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About a Solution of $\frac{\partial^3 x^\nu}{\partial x^\mu \partial x^\mu \partial x^\mu} = M:\{M = 0, M > 0\}$ in Tensor Satisfying Binary Law 2

Koji Ichidayama[1]

[1] Okayama 716-0002, Japan

Correspondence: Koji Ichidayama, Okayama 716-0002, Japan. Tel: 866-23-1173. E-mail: ichikoji@lime.ocn.ne.jp

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Abstract

I have already reported "About a Solution of $\frac{\partial^3 x^\nu}{\partial x^\mu \partial x^\mu \partial x^\mu} = M:\{M = 0, M > 0\}$ in Tensor Satisfying Binary Law". This article is revised edition of the article mentioned above. I reconsidered the article mentioned above and carried out an improvement or complete reform about the insufficient part. I carried out large improvement of the figure in this article.

Keywords: tensor, covariant derivative

1. Introduction

I reported that $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M$ was established in the tensor which satisfied Binary Law. (Ichidayama, 2023) I decide a solution of $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M:\{M > 0\}$ in this article in Proposition2, Proposition4. And I decide metric field by a solution of $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M:\{M > 0\}$ in Proposition3, Proposition4. I decide a solution of $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M:\{M = 0\}$ in this article in Proposition2, Proposition5. And I decide metric field by a solution of $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M:\{M = 0\}$ in Proposition3, Proposition5. I decide force field from this metric field in Proposition6, Proposition7, Proposition 8. I carry out visualization by the figure of metric field and the force field in Chapter 6.

According to the theory of general relativity, the space-time around the matter curves. In other words, the metric of the space-time around the matter forms metric field changing for distance with the matter. The force that is going to crush that namely gravity acts on matter. I explain in this article about what force can derive from the metric field newly in Chapter 5.

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, $x_\nu = x^\mu$ 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, $x_\mu = x^\nu$ is established. (Ichidayama, 2017)

Definition4. 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)

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

Definition6. 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, $\frac{\partial^3 M^{\mu}}{\partial x^{\nu}\partial x^{\nu}\partial x^{\nu}} = M$ is established. (Ichidayama, 2023)

Definition7. 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, $M_{\mu}^{;\mu} = \frac{\partial M_{\mu}}{\partial x_{\mu}} - M_{\nu}\frac{1}{2}\frac{\partial g^{\mu\nu}}{\partial x^{\mu}}$

is established.(Ichidayama, 2023)

Definition8. 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 Mass.

Definition9. $r = \sqrt{x^2 + y^2}, \theta = tan^{-1}\left(\frac{y}{x}\right)$ is established for Cartesian coordinate (x, y) and polar coordinates (r, θ). (Spiegel, 1968)

Definition10. $d\vec{r} = \overrightarrow{e^{\mu}} dx_{\mu}, d\vec{r} = \overrightarrow{e^{\nu}} dx_{\nu}, dx_{\nu} = \frac{\partial x^{\mu}}{\partial x^{\nu}} dx_{\mu}$ is established.

Definition11. $E = mc^2$ is established. (Taylor, 1975) “E” expresses Energy, “m” expresses Mass, and “c” expresses Speed of light.

Definition12. $\mathrm{W}(A \to B) = -\mathrm{U} = \int_A^B \vec{F} \cdot d\vec{r}$ is established. (Kittel, Knight, Ruderman, 1975) “W” expresses Work, “U” expresses Potential Energy, $\vec{F}$ expresses External force vector, and $\vec{r}$ expresses Displacement vector.

Definition13. $dx'^{i} = \frac{\partial x'^{i}}{\partial x^{\mu}} dx^{\mu}$ is established. (Fleisch, 2012)

Definition14. $ds^2 = \left(\overrightarrow{e'^{i}} \cdot \overrightarrow{e'^{j}}\right) dx_i' dx_j' = g^{ij} dx_i' dx_j'$ is established. (Fleisch, 2012)

Definition15. $y[x] = C[1] + xC[2]$ is established as a solution of the equations of $\frac{d^2 y}{dxdx} = 0$. y is function $y = f(x)$ which assumes x an independent variable. I obtained this calculation result using Mathematica 11.3J.

Definition16. $y[x] = C[1]Cos[x] + C[2]Sin[x]$ is established as a solution of the equations of $y''[x] + y[x] = 0$. y is function $y = f(x)$ which assumes x an independent variable. I obtained this calculation result using Mathematica 11.3J.

Definition17 $NDSolve\left[\left\{y''\left[\dot{x^1}\right] == 10^2/y\left[\dot{x^1}\right], y[0] == 10^{-7}, y'[0] == 10^{-7}\right\}, y, \left\{\dot{x^1}, 10^{-6}, 10^6\right\}\right]$

I decide to express $NDSolve[\{y''[r] == 10^2/y[r], y[0] == 10^{-7}, y'[0] == 10^{-7}\}, y, \{r, 10^{-6}, 10^6\}]$ in $h(r)$ here. I obtained this calculation result using Mathematica 11.3J.

Definition18. $TransformedField[\text{"Polar"} \to \text{"Cartesian"}, 200 * (Cos[r])^2, \{r, \theta\} \to \{x, y\}]$

I obtained the figure by Mathematica 11.3J.

Definition19.

$ContourPlot\left[200 * Cos\left[\sqrt{x^2 + y^2}\right]^2, \{x, y\} \in Disk[\{0,0\},10], PlotPoints \to 50, ColorFunction \to \text{BlueGreenYellow}, PlotLegends \to Automatic\right]$ I obtained the figure by Mathematica 11.3J.

Definition20. $TransformedField\left[\text{"Polar"} \to \text{"Cartesian"}, \left\{8000 * Sin[r], \frac{\pi}{4}\right\}, \{r, \theta\} \to \{x, y\}\right]$

I obtained the figure by Mathematica 11.3J.

Definition21.

$\text{Vectorplot}\left[\left\{-\frac{\pi y}{4*\sqrt{x^2+y^2}} + \frac{8000*x*Sin\left[\sqrt{x^2+y^2}\right]}{\sqrt{x^2+y^2}}, \frac{\pi x}{4*\sqrt{x^2+y^2}} + \frac{8000*y*Sin\left[\sqrt{x^2+y^2}\right]}{\sqrt{x^2+y^2}}\right\}, \{x, y\} \in\right.$

$Disk[\{0,0\},10], VectorPoints \rightarrow Fine, VectorStyle \rightarrow Black\Big]$ I obtained the figure by Mathematica 11.3J.

Definition22. $TransformedField\left["Polar" \rightarrow "Cartesian", 2\frac{dh(r)}{dr}\frac{dh(r)}{dr}, \{r,\theta\} \rightarrow \{x,y\}\right]$ I obtained the figure by Mathematica 11.3J. I decide to express $TransformedField\left["Polar" \rightarrow "Cartesian", 2\frac{dh(r)}{dr}\frac{dh(r)}{dr}, \{r,\theta\} \rightarrow \{x,y\}\right]$ in $TF\left[2\frac{dh(r)}{dr}\frac{dh(r)}{dr}\right]$ here.

Definition23.

$ContourPlot\left[\left\{TF\left[2\frac{d\hbar(r)}{dr}\frac{d\hbar(r)}{dr}\right]\right\}, \{x,y\} \in Disk[\{0,0\}, 10^{-6}], PlotPoints \rightarrow 100, ColorFunction \rightarrow \text{BlueGreenYellow}, PlotLegends \rightarrow Automatic\right]$

I obtained the figure by Mathematica 11.3J.

Definition24. $TransformedField\left["Polar" \rightarrow "Cartesian", \left\{-200 * (h(r))^{-2}\frac{dh(r)}{dr}\left(4\frac{dh(r)}{dr}\frac{d^2h(r)}{drdr}\right) + 200 * (h(r))^{-1}\left(4\frac{d^2h(r)}{drdr}\frac{d^2h(r)}{drdr} + 4\frac{dh(r)}{dr}\frac{d^3h(r)}{drdrdr}\right), \frac{\pi}{4}\right\}, \{r,\theta\} \rightarrow \{x,y\}\right]$

I decide to express $TransformedField\left["Polar" \rightarrow "Cartesian", \left\{-200 * (h(r))^{-2}\frac{dh(r)}{dr}\left(4\frac{dh(r)}{dr}\frac{d^2h(r)}{drdr}\right) + 200 * (h(r))^{-1}\left(4\frac{d^2h(r)}{drdr}\frac{d^2h(r)}{drdr} + 4\frac{dh(r)}{dr}\frac{d^3h(r)}{drdrdr}\right), \frac{\pi}{4}\right\}, \{r,\theta\} \rightarrow \{x,y\}\right]$

in $TF\left[-200 * (h(r))^{-2}\frac{dh(r)}{dr}\left(4\frac{dh(r)}{dr}\frac{d^2h(r)}{drdr}\right) + \cdots, \frac{\pi}{4}\right]$ here. I obtained the figure by Mathematica 11.3J.

Definition25.

$Vectorplot\left[\left\{TF\left[-200 * (h(r))^{-2}\frac{dh(r)}{dr}\left(4\frac{dh(r)}{dr}\frac{d^2h(r)}{drdr}\right) + \cdots, \frac{\pi}{4}\right]\right\}, \{x,y\} \in Disk[\{0,0\}, 10^{-5}], VectorPoints \rightarrow Fine, VectorStyle \rightarrow Black\right]$ I obtained the figure by Mathematica 11.3J.

Hypothesis1. $M \propto m, M = \epsilon m$ is established.

"M" expresses $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M$, ϵ expresses Proportional constant, and "m" expresses Mass.

