Chapter 2

Examining Three of the Five Inconsistencies in the Relativity Theory

2.1 The Fifth Inconsistency

Equation 2-1-1 is principally effective, even if totally effective, even if the total effect becomes closer to zero, when velocity becomes closer to the speed of light *c*.

$$U_{\mathrm{ay}} = dv\sqrt{1-\frac{v^2}{c^2}}$$

$$U_{\mathrm{by}} = -dv \qquad \text{2-1-1}$$

That is, between two frames, there is relative movement that satisfies the principle of relativity and the principle of equivalence. But, when velocity *v* becomes light speed *c*, there are no relative movements that lead to significant inconsistency. Nevertheless, when applied to the case between principally effective values of close to zero and a principally ineffective value of close to zero, this theory cannot guarantee physical justification of the results because there are agreements with theoretical prediction and experimental observation (e.g., the case of starlight deflection by the sun). This means that the quantitative prediction is right but qualitatively wrong. The first person who tried such a calculation was Johann Georg Von Soldner (1776−1833), whose calculation process and results were published in one of Germany's astronomical journals in 1801 [*Berliner Astronomer Jahrbuch*, pp. 161−172].

That Newtonian diffraction angle θ_N was

$$\theta_N = \frac{dv_\odot}{c} = 0.875'' \qquad \text{2-1-2}$$

Another calculation was performed by Einstein, who used only his equivalence principle. His diffraction angle θ_E was

$$\theta_E = \frac{dv_\odot}{c} = 0.875'' \qquad \text{2-1-3}$$

The free-fall diffraction angle and angle of curve of force line are the same by change of vacuum expectation value near the sun and related charge screening degree (cf. §18.8, §20.3)

$$d\theta = \theta_c = \theta_E = 0.875'' = \frac{2GM_\odot}{c^2 R_\odot} \qquad \text{2-1-4}$$

Therefore, total angle by the sun is the sum of the Newtonian diffraction angle and curved angle of force line by relativity of CFLE theory (cf.§18.8,§20.3). That is

$$\theta_t = \theta_N + \theta_c = \frac{dv_\odot}{c} + \frac{dv_\odot}{c}$$

$$= \frac{2GM_\odot}{c^2 R_\odot} + \frac{2GM_\odot}{c^2 R_\odot} = \frac{4GM_\odot}{c^2 R_\odot} = 1.75'' \qquad \text{2-1-5}$$

Those results are the same as the full field equation of the general relativity theory as curved space theory (cf. §1.1).

The really important point is that the $\Delta\theta_{curve\ of\ force\ line}$ is

$$\Delta\theta_{curve\ of\ force\ line} = \frac{2GM_\odot}{c^2 R_\odot} \qquad \text{2-1-6}$$

Note there are no relative movements of the *y*-axes, because velocity is $v = c$,

$$U_{ay} = dv\sqrt{1 - \frac{v^2}{c^2}} = dv_\odot \cdot 0 = 0 \qquad \text{2-1-7}$$

$$U_{\mathrm{by}} = -dv = -dv_{\odot} = -dv_{\odot} \qquad \text{2-1-8}$$

Therefore, any physical consideration of no relative movement of the y component, which is a fatal contradiction of this theory, is easily replaced by pure mathematical analysis. In fact, Einstein appropriately analyzed this problem. Realistically, there are no relative movements of the *y* component (when light moves along a straight path, light has no mass) and the light path is curved double according to the principle of relativity and equivalence principle. These results imply that "space-time is curved by gravity". In this curved space, light moves along a straight path (old Euclidian definition of a straight line); namely, "light moves in curved space straight forward". To mathematically generalize and formulate this concept, Riemann geometry was chosen and the metric tensor component $g_{\lambda\mu}$ was introduced. The definition of the distance between two points was changed:

$$dl^2 = dx^2 + dy^2 \Rightarrow dl^2$$

$$= g_{11}dx^2 + 2g_{12}dxdy + g_{22}dy^2 \qquad \text{2-1-9}$$

According to this idea, gravity causes empty space to curve, and an object that has mass has to move along a straight path in curved space. After such generalization of curved space, we have to solve the relative movement of the *y* component when velocity is not *c*, since in curved space the relative movement of the *y* component, even by Newtonian gravity, must always be zero for such mathematical consistency to be held without limits. Therefore, equivalence between gravity and acceleration (gravitational mass equivalent inertial mass) must be needed a necessary condition. The first person who calculated this was Erwin Schrödinger. He applied the full field equation from general relativity to calculate the energy density of the outside of a heavy ball. This calculation and its process were published in *Physik Zeitschrift* in November 1918. This original article (about inevitable negative infinity) is presented in the next few pages in order to emphasize its contradiction with the Penrose–Hawking singularity theorem (about inevitable positive infinity), as well as to remind us that Schrödinger's 1918 calculations apply equally to present-day science.

