^2x^1}{dtdt}=\frac{d^2x^1}{dtdt},\frac{d^2x^2}{dtdt}=\frac{d^2x^2}{dtdt}=0,$$

$$\frac{d^2x^3}{dtdt}=\frac{d^2x^3}{dtdt},\frac{d^2x^4}{dtdt}=\frac{d^2x^4}{dtdt}. \quad (54)$$

I get

$$\frac{d^2x^\mu}{dtdt}=\frac{d^2x^\mu}{dtdt} \quad (55)$$

from (54). I rewrite (51) and get

$$\frac{\partial^2 x^\mu}{\partial x^\mu \partial x^\mu}=\frac{\partial^2 x^\mu}{\partial x^\mu \partial x^\mu}. \quad (56)$$

Because I got (55) from (56), I get the conclusion that can replace $\frac{\partial^2 x^\mu}{\partial x^\mu \partial x^\mu}$ with $\frac{d^2x^\mu}{dtdt}$.

5. A Connection With Newton's Second Law of $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu}=M$ in Tensor Satisfying Binary Law

Proposition6. If $\overline{x^\mu}\neq x^\mu,\overline{x^\nu}\neq x^\nu,\overline{x^\mu}=x^\nu,\overline{x^\nu}=x^\mu$ is established, $M=m$ is established.

"M" expresses $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M$. "$m$" expresses Mass.

Proof. I get

$$F^\mu = \frac{d^2 x^\mu}{dtdt} \tag{57}$$

as $m = 1$ for Definision6. I express Definision6 as

$$F^{\mu\prime} = m\frac{d^2 x^\mu}{dtdt} \tag{58}$$

to distinguish Definision6 from (57). I get

$$F^{\mu\prime} = mF^\mu \tag{59}$$

from (57),(58). I rewrite (57) in consideration of Proposition5 and get

$$F^\mu_{\mu\mu} = \frac{\partial^2 x^\mu}{\partial x^\mu \partial x^\mu}. \tag{60}$$

I assume establishment of

$$\frac{\partial^2 x^\mu}{\partial x^\nu \partial x^\nu} = F^\mu_{\nu\nu} \quad (false) \tag{61}$$

here. I get

$$\frac{\partial^2 x^\mu}{\partial x^\mu \partial x^\mu} = F^\mu_{\mu\mu} \quad (false) \tag{62}$$

as $\mu = \nu$ for (61). I get

$$F^\mu_{\mu\mu} = F^\mu_{\mu\mu} \quad (false) \tag{63}$$

from (60),(62). Because (63) isn't established,

$$\frac{\partial^2 x^\mu}{\partial x^\nu \partial x^\nu} = F^\mu_{\nu\nu} \tag{64}$$

is established. I get

$$\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M, \tag{65}$$

$$\frac{\partial M}{\partial x^\nu} = 0 \tag{66}$$

from Definision5. I rewrite (65) in consideration of (66) and get

$$\frac{\partial^2 x^\mu}{\partial x^\nu \partial x^\nu} = Mx^\nu. \tag{67}$$

I get

$$F^\mu_{\nu\nu} = Mx^\nu \tag{68}$$

from (64),(67). I get

$$F^\mu_{\nu\nu} = x^\nu \tag{69}$$

as $M = 1$ for (68). I express (68) as

$$F^{\mu\prime}{}_{\nu\nu} = Mx^\nu \tag{70}$$

to distinguish (68) from (69). I get

$$F^{\mu\prime}{}_{\nu\nu} = MF^\mu_{\nu\nu} \tag{71}$$

from (69),(70). I get

$$F^{\mu\prime}_{\nu\nu} = M\frac{\partial^2 x^\mu}{\partial x^\nu \partial x^\nu} \tag{72}$$

from (64),(71). I get

$$F_{\mu\mu}^{\mu\ \prime} = M\frac{\partial^2 x^\mu}{\partial x^\mu \partial x^\mu} \tag{73}$$

as $\mu = \nu$ for (72). I rewrite (73) in consideration of Proposition5 and get

$$F^{\mu\prime} = M\frac{d^2 x^\mu}{dtdt}. \tag{74}$$

I assume establishment of

$$M = m \quad (false) \tag{75}$$

here. I get

$$F^{\mu\prime} = m\frac{d^2 x^\mu}{dtdt} \quad (false) \tag{76}$$

from (74),(75). Because (76) isn't established from (58),

$$M = m \tag{77}$$

is established. Thus, I get the conclusion that $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M$ can regard as mass of the matter.

6. Discussion

About Proposition3

In the tensor satisfying Binary Law, the world where the upper limit of the number of the dimensions is 1,2,3 can't exist from Proposition3. On the other hand, in the tensor satisfying Binary Law, the world where the upper limit of the number of the dimensions is 4,5,6,$\cdots$ can exist from Proposition3.

About Proposition6

I get $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = m$ from (65), (77). The mass m decides a space-time characteristic from $\frac{\partial^3 x^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = m$. Therefore, the matter gives the space-time characteristic change that there is it.

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