3. Property of $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M : (M > 0)$

Proposition1. When all coordinate systems satisfies Binary Law, $\frac{\partial M}{\partial x^\mu} = 0, \frac{\partial M}{\partial x^\nu} = 0$ is established. "M" expresses $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M$.

Proof. I get

$$\frac{\partial M}{\partial x^\nu} = \epsilon\frac{\partial m}{\partial x^\nu} = 0 \tag{1}$$

from Hypothesis1, Definision8. I get

$$\frac{\partial M}{\partial x^{\mu}} = 0 \tag{2}$$

as μ, ν-inversion form of (1).

Proposition2. When all coordinate system satisfies Binary Law,$\dot{x}^1 = \dot{x}^2, \frac{\partial^2 M^1}{\partial \dot{x}^1 \partial \dot{x}^1} = -M^1, \frac{\partial^2 M^2}{\partial \dot{x}^1 \partial \dot{x}^1} = -M^2$,

$\frac{\partial^2 M^1}{\partial \dot{x}^1 \partial \dot{x}^1} = \frac{(M)^2}{M^1}, \frac{\partial^2 M^2}{\partial \dot{x}^1 \partial \dot{x}^1} = \frac{(M)^2}{M^2}$ is established for $\frac{\partial^3 M^{\mu}}{\partial x^{\nu} \partial x^{\nu} \partial x^{\nu}} = M: (M > 0)$ if a number of dimension is 2.

Proof. I get

$$\frac{\partial^2 M^{\mu}}{\partial x^{\nu} \partial x^{\nu}} = \mathrm{M} \int \partial x^{\nu} = \mathrm{M} x^{\nu} \tag{3}$$

in consideration of Proposition1 for Definision6. Two next

$$\frac{\partial^2 M^{\mu}}{\partial x^{\nu} \partial x^{\nu}} = -M x^{\mu} = -M^{\mu}, \tag{4}$$

$$\frac{\partial^2 M^{\mu}}{\partial x^{\nu} \partial x^{\nu}} = M x_{\mu} = \frac{M}{x^{\mu}} = \frac{(M)^2}{M^{\mu}} \tag{5}$$

can rewrite (3) each using Definision3,Definision5. I get (5) as $x_{\mu} = \frac{1}{x^{\mu}}, M^{\mu} = M x^{\mu}$ here. I get

$$\frac{\partial^2 M^1}{\partial \dot{x}^1 \partial \dot{x}^1} = -M^1, \frac{\partial^2 M^1}{\partial \dot{x}^2 \partial \dot{x}^2} = -M^1, \frac{\partial^2 M^2}{\partial \dot{x}^1 \partial \dot{x}^1} = -M^2, \frac{\partial^2 M^2}{\partial \dot{x}^2 \partial \dot{x}^2} = -M^2, \tag{6}$$

$$\frac{\partial^2 M^1}{\partial \dot{x}^1 \partial \dot{x}^1} = \frac{(M)^2}{M^1}, \frac{\partial^2 M^1}{\partial \dot{x}^2 \partial \dot{x}^2} = \frac{(M)^2}{M^1}, \frac{\partial^2 M^2}{\partial \dot{x}^1 \partial \dot{x}^1} = \frac{(M)^2}{M^2}, \frac{\partial^2 M^2}{\partial \dot{x}^2 \partial \dot{x}^2} = \frac{(M)^2}{M^2} \tag{7}$$

from (4),(5) if I assume a dimensional number 2. I get

$$\frac{\partial^2 M^1}{\partial \dot{x}^1 \partial \dot{x}^1} = \frac{\partial^2 M^1}{\partial \dot{x}^2 \partial \dot{x}^2}, \frac{\partial^2 M^2}{\partial \dot{x}^1 \partial \dot{x}^1} = \frac{\partial^2 M^2}{\partial \dot{x}^2 \partial \dot{x}^2} \tag{8}$$

from (6),(7). I get

$$\frac{\partial^2 M^1}{\partial \dot{x}^1 \partial \dot{x}^1} = \frac{\partial^2 M^1}{\partial \dot{x}^1 \partial \dot{x}^1} \ (false), \frac{\partial^2 M^2}{\partial \dot{x}^1 \partial \dot{x}^1} = \frac{\partial^2 M^2}{\partial \dot{x}^1 \partial \dot{x}^1} \ (false) \tag{9}$$

from (8) if I assume establishment of $\dot{x}^1 = \dot{x}^2 \ (false)$. Because (9) isn't established,

$$\dot{x}^1 = \dot{x}^2 \tag{10}$$

is established. I get

$$\frac{\partial^2 M^1}{\partial \dot{x}^1 \partial \dot{x}^1} = -M^1, \frac{\partial^2 M^2}{\partial \dot{x}^1 \partial \dot{x}^1} = -M^2, \tag{11}$$

$$\frac{\partial^2 M^1}{\partial \dot{x}^1 \partial \dot{x}^1} = \frac{(M)^2}{M^1}, \frac{\partial^2 M^2}{\partial \dot{x}^1 \partial \dot{x}^1} = \frac{(M)^2}{M^2} \tag{12}$$

in consideration of (10) for (6),(7).

Proposition.3 When all coordinate system satisfies Binary Law, $g^{11} = 2\frac{dM^1}{d\dot{x}^1}\frac{dM^1}{d\dot{x}^1}, g^{12} = 2\frac{dM^1}{d\dot{x}^1}\frac{dM^2}{d\dot{x}^1}, g^{21} = 2\frac{dM^2}{d\dot{x}^1}\frac{dM^1}{d\dot{x}^1} = g^{12}, g^{22} = 2\frac{dM^2}{d\dot{x}^1}\frac{dM^2}{d\dot{x}^1}$ is established for $\frac{\partial^3 M^{\mu}}{\partial x^{\nu} \partial x^{\nu} \partial x^{\nu}} = M: (M > 0)$ if a number of dimension is 2.

Proof. I get

$$d\vec{r} = \overrightarrow{e^{\mu}} dM_{\mu}, \tag{13}$$

$$d\vec{r} = \overrightarrow{e^{\nu}} dx_{\nu}, \tag{14}$$

$$dx_{\nu} = \frac{\partial M^{\mu}}{\partial x^{\nu}} dM_{\mu} \tag{15}$$

from Definision10. $d\vec{r}$ can express either of $\overrightarrow{e^{\nu}} dx_{\nu}, \overrightarrow{e^{\mu}} dx_{\mu}, \overrightarrow{e^{\mu}} dM_{\mu}, \cdots$ here. I get

$$d\vec{r} = \overrightarrow{e^1} dM_1 + \overrightarrow{e^2} dM_2, \tag{16}$$

$$d\vec{r} = \overrightarrow{\dot{e}^1} d\dot{x}_1 + \overrightarrow{\dot{e}^2} d\dot{x}_2, \tag{17}$$

$$d\dot{x}_1 = \frac{\partial M^1}{\partial \dot{x}^1} dM_1 + \frac{\partial M^2}{\partial \dot{x}^1} dM_2, d\dot{x}_2 = \frac{\partial M^1}{\partial \dot{x}^2} dM_1 + \frac{\partial M^2}{\partial \dot{x}^2} dM_2 \tag{18}$$

from (13),(14),(15) if a number of dimension is 2. I get

$$\begin{aligned} ds^2 = d\vec{r} \cdot d\vec{r} &= \left(\overrightarrow{\dot{e}^1} d\dot{x}_1 + \overrightarrow{\dot{e}^2} d\dot{x}_2\right) \cdot \left(\overrightarrow{\dot{e}^1} d\dot{x}_1 + \overrightarrow{\dot{e}^2} d\dot{x}_2\right) \\ &= \left(\overrightarrow{\dot{e}^1} \cdot \overrightarrow{\dot{e}^1}\right) d\dot{x}_1 d\dot{x}_1 + \left(\overrightarrow{\dot{e}^2} \cdot \overrightarrow{\dot{e}^1}\right) d\dot{x}_2 d\dot{x}_1 \\ &\quad + \left(\overrightarrow{\dot{e}^1} \cdot \overrightarrow{\dot{e}^2}\right) d\dot{x}_1 d\dot{x}_2 + \left(\overrightarrow{\dot{e}^2} \cdot \overrightarrow{\dot{e}^2}\right) d\dot{x}_2 d\dot{x}_2 \\ &= d\dot{x}_1 d\dot{x}_1 + d\dot{x}_2 d\dot{x}_2 \end{aligned} \tag{19}$$

from (17). I selected it as $\left(\overrightarrow{\dot{e}^1} \cdot \overrightarrow{\dot{e}^1}\right) = \left(\overrightarrow{\dot{e}^2} \cdot \overrightarrow{\dot{e}^2}\right) = 1, \left(\overrightarrow{\dot{e}^2} \cdot \overrightarrow{\dot{e}^1}\right) = \left(\overrightarrow{\dot{e}^1} \cdot \overrightarrow{\dot{e}^2}\right) = 0$ here. I get