At that time, even Einstein was surprised about Schrödinger's findings. But after reviewing Schrödinger's calculation, Einstein dismissed the results as being applicable only to the existing physical fields, such as an electromagnetic field, but definitely not to a gravitational field. Therefore, the relativity theory remained incompatible with the classical electromagnetic theory, and Einstein maintained his theory to be correct. His own (English-translated) words about this were,

> "For infinitely small four-dimensional regions the theory of relativity in the restricted sense is appropriate, if the co-ordinates are suitably chosen." [1]

However, because the equivalence principle must become a universal principle in the general theory of relativity, according to Einstein's assertion, the general theory of relativity now can be forever unlimitedly established (according to such assertion that co-ordinates can always be suitably chosen). Such unlimited establishing is only speculatively and mathematically possible. Philosophically and physically, is it impossible, as demonstrated in the following simple analysis.

The problematic relative movements of the *y* components are

$$U_{\mathrm{ay}} = dv\sqrt{1-\frac{v^2}{c^2}} \qquad \text{2-1-10}$$

$$U_{\mathrm{by}} = -dv \qquad \text{2-1-11}$$

1. Excerpt from Einstein, Albert. 1916. *The Foundation of the General Theory of Relativity*, p. 154 in the Translation Volume. Available at http://www.alberteinstein.info/gallery/gtext3.html (accessed June 2011).

$$\frac{d}{ds}\left(\mathfrak{s}-\frac{\mathfrak{w}}{c}\right)=-\frac{1}{c}\,\mathrm{grad}\,(\mathfrak{w}\mathfrak{s}), \qquad (8)$$

wobei die Operation grad sich nur auf $\mathfrak{w}$, nicht aber auf $\mathfrak{s}$ bezieht. Nun ist bekanntlich nach der Definition des Krümmungsvektors

$$\mathfrak{k}=\frac{d\mathfrak{s}}{ds}$$

also ist nach Gleichung (8)

$$\mathfrak{k}=\frac{1}{c}\frac{d\mathfrak{w}}{ds}-\frac{1}{c}\,\mathrm{grad}\,(\mathfrak{w}\mathfrak{s}). \qquad (9)$$

Nun gilt für zwei beliebige Vektorfelder $\mathfrak{A}$ und $\mathfrak{B}$ die Identität[1])

$$\mathrm{grad}\,(\mathfrak{A}\mathfrak{B})=(\mathfrak{A}\nabla)\mathfrak{B}+(\mathfrak{B}\nabla)\mathfrak{A}+[\mathfrak{A}\,\mathrm{rot}\,\mathfrak{B}]+[\mathfrak{B}\,\mathrm{rot}\,\mathfrak{A}].$$

Setzen wir hierin $\mathfrak{A}=\mathfrak{w}$, $\mathfrak{B}=\mathfrak{s}$ und beachten, daß $\mathfrak{s}$ nicht als Funktion der Koordinaten zu betrachten ist, also durch die Operationen rot und ∇ zu Null gemacht wird, so ergibt sich

$$\mathrm{grad}\,(\mathfrak{w}\mathfrak{s})=(\mathfrak{s}\nabla)\mathfrak{w}+[\mathfrak{s}\,\mathrm{rot}\,\mathfrak{w}] \qquad (10)$$

Da nun nach der Bedeutung von ∇ bekanntlich

$$\frac{d\mathfrak{w}}{ds}=(\mathfrak{s}\nabla)\mathfrak{w},$$

erhalten wir aus Gleichung (9) und (10) die zu beweisende Gleichung (5).

1) Siehe z. B. W. v. Ignatowsky, Die Vektoranalysis, Bd. I, Gl. 68.

Prag, 7. November 1917.

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Die Energiekomponenten des Gravitationsfeldes.

Von Erwin Schrödinger.