$$\begin{aligned} ds^2 &= \left(\frac{\partial M^1}{\partial \dot{x}^1} dM_1 + \frac{\partial M^2}{\partial \dot{x}^1} dM_2\right)^2 + \left(\frac{\partial M^1}{\partial \dot{x}^2} dM_1 + \frac{\partial M^2}{\partial \dot{x}^2} dM_2\right)^2 \\ &= \frac{\partial M^1}{\partial \dot{x}^1}\frac{\partial M^1}{\partial \dot{x}^1} dM_1 dM_1 + \frac{\partial M^2}{\partial \dot{x}^1}\frac{\partial M^1}{\partial \dot{x}^1} dM_2 dM_1 \\ &\quad + \frac{\partial M^1}{\partial \dot{x}^1}\frac{\partial M^2}{\partial \dot{x}^1} dM_1 dM_2 + \frac{\partial M^2}{\partial \dot{x}^1}\frac{\partial M^2}{\partial \dot{x}^1} dM_2 dM_2 \\ &\quad + \frac{\partial M^1}{\partial \dot{x}^2}\frac{\partial M^1}{\partial \dot{x}^2} dM_1 dM_1 + \frac{\partial M^2}{\partial \dot{x}^2}\frac{\partial M^1}{\partial \dot{x}^2} dM_2 dM_1 \\ &\quad + \frac{\partial M^1}{\partial \dot{x}^2}\frac{\partial M^2}{\partial \dot{x}^2} dM_1 dM_2 + \frac{\partial M^2}{\partial \dot{x}^2}\frac{\partial M^2}{\partial \dot{x}^2} dM_2 dM_2 \\ &= \left(\frac{\partial M^1}{\partial \dot{x}^1}\frac{\partial M^1}{\partial \dot{x}^1} + \frac{\partial M^1}{\partial \dot{x}^2}\frac{\partial M^1}{\partial \dot{x}^2}\right) dM_1 dM_1 + \left(\frac{\partial M^1}{\partial \dot{x}^1}\frac{\partial M^2}{\partial \dot{x}^1} + \frac{\partial M^1}{\partial \dot{x}^2}\frac{\partial M^2}{\partial \dot{x}^2}\right) dM_1 dM_2 \\ &\quad + \left(\frac{\partial M^2}{\partial \dot{x}^1}\frac{\partial M^1}{\partial \dot{x}^1} + \frac{\partial M^2}{\partial \dot{x}^2}\frac{\partial M^1}{\partial \dot{x}^2}\right) dM_2 dM_1 + \left(\frac{\partial M^2}{\partial \dot{x}^1}\frac{\partial M^2}{\partial \dot{x}^1} + \frac{\partial M^2}{\partial \dot{x}^2}\frac{\partial M^2}{\partial \dot{x}^2}\right) dM_2 dM_2 \end{aligned} \tag{20}$$

from (18),(19). I get

$$\begin{aligned} ds^2 = d\vec{r} \cdot d\vec{r} &= \left(\overrightarrow{e^1} dM_1 + \overrightarrow{e^2} dM_2\right) \cdot \left(\overrightarrow{e^1} dM_1 + \overrightarrow{e^2} dM_2\right) \\ &= \left(\overrightarrow{e^1} \cdot \overrightarrow{e^1}\right) dM_1 dM_1 + \left(\overrightarrow{e^2} \cdot \overrightarrow{e^1}\right) dM_2 dM_1 \\ &\quad + \left(\overrightarrow{e^1} \cdot \overrightarrow{e^2}\right) dM_1 dM_2 + \left(\overrightarrow{e^2} \cdot \overrightarrow{e^2}\right) dM_2 dM_2 \end{aligned} \tag{21}$$

from (16). I get

$$\left(\overrightarrow{e^1}\cdot\overrightarrow{e^1}\right)=g^{11}=\frac{\partial M^1}{\partial \dot{x}^1}\frac{\partial M^1}{\partial \dot{x}^1}+\frac{\partial M^1}{\partial \dot{x}^2}\frac{\partial M^1}{\partial \dot{x}^2},$$
$$\left(\overrightarrow{e^1}\cdot\overrightarrow{e^2}\right)=g^{12}=\frac{\partial M^1}{\partial \dot{x}^1}\frac{\partial M^2}{\partial \dot{x}^1}+\frac{\partial M^1}{\partial \dot{x}^2}\frac{\partial M^2}{\partial \dot{x}^2},$$
$$\left(\overrightarrow{e^2}\cdot\overrightarrow{e^1}\right)=g^{21}=\frac{\partial M^2}{\partial \dot{x}^1}\frac{\partial M^1}{\partial \dot{x}^1}+\frac{\partial M^2}{\partial \dot{x}^2}\frac{\partial M^1}{\partial \dot{x}^2},$$
$$\left(\overrightarrow{e^2}\cdot\overrightarrow{e^2}\right)=g^{22}=\frac{\partial M^2}{\partial \dot{x}^1}\frac{\partial M^2}{\partial \dot{x}^1}+\frac{\partial M^2}{\partial \dot{x}^2}\frac{\partial M^2}{\partial \dot{x}^2} \tag{22}$$

from (20), (21). I got (19), (20), (21), (22) with reference to (Fleisch, 2021) here. I rewrite (22) in consideration of (10) and get

$$g^{11}=2\frac{dM^1}{d\dot{x}^1}\frac{dM^1}{d\dot{x}^1},g^{12}=2\frac{dM^1}{d\dot{x}^1}\frac{dM^2}{d\dot{x}^1},$$
$$g^{21}=2\frac{dM^2}{d\dot{x}^1}\frac{dM^1}{d\dot{x}^1}=g^{12},g^{22}=2\frac{dM^2}{d\dot{x}^1}\frac{dM^2}{d\dot{x}^1}. \tag{23}$$

Proposition.4 When all coordinate system satisfies Binary Law,

$$g^{11}=g^{12}=g^{21}=g^{22}=2(M)^2Cos^2\left(\dot{x}^1\right),\ g^{11}=g^{12}=g^{21}=g^{22}=2\frac{dh\left(\dot{x}^1\right)}{d\dot{x}^1}\frac{dh\left(\dot{x}^1\right)}{d\dot{x}^1}$$

is established for $\frac{\partial^3 M^{\mu}}{\partial x^{\nu}\,\partial x^{\nu}\,\partial x^{\nu}}=M:(M>0)$ if a number of dimension is 2. I got $h\left(\dot{x}^1\right)$ by numerical computation using Definision17 here.

Proof. When $M>0$ is established, I get

$$M^1=C[1]Cos\left(\dot{x}^1\right)+C[2]Sin\left(\dot{x}^1\right),$$
$$M^2=C[1]Cos\left(\dot{x}^1\right)+C[2]Sin\left(\dot{x}^1\right) \tag{24}$$

as a solution of the equations of (11) in consideration of Definision16. I get

$$M^1=C[2]Sin\left(\dot{x}^1\right),M^2=C[2]Sin\left(\dot{x}^1\right) \tag{25}$$

as $C[1]=0$ for (24). I assume that

$$x^1=Sin\left(\dot{x}^1\right)\ (false),x^2=Sin\left(\dot{x}^1\right)\ (false) \tag{26}$$

is established. I rewrite (26) using $M^{\mu}=Mx^{\mu}$ and get

$$M^1=MSin\left(\dot{x}^1\right)\ (false),M^2=MSin\left(\dot{x}^1\right)\ (false). \tag{27}$$

I get

$$\frac{d^2M^1}{d\dot{x}^1d\dot{x}^1}=-MSin\left(\dot{x}^1\right)=-M^1\ (false),$$
$$\frac{d^2M^2}{d\dot{x}^1d\dot{x}^1}=-MSin\left(\dot{x}^1\right)=-M^2\ (false) \tag{28}$$

from (27) in consideration of Definision8,(26). I get the conclusion that

$$x^1=Sin\left(\dot{x}^1\right),x^2=Sin\left(\dot{x}^1\right) \tag{29}$$

is established as (28) is not established from (11). I get

$$M^1=C[2]x^1,M^2=C[2]x^2 \tag{30}$$

from (25),(29). I get

$$C[2]=\frac{Mx^1}{x^1}=\frac{Mx^2}{x^2}=M \tag{31}$$

as $M^{\mu}=Mx^{\mu}$ in (30). I get

$$M^1=MSin\left(\dot{x}^1\right),M^2=MSin\left(\dot{x}^1\right) \tag{32}$$

from (25),(31). I get

$$\frac{dM^1}{d\dot{x^1}} = MCos(\dot{x^1}), \frac{dM^2}{d\dot{x^1}} = MCos(\dot{x^1}) \quad (33)$$

from (32) in consideration of Definision8. I get

$$g^{11} = 2(M)^2 Cos^2(\dot{x^1}),$$
$$g^{12} = 2(M)^2 Cos^2(\dot{x^1}) = g^{21},$$
$$g^{22} = 2(M)^2 Cos^2(\dot{x^1}),$$
$$g^{11} = g^{12} = g^{21} = g^{22} = 2(M)^2 Cos^2(\dot{x^1}) = f(\dot{x^1}) \quad (34)$$

from (23), (33).

When $M > 0$ is established, I get

$$M^1 = h(\dot{x^1}), M^2 = h(\dot{x^1}) \quad (35)$$

as a solution of the equations of (12). I got (35) by numerical computation using Definision17 here. I get

$$g^{11} = 2\frac{dh(\dot{x^1})}{d\dot{x^1}}\frac{dh(\dot{x^1})}{d\dot{x^1}}, g^{12} = 2\frac{dh(\dot{x^1})}{d\dot{x^1}}\frac{dh(\dot{x^1})}{d\dot{x^1}} = g^{21},$$
$$g^{22} = 2\frac{dh(\dot{x^1})}{d\dot{x^1}}\frac{dh(\dot{x^1})}{d\dot{x^1}},$$
$$g^{11} = g^{12} = g^{21} = g^{22} = 2\frac{dh(\dot{x^1})}{d\dot{x^1}}\frac{dh(\dot{x^1})}{d\dot{x^1}} = f(\dot{x^1}) \quad (36)$$

from (23), (35).

4. Property of $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M: (M = 0)$

Proposition.5 When all coordinate system satisfies Binary Law, $g^{11} = g^{12} = g^{21} = g^{22} = 2(C[2])^2$ is established for $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M: (M = 0)$ if a number of dimension is 2. $C[2]$ expresses a constant term for variable $\dot{x^1}$ here.

Proof. When $M = 0$ is established, I get

$$\frac{\partial^2 M^\mu}{\partial x^\nu \partial x^\nu} = 0 \quad (37)$$

from (4),(5). I get

$$\frac{\partial^2 M^1}{\partial \dot{x^1} \partial \dot{x^1}} = 0, \frac{\partial^2 M^1}{\partial \dot{x^2} \partial \dot{x^2}} = 0,$$
$$\frac{\partial^2 M^2}{\partial \dot{x^1} \partial \dot{x^1}} = 0, \frac{\partial^2 M^2}{\partial \dot{x^2} \partial \dot{x^2}} = 0 \quad (38)$$

from (37) if I assume a dimensional number 2. I get

$$\frac{\partial^2 M^1}{\partial \dot{x^1} \partial \dot{x^1}} = 0, \frac{\partial^2 M^2}{\partial \dot{x^1} \partial \dot{x^1}} = 0. \quad (39)$$

from (38) in consideration of (10). I get

$$M^1 = C[1] + \dot{x^1} C[2], M^2 = C[1] + \dot{x^1} C[2] \quad (40)$$

as a solution of the equations of (39) in consideration of Definision15. $C[1], C[2]$ expresses a constant term for variable $\dot{x^1}$ here. I get

$$M^1 = C[2]\dot{x^1}, M^2 = C[2]\dot{x^1} \quad (41)$$

as $C[1] = 0$ for (40). I get

$$\frac{dM^1}{d\dot{x^1}} = C[2], \frac{dM^2}{d\dot{x^1}} = C[2] \tag{42}$$

from (41). I get

$$g^{11} = 2(C[2])^2, g^{12} = 2(C[2])^2 = g^{21}, g^{22} = 2(C[2])^2,$$
$$g^{11} = g^{12} = g^{21} = g^{22} = 2(C[2])^2 \tag{43}$$

from (23), (42).

5. Force in the Tensor Satisfying Binary Law

Proposition.6 When all coordinate system satisfies Binary Law, $M' = M - (M)^2(M^1)^{-1}\frac{1}{2}\frac{dg^{11}}{d\dot{x^1}} - (M)^2(M^2)^{-1}\frac{1}{2}\frac{dg^{12}}{d\dot{x^1}} - (M)^2(M^1)^{-1}\frac{1}{2}\frac{dg^{21}}{d\dot{x^1}} - (M)^2(M^2)^{-1}\frac{1}{2}\frac{dg^{22}}{d\dot{x^1}}$ is established for $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M : (M > 0)$ if a number of dimension is 2.

Proof. μ, ν-reverses Definision7 and gets

$$M_\nu^{;\nu} = \frac{\partial M_\nu}{\partial x_\nu} - M_\mu \frac{1}{2}\frac{\partial g^{\nu\mu}}{\partial x^\nu}. \tag{44}$$

If the second term of the right side of (44) is zero, I get

$$M_\nu^{;\nu} = \frac{\partial M_\nu}{\partial x_\nu} = M\frac{\partial x_\nu}{\partial x_\nu} = M \tag{45}$$

in consideration of Definision8, $M_\nu = Mx_\nu$. I get

$$M = M - M_\mu \frac{1}{2}\frac{\partial g^{\nu\mu}}{\partial x^\nu} \tag{46}$$

from (44),(45). I express it in

$$M' = M - M_\mu \frac{1}{2}\frac{\partial g^{\nu\mu}}{\partial x^\nu} \tag{47}$$

to distinguish it as M of the both sides of the equation of (46) is equal. I rewrite (47) using $x_\mu = \frac{1}{x^\mu}, M_\mu = Mx_\mu, M^\mu = Mx^\mu$ and get

$$M' = M - \frac{(M)^2}{M^\mu}\frac{1}{2}\frac{\partial g^{\nu\mu}}{\partial x^\nu}. \tag{48}$$

I get

$$M' = M - \frac{(M)^2}{M^1}\frac{1}{2}\frac{\partial g^{\nu 1}}{\partial x^\nu} - \frac{(M)^2}{M^2}\frac{1}{2}\frac{\partial g^{\nu 2}}{\partial x^\nu},$$
$$M' = M - \frac{(M)^2}{M^1}\frac{1}{2}\frac{\partial g^{11}}{\partial \dot{x^1}} - \frac{(M)^2}{M^2}\frac{1}{2}\frac{\partial g^{12}}{\partial \dot{x^1}} - \frac{(M)^2}{M^1}\frac{1}{2}\frac{\partial g^{21}}{\partial \dot{x^2}} - \frac{(M)^2}{M^2}\frac{1}{2}\frac{\partial g^{22}}{\partial \dot{x^2}} \tag{49}$$

from (48) if I assume a dimensional number 2. I get

$$M' = M - (M)^2(M^1)^{-1}\frac{1}{2}\frac{dg^{11}}{d\dot{x^1}} - (M)^2(M^2)^{-1}\frac{1}{2}\frac{dg^{12}}{d\dot{x^1}}$$
$$-(M)^2(M^1)^{-1}\frac{1}{2}\frac{dg^{21}}{d\dot{x^1}} - (M)^2(M^2)^{-1}\frac{1}{2}\frac{dg^{22}}{d\dot{x^1}} \tag{50}$$

in consideration of (10) for (49).

Proposition.7 When all coordinate system satisfies Binary Law, $F_\nu = -\frac{\partial M}{\partial x^\nu}$ is established.

Proof.

$$\vec{F} = \overrightarrow{e^{\nu}}F_{\nu}, d\vec{r} = \overrightarrow{e_{\nu}}dx^{\nu} \tag{51}$$

is established. I rewrite Definision12 using (51) and get

$$U = -\int \overrightarrow{e^{\nu}}F_{\nu} \cdot \overrightarrow{e_{\nu}}dx^{\nu} = -\int\left(\overrightarrow{e^{\nu}} \cdot \overrightarrow{e_{\nu}}\right)F_{\nu}\, dx^{\nu} = -\int F_{\nu}dx^{\nu}. \tag{52}$$

I get (52) as $\overrightarrow{e^{\nu}} \cdot \overrightarrow{e_{\nu}} = 1$ here. I get

$$F_{\nu} = -\frac{\partial U}{\partial x^{\nu}} \tag{53}$$

from (52). I get

$$U = \frac{c^2}{\epsilon}M \tag{54}$$

from Definision11,Hypothesis1. I get

$$U = M \tag{55}$$

as $\frac{c^2}{\epsilon} = 1$ for (54). In addition, I rewrite Hypothesis1 using $\frac{c^2}{\epsilon} = 1$ and get

$$M = mc^2. \tag{56}$$

I get

$$F_{\nu} = -\frac{\partial M}{\partial x^{\nu}} \tag{57}$$

from (53), (55).

Proposition.8 When all coordinate system satisfies Binary Law, $F_1' = F_2' = -(M)^2(M^1)^{-2}\frac{dM^1}{d\dot{x}^1}\frac{dg^{11}}{d\dot{x}^1} + (M)^2(M^1)^{-1}\frac{d^2g^{11}}{d\dot{x}^1\partial\dot{x}^1} - (M)^2(M^2)^{-2}\frac{dM^2}{d\dot{x}^1}\frac{dg^{11}}{d\dot{x}^1} + (M)^2(M^2)^{-1}\frac{d^2g^{11}}{d\dot{x}^1 d\dot{x}^1}$ is established for $\frac{\partial^3 M^{\mu}}{\partial x^{\nu}\partial x^{\nu}\partial x^{\nu}} = M{:}\,(M > 0)$ if a number of dimension is 2.

Proof. I get

$$F_{\nu}' = -\frac{\partial M'}{\partial x^{\nu}} = -\frac{\partial M}{\partial x^{\nu}} + \frac{\partial}{\partial x^{\nu}}\left(\frac{(M)^2}{M^{\mu}}\frac{1}{2}\frac{\partial g^{\nu\mu}}{\partial x^{\nu}}\right)$$

$$= \frac{\partial}{\partial x^{\nu}}\left(\frac{(M)^2}{M^{\mu}}\frac{1}{2}\frac{\partial g^{\nu\mu}}{\partial x^{\nu}}\right) \tag{58}$$

from (48), (57), Definision8. I get

$$F_1' = \frac{\partial}{\partial \dot{x}^1}\left(\frac{(M)^2}{M^1}\frac{1}{2}\frac{\partial g^{11}}{\partial \dot{x}^1} + \frac{(M)^2}{M^2}\frac{1}{2}\frac{\partial g^{12}}{\partial \dot{x}^1} + \frac{(M)^2}{M^1}\frac{1}{2}\frac{\partial g^{21}}{\partial \dot{x}^2} + \frac{(M)^2}{M^2}\frac{1}{2}\frac{\partial g^{22}}{\partial \dot{x}^2}\right),$$

$$F_2' = \frac{\partial}{\partial \dot{x}^2}\left(\frac{(M)^2}{M^1}\frac{1}{2}\frac{\partial g^{11}}{\partial \dot{x}^1} + \frac{(M)^2}{M^2}\frac{1}{2}\frac{\partial g^{12}}{\partial \dot{x}^1} + \frac{(M)^2}{M^1}\frac{1}{2}\frac{\partial g^{21}}{\partial \dot{x}^2} + \frac{(M)^2}{M^2}\frac{1}{2}\frac{\partial g^{22}}{\partial \dot{x}^2}\right) \tag{59}$$

from (57) if I assume a dimensional number 2. I get

$$F_1' = F_2' = \frac{d}{d\dot{x}^1}\left((M)^2(M^1)^{-1}\frac{1}{2}\frac{dg^{11}}{d\dot{x}^1}\right) + \frac{d}{d\dot{x}^1}\left((M)^2(M^2)^{-1}\frac{1}{2}\frac{dg^{12}}{d\dot{x}^1}\right)$$