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1. In der Gravitationstheorie der allgemeinen Relativität spielen — insbesondere für die Art der Einführung des Energietensors der Materie in die Feldgleichungen — eine ausschlaggebende Rolle die 16 Größen t_σ^ν, welche Einstein als Energiekomponenten des Gravitationsfeldes bezeichnet[1]). Bedient man sich eines Koordinatensystems, für welches

$$\sqrt{-g}=1, \qquad (1)$$

so erhält man für die t_σ^α die verhältnismäßig einfachen Ausdrücke

$$\varkappa t_\sigma^\alpha=\frac{1}{2}\delta_\sigma^\alpha g^{\mu\nu}\Gamma_{\mu\beta}^\lambda\Gamma_{\nu\lambda}^\beta-g^{\mu\nu}\Gamma_{\mu\beta}^\alpha\Gamma_{\nu\sigma}^\beta, \qquad (2)$$

wobei — wie im folgenden stets, wenn nicht ausdrücklich das Gegenteil bemerkt — über zweimal auftretende allgemeine Indizes von 1 bis 4 zu summieren ist. — Zeichenerklärung:

$$\Gamma_{\mu\nu}^\lambda=-g^{\lambda\beta}\begin{bmatrix}\mu\nu\\ \beta\end{bmatrix}=-\frac{1}{2}g^{\lambda\beta}\left[\frac{\partial g_{\nu\beta}}{\partial x_\nu}+\frac{\partial g_{\nu\beta}}{\partial x_\mu}-\frac{\partial g_{\mu\nu}}{\partial x_\beta}\right]; \qquad (3)$$

die $g_{\mu\nu}$ sind in gewohnter Weise durch den Ausdruck für das Quadrat des (vierdimensionalen) Linienelements definiert:

$$ds^2=g_{\mu\nu}\,dx_\mu\,dx_\nu;\quad g_{\nu\mu}=g_{\mu\nu},\quad g=\text{Det. der } g_{\mu\nu}. \qquad (4)$$

Die $g^{\mu\nu}$ sind die adjungierten, normierten Unterdeterminanten 1. Ordnung im Schema der $g_{\mu\nu}$. Endlich ist

$$\delta_\sigma^\alpha=g_{\mu\sigma}g^{\mu\alpha}=\begin{matrix}0\\1\end{matrix}\Big\}\text{ für }\Big\{\begin{matrix}\sigma\neq\alpha\\ \sigma=\alpha\end{matrix} \qquad (5)$$

und $\varkappa$ (im wesentlichen) die Gravitationskonstante.

Den Gegenstand dieser Mitteilung bildet die explizite Berechnung der Größen t_σ^α in der Umgebung einer ruhenden Kugel aus inkompressibler, gravitierender Flüssigkeit. Die Rechnung wird auf Grund der von Schwarzschild[1]) ermittelten Werte der $g_{\mu\nu}$ exakt durchgeführt für ein räumliches Koordinatensystem, das sich von einem rechtwinkligen kartesischen nur äußerst wenig unterscheidet, ja vielleicht geradezu als ein solches bezeichnet werden könnte. — Man muß bei jeder Berechnung der t_σ^α die Angabe des Koordinatensystems hinzufügen, denn diese Größen bilden keinen Tensor; sie verschwinden beispielsweise nicht in allen Systemen, wenn sie es bei bestimmter Koordinatenwahl tun. Das Ergebnis, zu dem man in diesem speziellen Fall gelangt — exaktes, identisches Verschwinden aller t_σ^α in dem gewählten Bezugssystem — scheint mir gleichwohl so befremdend, daß ich glaube, es zur allgemeinen Diskussion stellen zu sollen.

2. Schwarzschild findet l. c. für das Quadrat des Linienelements

$$ds^2=(1-\alpha/R)\,dt^2-\frac{dR^2}{1-\alpha/R}-R^2(d\vartheta^2+\sin^2\vartheta\,d\varphi^2) \qquad (6)$$

mit der Abkürzung

$$R=(r^3+\varrho)^{1/3}. \qquad (7)$$

r, ϑ, φ, t sind gewöhnliche Polarkoordinaten und Zeit, α und ϱ sind Integrationskonstanten, welche von der Dichte und dem Radius der gravitierenden Kugel abhängen und in Wirklichkeit immer außerordentlich klein sind gegen alle in Betracht kommenden Werte von r bzw. r^3.

1) A. Einstein, Die Grundlage der allgemeinen Relativitätstheorie (J. A. Barth 1916), S. 45 ff.

1) Schwarzschild, Berl. Ber. 1916, S. 424.