$$+\frac{d}{d\dot{x}^1}\left((M)^2(M^1)^{-1}\frac{1}{2}\frac{dg^{21}}{d\dot{x}^1}\right) + \frac{d}{d\dot{x}^1}\left((M)^2(M^2)^{-1}\frac{1}{2}\frac{dg^{22}}{d\dot{x}^1}\right) \tag{60}$$

in consideration of (10) for (59). I get

$$F_1' = F_2' = \frac{d}{d\dot{x}^1}\left((M)^2(M^1)^{-1}\frac{dg^{11}}{d\dot{x}^1}\right) + \frac{d}{d\dot{x}^1}\left((M)^2(M^2)^{-1}\frac{dg^{11}}{d\dot{x}^1}\right) \tag{61}$$

in consideration of (34), (36), (43) for (60). I get

$$F_1' = F_2' = -(M)^2(M^1)^{-2}\frac{dM^1}{d\dot{x}^1}\frac{dg^{11}}{d\dot{x}^1} + (M)^2(M^1)^{-1}\frac{d^2g^{11}}{d\dot{x}^1\,\partial\dot{x}^1}$$

$$-(M)^2(M^2)^{-2}\frac{dM^2}{d\dot{x}^1}\frac{dg^{11}}{d\dot{x}^1} + (M)^2(M^2)^{-1}\frac{d^2g^{11}}{d\dot{x}^1\,\partial\dot{x}^1} \quad (62)$$

from (61).

When $M = 0$ is established, I get

$$\frac{dg^{11}}{d\dot{x}^1} = \frac{d2(C[2])^2}{d\dot{x}^1} = 0, \frac{d^2g^{11}}{d\dot{x}^1\,\partial\dot{x}^1} = 0 \quad (63)$$

from (43). I get

$$F_1' = F_2' = -(M)^2\left(C[2]\dot{x}^1\right)^{-2}C[2]\frac{dg^{11}}{d\dot{x}^1} + (M)^2\left(C[2]\dot{x}^1\right)^{-1}\frac{d^2g^{11}}{d\dot{x}^1\,\partial\dot{x}^1}$$

$$-(M)^2\left(C[2]\dot{x}^1\right)^{-2}C[2]\frac{dg^{11}}{d\dot{x}^1} + (M)^2\left(C[2]\dot{x}^1\right)^{-1}\frac{d^2g^{11}}{d\dot{x}^1\,\partial\dot{x}^1} = 0 \quad (64)$$

from (41),(42),(62),(63).

When $M > 0$ is established, I get

$$\frac{dg^{11}}{d\dot{x}^1} = \frac{d2(M)^2Cos^2\left(\dot{x}^1\right)}{d\dot{x}^1} = -4(M)^2Cos\left(\dot{x}^1\right)Sin\left(\dot{x}^1\right),$$

$$\frac{d^2g^{11}}{d\dot{x}^1\,\partial\dot{x}^1} = -4(M)^2Cos^2\left(\dot{x}^1\right) + 4(M)^2Sin^2\left(\dot{x}^1\right) \quad (65)$$

from (34). I get

$$F_1' = F_2' = -(M)^2\left(MSin\left(\dot{x}^1\right)\right)^{-2}MCos\left(\dot{x}^1\right)\left(-4(M)^2Cos\left(\dot{x}^1\right)Sin\left(\dot{x}^1\right)\right)$$

$$+(M)^2\left(MSin\left(\dot{x}^1\right)\right)^{-1}\left(-4(M)^2Cos^2\left(\dot{x}^1\right) + 4(M)^2Sin^2\left(\dot{x}^1\right)\right)$$

$$-(M)^2\left(MSin\left(\dot{x}^1\right)\right)^{-2}MCos\left(\dot{x}^1\right)\left(-4(M)^2Cos\left(\dot{x}^1\right)Sin\left(\dot{x}^1\right)\right)$$

$$+(M)^2\left(MSin\left(\dot{x}^1\right)\right)^{-1}\left(-4(M)^2Cos^2\left(\dot{x}^1\right) + 4(M)^2Sin^2\left(\dot{x}^1\right)\right)$$

$$= -2(M)^2\left(MSin\left(\dot{x}^1\right)\right)^{-2}MCos\left(\dot{x}^1\right)\left(-4(M)^2Cos\left(\dot{x}^1\right)Sin\left(\dot{x}^1\right)\right)$$

$$+2(M)^2\left(MSin\left(\dot{x}^1\right)\right)^{-1}\left(-4(M)^2Cos^2\left(\dot{x}^1\right) + 4(M)^2Sin^2\left(\dot{x}^1\right)\right)$$

$$= 8(M)^3Sin\left(\dot{x}^1\right) = f\left(\dot{x}^1\right) \quad (66)$$

from (32), (33), (62), (65).

Similarly, when $M > 0$ is established, I get

$$\frac{dg^{11}}{d\dot{x}^1} = \frac{d}{d\dot{x}^1}\left(2\frac{dh\left(\dot{x}^1\right)}{d\dot{x}^1}\frac{dh\left(\dot{x}^1\right)}{d\dot{x}^1}\right) = 4\frac{dh\left(\dot{x}^1\right)}{d\dot{x}^1}\frac{d^2h\left(\dot{x}^1\right)}{d\dot{x}^1d\dot{x}^1},$$

$$\frac{d^2g^{11}}{d\dot{x}^1\,\partial\dot{x}^1} = 4\frac{d^2h\left(\dot{x}^1\right)}{d\dot{x}^1d\dot{x}^1}\frac{d^2h\left(\dot{x}^1\right)}{d\dot{x}^1d\dot{x}^1} + 4\frac{dh\left(\dot{x}^1\right)}{d\dot{x}^1}\frac{d^3h\left(\dot{x}^1\right)}{d\dot{x}^1d\dot{x}^1d\dot{x}^1} \quad (67)$$

from (36). I get

$$F_1' = F_2' = -(M)^2\left(h(\dot{x^1})\right)^{-2}\frac{dh(\dot{x^1})}{d\dot{x^1}}\left(4\frac{dh(\dot{x^1})}{d\dot{x^1}}\frac{d^2h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}}\right)$$
$$+(M)^2\left(h(\dot{x^1})\right)^{-1}\left(4\frac{d^2h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}}\frac{d^2h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}}+4\frac{dh(\dot{x^1})}{d\dot{x^1}}\frac{d^3h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}d\dot{x^1}}\right)$$
$$-(M)^2\left(h(\dot{x^1})\right)^{-2}\frac{dh(\dot{x^1})}{d\dot{x^1}}\left(4\frac{dh(\dot{x^1})}{d\dot{x^1}}\frac{d^2h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}}\right)$$
$$+(M)^2\left(h(\dot{x^1})\right)^{-1}\left(4\frac{d^2h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}}\frac{d^2h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}}+4\frac{dh(\dot{x^1})}{d\dot{x^1}}\frac{d^3h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}d\dot{x^1}}\right)$$
$$= -2(M)^2\left(h(\dot{x^1})\right)^{-2}\frac{dh(\dot{x^1})}{d\dot{x^1}}\left(4\frac{dh(\dot{x^1})}{d\dot{x^1}}\frac{d^2h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}}\right)$$
$$+2(M)^2\left(h(\dot{x^1})\right)^{-1}\left(4\frac{d^2h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}}\frac{d^2h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}}+4\frac{dh(\dot{x^1})}{d\dot{x^1}}\frac{d^3h(\dot{x^1})}{d\dot{x^1}d\dot{x^1}d\dot{x^1}}\right) = f(\dot{x^1}) \quad (68)$$

from (35), (62), (67).

6. Visualization of the Force in the Tensor Satisfying Binary Law

I get

$$r = \sqrt{\left(\dot{x^1}\right)^2 + \left(\dot{x^2}\right)^2}, \theta = tan^{-1}\left(\frac{\dot{x^2}}{\dot{x^1}}\right) \quad (69)$$

as $x \to \dot{x^1}, y \to \dot{x^2}$ for Definision9. I get

$$\dot{x^1} = \frac{r}{\sqrt{2}}, \theta = \frac{\pi}{4} \quad (70)$$

in consideration of (10) for (69). I get

$$\frac{\partial^2 M^1}{\partial\dot{x^1}\,\partial\dot{x^1}} = -M^1 = f(\dot{x^1}) = f\left(\frac{r}{\sqrt{2}}\right) = f(r),$$
$$\frac{\partial^2 M^2}{\partial\dot{x^1}\partial\dot{x^1}} = -M^2 = f(\dot{x^1}) = f\left(\frac{r}{\sqrt{2}}\right) = f(r) \quad (71)$$

in consideration of (70) for (11). I decide to replace (71) with

$$\frac{d^2M^1}{drdr} = -M^1, \frac{d^2M^2}{drdr} = -M^2 \quad (72)$$

by establishment of $f(\dot{x^1}) = f(r)$ from (71). I get

$$g^{11} = g^{12} = g^{21} = g^{22} = 2(M)^2 Cos^2(\dot{x^1}) = f(\dot{x^1}) = f\left(\frac{r}{\sqrt{2}}\right) = f(r) \quad (73)$$

in consideration of (70) for (34). I decide to replace (73) with

$$g^{11} = g^{12} = g^{21} = g^{22} = 2(M)^2 Cos^2(r) \quad (74)$$

by establishment of $f(\dot{x^1}) = f(r)$ from (73). Thus, I convert it into Cartesian coordinate system from polar coordinate in (74) using Definision18. I show figure of scalar field g^{11} of (74) to Figure 1 using Definision19. I get $\left(g^{11} - \left(\dot{x^1} - 5, \dot{x^2}\right)\right)$ plot from $\left(g^{11} - \left(\dot{x^1}, \dot{x^2}\right)\right)$ plot of Figure 1. Similarly, I get $\left(g^{11} - \left(\dot{x^1} + 5, \dot{x^2}\right)\right)$ plot from $\left(g^{11} - \left(\dot{x^1}, \dot{x^2}\right)\right)$ plot of Figure 1. I show sum of $\left(g^{11} - \left(\dot{x^1} - 5, \dot{x^2}\right)\right)$ plot and the $\left(g^{11} - \left(\dot{x^1} + 5, \dot{x^2}\right)\right)$ plot in Figure 2. I get

$$F_1' = F_2' = 8(M)^3 Sin(\dot{x^1}) = f(\dot{x^1}) = f\left(\frac{r}{\sqrt{2}}\right) = f(r) \quad (75)$$

in consideration of (70) for (66). I decide to replace (75) with

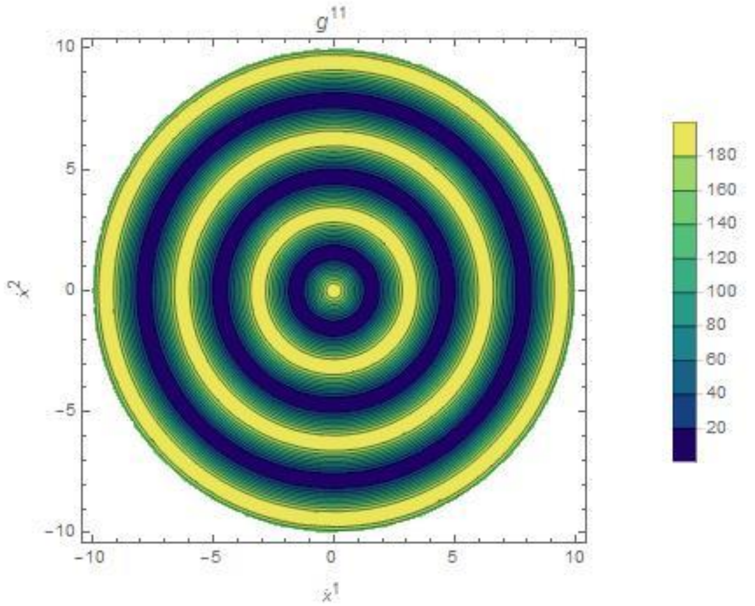

Figure 1. $\left(g^{11}-\left(\dot{x^1},\dot{x^2}\right)\right):\left\{\sqrt{\left(\dot{x^1}\right)^2+\left(\dot{x^2}\right)^2}\leq 10\right\}$ as $g^{11}=2(M)^2Cos^2(r):\left\{M=10, r=\sqrt{\left(\dot{x^1}\right)^2+\left(\dot{x^2}\right)^2}, \dot{x^1}=\dot{x^2}\right\}$

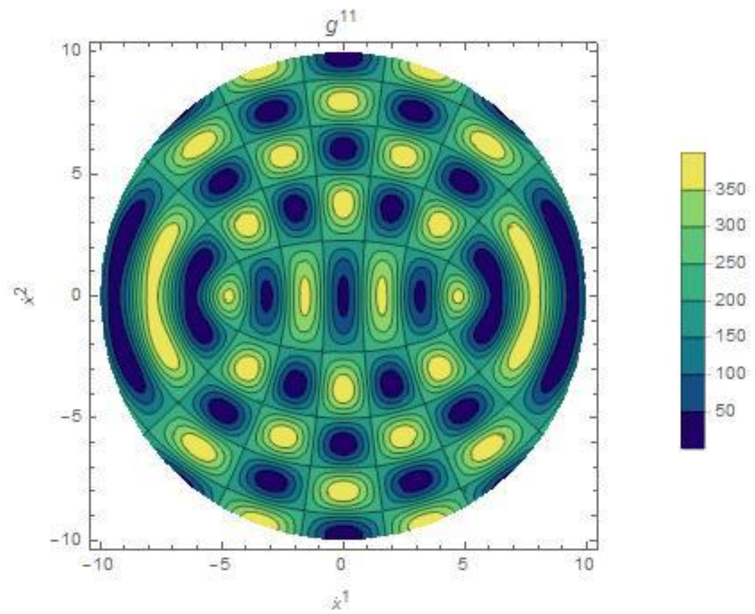

Figure 2. Sum of $\left(g^{11}-\left(\dot{x^1}-5,\dot{x^2}\right)\right)$ and $\left(g^{11}-\left(\dot{x^1}+5,\dot{x^2}\right)\right):\left\{\sqrt{\left(\dot{x^1}\right)^2+\left(\dot{x^2}\right)^2}\leq 10\right\}$ as $g^{11}=2(M)^2Cos^2(r):\left\{M=10, r=\sqrt{\left(\dot{x^1}\right)^2+\left(\dot{x^2}\right)^2}, \dot{x^1}=\dot{x^2}\right\}$.

$$F_1' = F_2' = 8(M)^3Sin(r) \tag{76}$$

by establishment of $f(\dot{x}^1) = f(r)$ from (75). Thus, I convert it into Cartesian coordinate system from polar coordinate in (76) using Definision20. I considered establishment of $\theta = \frac{\pi}{4}$ from (70) here. I show figure of vector field (F_1', F_2') of (76) to Figure 3 using Definision21. The circle by the magenta line in Figure 3 expressed the

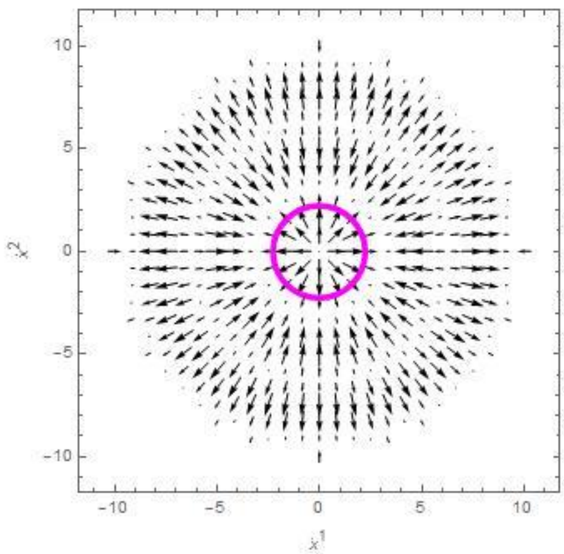

Figure 3. $\left((F_1', F_2') - (\dot{x}^1, \dot{x}^2)\right) : \left\{\sqrt{(\dot{x}^1)^2 + (\dot{x}^2)^2} \le 10\right\}$ as $F_1' = F_2' = 8(M)^3 Sin(r) : \left\{M = 10, r = \sqrt{(\dot{x}^1)^2 + (\dot{x}^2)^2}, \dot{x}^1 = \dot{x}^2\right\}$

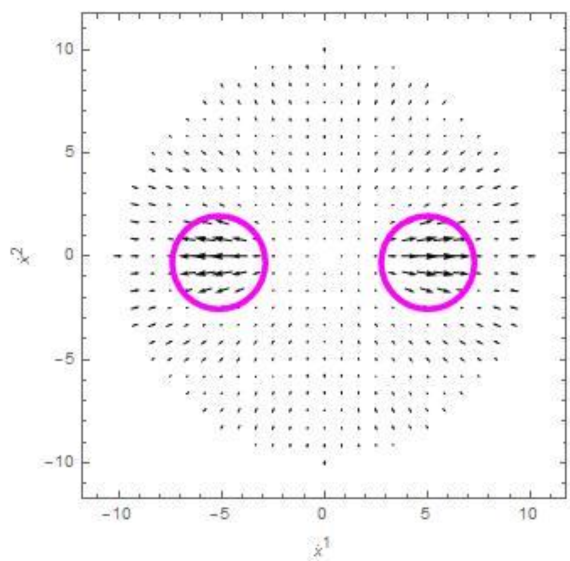

Figure 4. Sum of $\left((F_1', F_2') - (\dot{x}^1 - 5, \dot{x}^2)\right)$ and $\left((F_1', F_2') - (\dot{x}^1 + 5, \dot{x}^2)\right) : \left\{\sqrt{(\dot{x}^1)^2 + (\dot{x}^2)^2} \le 10\right\}$ as

$$F_1' = F_2' = 8(M)^3 Sin(r) : \left\{M = 10, r = \sqrt{(\dot{x}^1)^2 + (\dot{x}^2)^2}, \dot{x}^1 = \dot{x}^2\right\}$$

area where a lump of the matter occupied space as a disk. As I assume a number of dimension 2 here, a lump of the matter expresses area occupying space as a disk. I can confirm existence of the central force with the center of gravity of the lump of the matter as divergence point from Figure 3. As this central force maintains symmetric property, central force does not move the center of gravity of the lump of the matter in the specific direction. I get $\left((F_1', F_2') - \left(\dot{x^1} - 5, \dot{x^2}\right)\right)$ plot from $\left((F_1', F_2') - \left(\dot{x^1}, \dot{x^2}\right)\right)$ plot of Figure 3. Similarly, I get $\left((F_1', F_2') - \left(\dot{x^1} + 5, \dot{x^2}\right)\right)$ plot from $\left((F_1', F_2') - \left(\dot{x^1}, \dot{x^2}\right)\right)$ plot of Figure 3. I show sum of $\left((F_1', F_2') - \left(\dot{x^1} - 5, \dot{x^2}\right)\right)$ plot and the $\left((F_1', F_2') - \left(\dot{x^1} + 5, \dot{x^2}\right)\right)$ plot in Figure 4. The circle by the magenta line in Figure 4 expressed the area where a lump of the matter occupied space as a disk. Figure 4 shows the case that there are two lumps of the matter in the same space. As the symmetric property of the central force collapses here, the central force moves the center of gravity of the lump of the matter in the specific direction. This force arrives at the repulsive force to act between two lumps of the matter. I get