(Source: Schrödinger, Erwin. 1918. Die energiekomponenten des gravitationsfeldes. *Physik Zeitschrift* XIX, p. 4.)

In (6) führen wir neue Koordinaten x_1, x_2, x_3, x_4 ein durch die Gleichungen

$$\begin{aligned} x_1 &= R \sin\vartheta \cos\varphi \\ x_2 &= R \sin\vartheta \sin\varphi \\ x_3 &= R \cos\vartheta \\ x_4 &= t. \end{aligned} \qquad (8)$$

Hieraus ergibt sich in bekannter Weise:

$$R^2 = x_1^2 + x_2^2 + x_3^2, \qquad (9)$$

ferner

$$dt = dx_4$$

$$dR^2 = \frac{x_\mu x_\nu}{R^2}\, dx_\mu\, dx_\nu$$

$$\begin{aligned} R^2(d\vartheta^2 + \sin^2\vartheta\, d\varphi^2) &= dx_1^2 + dx_2^2 + dx_3^2 - dR^2 \\ &= \left(\delta_{\mu\nu} - \frac{x_\mu x_\nu}{R^2}\right) dx_\mu\, dx_\nu \end{aligned} \qquad (10)$$

$$\left[\mu, \nu = 1, 2, 3;\ \delta_{\mu\nu} \begin{matrix} = 0 \\ = 1 \end{matrix} \text{ für } \mu \begin{matrix} \neq \\ = \end{matrix} \nu\right].$$

(Hier verwenden wir unsere Summationssymbolik vorübergehend etwas inkonsequent für Summen, die nur von 1—3 laufen!)

Indem man (10) in (6) einsetzt, erhält man das Linienelement in den neuen Koordinaten

$$\begin{aligned} ds^2 = (1 - \alpha/R)\, dx_4^2 &- \\ - \left[\delta_{\mu\nu} + \frac{\alpha x_\mu x_\nu}{R^3(1-\alpha/R)}\right] dx_\mu\, dx_\nu&, \end{aligned} \qquad (11)$$

woraus man nach (4) abliest:

$$g_{\mu\nu} = -\left[\delta_{\mu\nu} + \frac{\alpha x_\mu x_\nu}{R^3(1-\alpha/R)}\right] \text{ für } \mu, \nu = 1, 2, 3.$$

$$g_{14} = g_{24} = g_{34} = 0 \qquad g_{44} = 1 - \alpha/R. \qquad (12)$$

Der Buchstabe R hat hier und weiterhin als Abkürzung zu gelten für

$$R = +\sqrt{x_1^2 + x_2^2 + x_3^2}. \qquad (13)$$

Um zur Berechnung der t_σ^α die Gleichungen (2) und (3) anwenden zu dürfen, müssen wir vor allem zeigen, daß das gewählte Bezugsystem der Bedingung (1) genügt. Zunächst erhält man auf einer Koordinatenachse, etwa auf der x_1-Achse ($x_2 = x_3 = 0$), für den Fundamentaltensor (12) das einfache Schema:

$$|g_{\mu\nu}| = \begin{vmatrix} -\frac{R}{R-\alpha} & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & \frac{R-\alpha}{R} \end{vmatrix} \qquad (14)$$

Für den späteren Gebrauch notieren wir sogleich auch das Schema des **kontravarianten** Fundamentaltensors in einem Punkt der x_1-Achse

$$|g^{\mu\nu}| = \begin{vmatrix} -\frac{R-\alpha}{R} & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & \frac{R}{R-\alpha} \end{vmatrix}. \qquad (15)$$

Aus (14) folgt in Anbetracht der Kugelsymmetrie des Feldes, daß Gleichung (1) überall erfüllt ist; denn jeder beliebige Punkt läßt sich in die x_1-Achse verlegen durch eine Transformation von der Determinante $+1$ (räumliche Drehung). (2) und (3) sind also anwendbar.

Die eben genannte Transformation ist bekanntlich eine lineare. Gegenüber linearen Transformationen besitzen aber die Größen t_σ^α Tensorkovarianz (was leicht zu zeigen ist) — jedenfalls also linear homogene Transformationsformeln. Deshalb wird es genügen, auch diese Größen nur in einem beliebigen Punkt der x_1-Achse zu berechnen, (wodurch sich die Rechnung ungeheuer vereinfacht). Denn da sich zeigen wird, daß sie in einem solchen Punkt sämtlich verschwinden, werden wir schließen dürfen, daß sie überall identisch verschwinden.