$$\frac{\partial^2 M^1}{\partial \dot{x^1}\,\partial \dot{x^1}} = \frac{(M)^2}{M^1} = f\left(\dot{x^1}\right) = f\left(\frac{r}{\sqrt{2}}\right) = f(r),$$

$$\frac{\partial^2 M^2}{\partial \dot{x^1}\,\partial \dot{x^1}} = \frac{(M)^2}{M^2} = f\left(\dot{x^1}\right) = f\left(\frac{r}{\sqrt{2}}\right) = f(r) \tag{77}$$

in consideration of (70) for (12). I decide to replace (77) with

$$\frac{d^2 M^1}{drdr} = \frac{(M)^2}{M^1}, \frac{d^2 M^2}{drdr} = \frac{(M)^2}{M^2} \tag{78}$$

by establishment of $f\left(\dot{x^1}\right) = f(r)$ from (77). I get

$$g^{11} = g^{12} = g^{21} = g^{22} = 2\frac{dh\left(\dot{x^1}\right)}{d\dot{x^1}}\frac{dh\left(\dot{x^1}\right)}{d\dot{x^1}} = f\left(\dot{x^1}\right) = f\left(\frac{r}{\sqrt{2}}\right) = f(r) \tag{79}$$

in consideration of (70) for (36). I decide to replace (79) with

$$g^{11} = g^{12} = g^{21} = g^{22} = 2\frac{dh(r)}{dr}\frac{dh(r)}{dr} \tag{80}$$

by establishment of $f\left(\dot{x^1}\right) = f(r)$ from (79). Thus, I convert it into Cartesian coordinate system from polar coordinate in (80) using Definision17, Definision22. I show figure of scalar field g^{11} of (80) to Figure 5 using Definision17, Definision23. I get $\left(g^{11} - \left(\dot{x^1} - 5 \times 10^{-7}, \dot{x^2}\right)\right)$ plot from $\left(g^{11} - \left(\dot{x^1}, \dot{x^2}\right)\right)$ plot of Figure 5. Similarly, I get $\left(g^{11} - \left(\dot{x^1} + 5 \times 10^{-7}, \dot{x^2}\right)\right)$ plot from $\left(g^{11} - \left(\dot{x^1}, \dot{x^2}\right)\right)$ plot of Figure 5. I show sum of $\left(g^{11} - \left(\dot{x^1} - 5 \times 10^{-7}, \dot{x^2}\right)\right)$ plot and the $\left(g^{11} - \left(\dot{x^1} + 5 \times 10^{-7}, \dot{x^2}\right)\right)$ plot in Figure 6. I get

$$F_1' = F_2' = -2(M)^2\left(h\left(\dot{x^1}\right)\right)^{-2}\frac{dh\left(\dot{x^1}\right)}{d\dot{x^1}}\left(4\frac{dh\left(\dot{x^1}\right)}{d\dot{x^1}}\frac{d^2h\left(\dot{x^1}\right)}{d\dot{x^1}d\dot{x^1}}\right)$$
$$+2(M)^2\left(h\left(\dot{x^1}\right)\right)^{-1}\left(4\frac{d^2h\left(\dot{x^1}\right)}{d\dot{x^1}d\dot{x^1}}\frac{d^2h\left(\dot{x^1}\right)}{d\dot{x^1}d\dot{x^1}} + 4\frac{dh\left(\dot{x^1}\right)}{d\dot{x^1}}\frac{d^3h\left(\dot{x^1}\right)}{d\dot{x^1}d\dot{x^1}d\dot{x^1}}\right) = f\left(\dot{x^1}\right)$$
$$= f\left(\frac{r}{\sqrt{2}}\right) = f(r) \tag{81}$$

in consideration of (70) for (68). I decide to replace (81) with

$$F_1' = F_2' = -2(M)^2\left(h(r)\right)^{-2}\frac{dh(r)}{dr}\left(4\frac{dh(r)}{dr}\frac{d^2h(r)}{drdr}\right)$$
$$+2(M)^2\left(h(r)\right)^{-1}\left(4\frac{d^2h(r)}{drdr}\frac{d^2h(r)}{drdr}+4\frac{dh(r)}{dr}\frac{d^3h(r)}{drdrdr}\right) \quad (82)$$

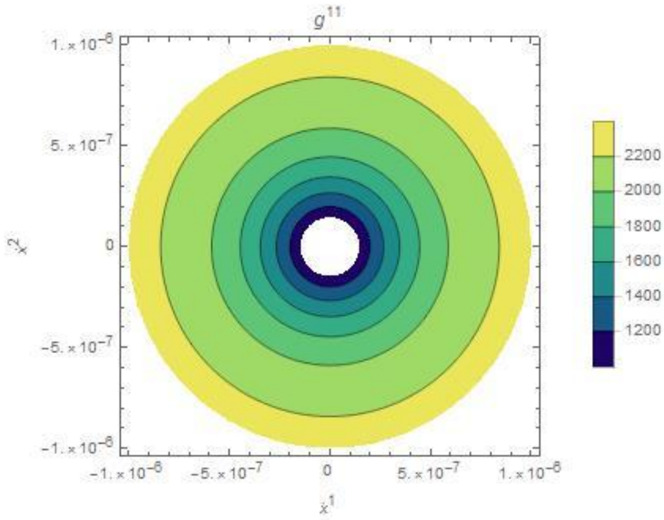

Figure 5. $\left(g^{11}-(\dot{x^1},\dot{x^2})\right):\left\{\sqrt{(\dot{x^1})^2+(\dot{x^2})^2}\le 10^{-6}\right\}$ as $g^{11}=2\frac{dh(r)}{dr}\frac{dh(r)}{dr}:\left\{M=10, r=\sqrt{(\dot{x^1})^2+(\dot{x^2})^2}, \dot{x^1}=\dot{x^2}\right\}$. $h(r)$ expresses a solution by the numerical computation of $\frac{d^2M^1}{drdr}=\frac{(M)^2}{M^1}, \frac{d^2M^2}{drdr}=\frac{(M)^2}{M^2}$

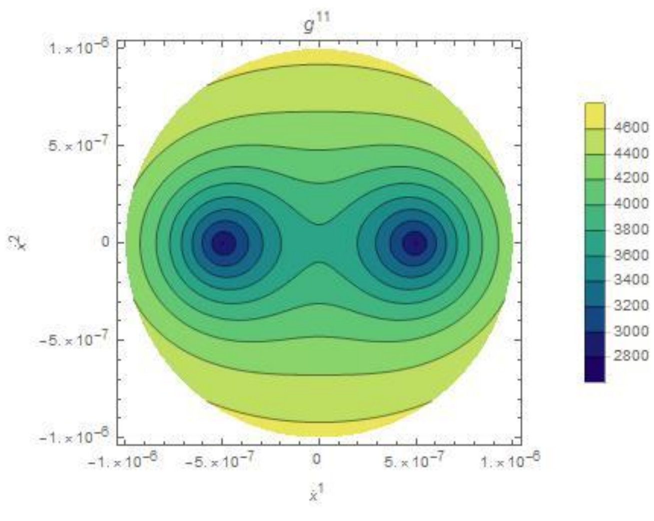

Figure 6. Sum of $\left(g^{11}-(\dot{x^1}-5\times10^{-7},\dot{x^2})\right)$ and $\left(g^{11}-(\dot{x^1}+5\times10^{-7},\dot{x^2})\right):\left\{\sqrt{(\dot{x^1})^2+(\dot{x^2})^2}\le 10^{-6}\right\}$ as $g^{11}=2\frac{dh(r)}{dr}\frac{dh(r)}{dr}:\left\{M=10, r=\sqrt{(\dot{x^1})^2+(\dot{x^2})^2}, \dot{x^1}=\dot{x^2}\right\}$. $h(r)$ expresses a solution by the numerical computation of $\frac{d^2M^1}{drdr}=\frac{(M)^2}{M^1}, \frac{d^2M^2}{drdr}=\frac{(M)^2}{M^2}$

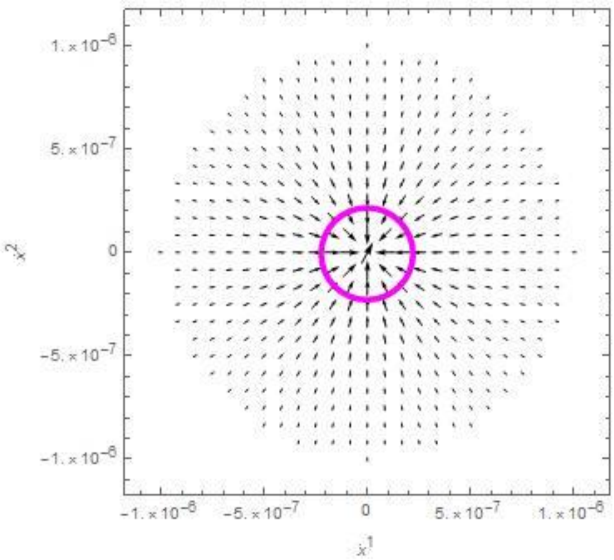

Figure 7. $\left((F_1', F_2') - (\dot{x^1}, \dot{x^2})\right) : \left\{\sqrt{\left(\dot{x^1}\right)^2 + \left(\dot{x^2}\right)^2} \leq 10^{-6}\right\}$ as $F_1' = F_2' = -2(M)^2\left(h(r)\right)^{-2}\frac{dh(r)}{dr}\left(4\frac{dh(r)}{dr}\frac{d^2h(r)}{drdr}\right)$ $+2(M)^2\left(h(r)\right)^{-1}\left(4\frac{d^2h(r)}{drdr}\frac{d^2h(r)}{drdr} + 4\frac{dh(r)}{dr}\frac{d^3h(r)}{drdrdr}\right) : \left\{M = 10, r = \sqrt{\left(\dot{x^1}\right)^2 + \left(\dot{x^2}\right)^2}, \dot{x^1} = \dot{x^2}\right\}$. $h(r)$ expresses a solution by the numerical computation of $\frac{d^2M^1}{drdr} = \frac{(M)^2}{M^1}, \frac{d^2M^2}{drdr} = \frac{(M)^2}{M^2}$