Aus (12) erkennt man leicht, daß für einen Punkt der x_1-Achse von den 40 Größen $\frac{\partial g_{\mu\nu}}{\partial x_\sigma}$ nur einige wenige von 0 verschieden sind. Für diese gibt eine leichte Rechnung:

$$\left.\begin{aligned} \frac{\partial g_{11}}{\partial x_1} &= \frac{\alpha}{(R-\alpha)^2} \\ \frac{\partial g_{12}}{\partial x_2} &= \frac{\partial g_{13}}{\partial x_3} = -\frac{\alpha}{R(R-\alpha)} \\ \frac{\partial g_{44}}{\partial x_1} &= \frac{\alpha}{R^2} \\ \text{Alle anderen} &= 0. \end{aligned}\right\}. \qquad (17)$$

Für die $\Gamma_{\mu\nu}^\lambda$ ergibt sich zunächst aus (3) und (15)

$$\begin{aligned} \Gamma_{\mu\nu}^\lambda &= -(g^{\lambda\lambda})\begin{bmatrix}\mu\nu \\ \lambda\end{bmatrix} = \\ &= -\frac{1}{2}(g^{\lambda\lambda})\left\{\frac{\partial g_{\mu\lambda}}{\partial x_\nu} + \frac{\partial g_{\nu\lambda}}{\partial x_\mu} - \frac{\partial g_{\mu\nu}}{\partial x_\lambda}\right\}. \end{aligned} \qquad (18)$$

(Daß über den Index λ nicht zu summieren ist, mag durch die runde Klammer angedeutet sein!) Wir haben also die 40 Größen $\begin{bmatrix}\mu\nu \\ \lambda\end{bmatrix}$ daraufhin zu durchmustern, welche von ihnen auf Grund von (17) nicht verschwinden.

A. μ, ν, λ „räumlich" (d. i. = 1, 2, 3).

1. $\mu \neq \nu$.

a) $\mu \neq \lambda \neq \nu$. (3 Größen). Verschwinden,

(Source: Schrödinger, Erwin. 1918. Die energiekomponenten des gravitationsfeldes. *Physik Zeitschrift* XIX, p. 5.)

da unter (17) keine Größe mit drei verschiedenen Indizes auftritt.

b) $\lambda = \mu$. (6 Größen).

$$\left(\begin{bmatrix}\mu\nu\\ \mu\end{bmatrix}\right) = \frac{1}{2}\left(\frac{\partial g_{\mu\mu}}{\partial x_\nu}\right).$$

Verschwinden, da sich unter (17) keine Größen dieser Art mit nur räumlichen Indizes vorfinden.

2. $\mu = \nu$.

a) $\lambda \neq \mu$. (6 Größen).

$$\left(\begin{bmatrix}\mu\mu\\ \lambda\end{bmatrix}\right) = \left(\frac{\partial g_{\mu\lambda}}{\partial x_\mu}\right) - \frac{1}{2}\left(\frac{\partial g_{\mu\mu}}{\partial x_\lambda}\right).$$

Von 0 verschieden, wenn $\lambda = 1$, $\mu = 2, 3$, und zwar:

$$\begin{bmatrix}22\\ 1\end{bmatrix} = \begin{bmatrix}33\\ 1\end{bmatrix} = -\frac{\alpha}{R(R-\alpha)}.$$

b) $\lambda = \mu$. (3 Größen).

$$\left(\begin{bmatrix}\mu\mu\\ \mu\end{bmatrix}\right) = \frac{1}{2}\left(\frac{\partial g_{\mu\mu}}{\partial x_\mu}\right).$$

Von 0 verschieden für $\mu = 1$, und zwar:

$$\begin{bmatrix}11\\ 1\end{bmatrix} = \frac{1}{2}\frac{\alpha}{(R-\alpha)^2}.$$

B. Ein Index gleich 4. ($6 + 9 = 15$ Größen).

In jedem Term wird entweder nach x_4, oder es wird eine der Größen g_{14}, g_{24}, g_{34} differentiiert. Daher verschwinden diese 15 Größen.