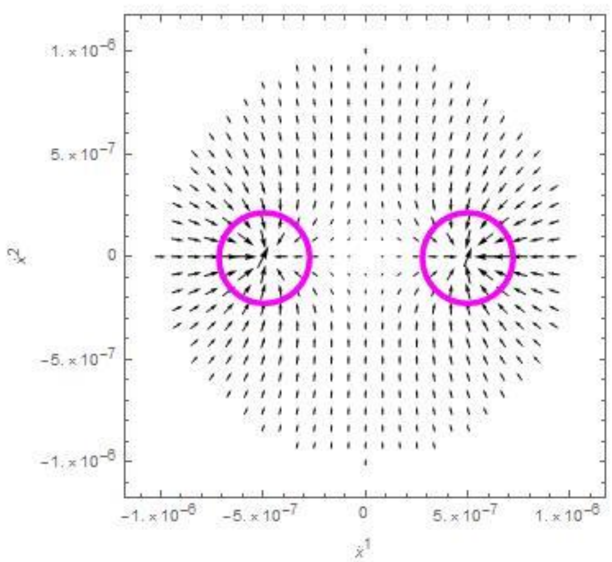

Figure 8. Sum of $\left((F_1', F_2') - (\dot{x^1} - 5\times10^{-7}, \dot{x^2})\right)$ and $\left((F_1', F_2') - (\dot{x^1} + 5\times10^{-7}, \dot{x^2})\right) : \left\{\sqrt{\left(\dot{x^1}\right)^2 + \left(\dot{x^2}\right)^2} \leq 10^{-6}\right\}$ as $F_1' = F_2' = -2(M)^2\left(h(r)\right)^{-2}\frac{dh(r)}{dr}\left(4\frac{dh(r)}{dr}\frac{d^2h(r)}{drdr}\right) + 2(M)^2\left(h(r)\right)^{-1}\left(4\frac{d^2h(r)}{drdr}\frac{d^2h(r)}{drdr} + 4\frac{dh(r)}{dr}\frac{d^3h(r)}{drdrdr}\right) : \left\{M = 10, r = \sqrt{\left(\dot{x^1}\right)^2 + \left(\dot{x^2}\right)^2}, \dot{x^1} = \dot{x^2}\right\}$. $h(r)$ expresses a solution by the numerical computation of $\frac{d^2M^1}{drdr} = \frac{(M)^2}{M^1}, \frac{d^2M^2}{drdr} = \frac{(M)^2}{M^2}$ by establishment of $f\left(\dot{x^1}\right) = f(r)$ from (81).

Thus, I convert it into Cartesian coordinate system from polar coordinate in (82) using Definision17, Definision24. I considered establishment of $\theta = \frac{\pi}{4}$ from (70) here. I show figure of vector field (F_1', F_2') of (82) to Figure 7 using Definision17, Definision25. The circle by the magenta line in Figure 7 expressed the area where a lump of the matter occupied space as a disk. As I assume a number of dimension 2 here, a lump of the matter expresses area occupying space as a disk. I can confirm existence of the central force towards the center of gravity of the lump of the matter from Figure 7. As this central force maintains symmetric property, central force does not move the center of gravity of the lump of the matter in the specific direction. However, this central force compresses a lump of the matter towards the center of gravity. And the compressive force becomes maximum in the center of gravity of the lump of the matter and decreases as it shifts to the border of the lump of the matter. I get $\left((F_1', F_2') - (\dot{x^1} - 5 \times 10^{-7}, \dot{x^2})\right)$ plot from $\left((F_1', F_2') - (\dot{x^1}, \dot{x^2})\right)$ plot of Figure 7. Similarly, I get $\left((F_1', F_2') - (\dot{x^1} + 5 \times 10^{-7}, \dot{x^2})\right)$ plot from $\left((F_1', F_2') - (\dot{x^1}, \dot{x^2})\right)$ plot of Figure 7. I show sum of $\left((F_1', F_2') - (\dot{x^1} - 5 \times 10^{-7}, \dot{x^2})\right)$ plot and the $\left((F_1', F_2') - (\dot{x^1} + 5 \times 10^{-7}, \dot{x^2})\right)$ plot in Figure 8. The circle by the magenta line in Figure 8 expressed the area where a lump of the matter occupied space as a disk. Figure 8 shows the case that there are two lumps of the matter in the same space. As the symmetric property of the central force collapses here, the central force moves the center of gravity of the lump of the matter in the specific direction. This force arrives at attractive force to act between two lumps of the matter.

7. Discussion

I express field of the metric when there is one matter lump on the space in Figure 1. I express field of the metric when there are two matter lumps on the space in Figure 2. The existence of the field of the metric in the Figure 1, Figure 2 is not found. Matter is right wave than Figure 1. It is wave of the space-time, and this is not wave changing for the time when we can imagine it. I do not know whether this is cause with a property as the wave of the matter. Wave length λ of the wave of the matter is very small for our body height h. I can think that the wave of the matter does not exist in the scale of body height h. In contrast, the character as the wave of the matter appears in the scale of wave length λ of the wave of the matter strongly.

I express field of force when there is one matter lump on the space in Figure 3. I express field of force when there are two matter lumps on the space in Figure 4. The existence of the field of force in the Figure 3, Figure 4 is not found.

It is interesting that force to be caused between two matter lumps on the space in Figure 4 is repulsive force.

I express field of the metric when there is one matter lump on the space in Figure 5. I express field of the metric when there are two matter lumps on the space in Figure 6. These accord with consequence from general relativity qualitatively.

I express field of force when there is one matter lump on the space in Figure 7. According to this, I can explain gravity to be caused in one matter lump qualitatively. I express the force that is going to crush a lump of the matter towards the center of gravity of the lump of the matter with "gravity" here. I express field of force when there are two matter lumps on the space in Figure 8. According to this, I can explain universal gravitation to be caused between two matter lumps qualitatively.

I understood that metric field shown in Figure 1, Figure 5 appeared from $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M$ in case of $M > 0$. If I think "M" to be equivalent to mass of the matter. When matter exists, both have metric field shown in Figure 1, Figure 5 to the matter. I think that the Figure 1 shows a matter wave qualitatively, and Figure 5 shows gravitational field qualitatively. When matter did not exist, I explained that the metric field shown in Figure 1, Figure 5 did not appear in Chapter 4. From these, I propose $\frac{\partial^3 M^\mu}{\partial x^\nu \partial x^\nu \partial x^\nu} = M$ as the mathematics equation that matter follows.

8. One Prospect of the Technology Based on My Delusion

I regard a lump of the matter in Figure 8 as a car and the earth each. In this case the car receives the attractive force of the center of gravity direction of the earth, and the earth receives the attractive force of the car center of gravity direction. The car exists with a certain weight close to ground. Well, I can consider that there is the car in an acceleration kinetic system if I indicate equivalence principle for a car. In other words, I can expect that symmetric property of the field of the metric around the car in the acceleration kinetic system collapses. And, as for the force to appear by this symmetric break, inertial force of the matter that we know can expect that it is equivalent.

I think about the case which there is a car in the International Space Station flying at a height of 400 km above the ground. As for the attractive force of the center of gravity direction of the earth which a car receives, the distinction of the volume is very small in ground and the 400 km sky. And it is expected that the car in the International Space Station has a certain weight. However, there is it in an acceleration kinetic system as the International Space Station free-falls. I can expect that a symmetric break of the field of the metric around the car occurs with this acceleration kinetic system. This symmetric break restores a symmetric break of the field of the metric around the car occurring by gravitational field of the earth, and the force that the car receives can expect with minimum. In this case I can expect that the symmetric property of the field of the metric around the car follows Figure 7. The restoration of the symmetric break of the field of the metric around the car occurring by gravitational field of the earth is possible by taking the acceleration kinetic system, but I do not know other means.

I can expect that a car is freed from gravitational influence in the ground if I can operate a symmetric break of the field of the metric around the car freely artificially. Furthermore, I can expect that a vehicle speed changes if I operate symmetric property of the field of the metric for a car front part and the rear. In this case if symmetric breaks increase, I can expect that the force to appear increases.

9. Conclusion

I was able to confirm existence of two kinds of field of force in space-time around the matter from Figure 3, Figure 7. The field of force of Figure 7 keeps symmetry for the center of gravity of the matter. Figure 8 expresses the case that there is another matter in neighborhood of this matter. It understood from Figure 8 that the symmetry of the field of force of the matter was broken by interaction with the field of force of other matter. The symmetric collapse of this field of force is caused for both fields of force around the matter. The symmetric collapse of this field of force brings the force that is dissymmetry to matter. When force does not act on matter, the field of force around the matter keeps symmetry from these. And I get the conclusion that the symmetry of the field of force around the matter collapses when force acts on matter.

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No additional data are available.

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