C. Zwei Indizes gleich 4. ($3 + 3 = 6$ Größen).

Von 0 verschieden sind offenbar nur

$$\begin{bmatrix}41\\ 4\end{bmatrix} = -\begin{bmatrix}44\\ 1\end{bmatrix} = \frac{1}{2}\frac{\alpha}{R^2}.$$

D. Alle drei Indizes gleich 4. (1 Größe).

Verschwindet. —

Auf Grund dieser Durchmusterung findet man aus (18) mit Rücksicht auf (15):

$$\left.\begin{aligned}
\Gamma^1_{22} &= \Gamma^1_{33} = -\frac{\alpha}{R^2}\\
\Gamma^1_{11} &= -\Gamma^4_{14} = \frac{1}{2}\frac{\alpha}{R(R-\alpha)}\\
\Gamma^1_{44} &= -\frac{1}{2}\frac{\alpha(R-\alpha)}{R^3}
\end{aligned}\right\} \qquad (19)$$

Alle anderen $= 0$. —

Die Ausdrücke (2), die wir jetzt zu bilden haben, lassen sich mit der Abkürzung

$$A^\alpha_\sigma = g^{\mu\nu}\Gamma^\alpha_{\mu\beta}\Gamma^\beta_{\nu\sigma} \qquad (20)$$

folgendermaßen schreiben:

$$\varkappa t^\alpha_\sigma = \frac{1}{2}\delta^\alpha_\sigma A^\lambda_\lambda - A^\alpha_\sigma. \qquad (21)$$

Wir berechnen A^α_σ. Wegen (15) verschwinden in (20) alle Terme mit $\mu \neq \nu$. Schreiben wir etwas ausführlicher:

$$A^\alpha_\sigma = g^{11}\Gamma^\alpha_{1\beta}\Gamma^\beta_{1\sigma} + g^{22}\Gamma^\alpha_{2\beta}\Gamma^\beta_{2\sigma} + g^{33}\Gamma^\alpha_{3\beta}\Gamma^\beta_{3\sigma} + g^{44}\Gamma^\alpha_{4\beta}\Gamma^\beta_{4\sigma}, \qquad (22)$$

so erkennt man, daß auch die im 2. und 3. Term zusammengefaßten Glieder wegen (19) einzeln verschwinden, und zwar wenn $\beta = 2$ bzw. $= 3$ wegen des dritten, sonst wegen des zweiten Faktors. Bleibt

$$A^\alpha_\sigma = g^{11}\Gamma^\alpha_{1\beta}\Gamma^\beta_{1\sigma} + g^{44}\Gamma^\alpha_{4\beta}\Gamma^\beta_{4\sigma}. \qquad (23)$$

Hieraus erkennt man sofort, daß alle jene A^α_σ verschwinden, welche den Index 2 oder 3 enthalten. Es bleiben also nur noch zu untersuchen:

$$A^4_1,\ A^1_4,\ A^1_1,\ A^4_4. \qquad (24)$$

In den betreffenden Ausdrücken fallen noch alle jene Glieder fort, in denen $\beta = 2, 3$, ferner jene, in denen eine Γ-Größe den Index 4 einmal oder dreimal enthält. Daraus folgt einmal

$$A^4_1 = A^1_4 = 0. \qquad (25)$$

Endlich berechnet man explizite aus (23), (19) und (15):

$$\left.\begin{aligned}
A^1_1 &= g^{11}(\Gamma^1_{11})^2 + g^{44}\Gamma^1_{44}\Gamma^4_{41}\\
A^4_4 &= g^{11}(\Gamma^4_{41})^2 + g^{44}\Gamma^4_{41}\Gamma^1_{44}
\end{aligned}\right\} = \qquad (26)$$

$$= -\frac{R-\alpha}{R}\cdot\frac{1}{4}\frac{\alpha^2}{R^2(R-\alpha)^2} + \frac{R}{R-\alpha}\cdot\frac{1}{4}\frac{\alpha^2}{R^4} = 0.$$

Auf der x_1-Achse verschwinden also alle Größen A^α_σ identisch in $R\,(= x_1)$. Wegen (21) gilt dasselbe von den t^α_σ. Wie oben vorausgreifend bemerkt, folgt daraus, wegen der Kovarianz dieser Größen bei linearen Transformationen und wegen der Kugelsymmetrie des Feldes, daß die t^α_σ für das gewählte Bezugsystem überall (außerhalb der gravitierenden Kugel) identisch in allen Koordinaten verschwinden. W. z. b. w.

3. Dieses Ergebnis scheint mir unter allen Umständen von ziemlicher Bedeutung für unsere Auffassung von der physikalischen Natur des Gravitationsfeldes. Denn entweder müssen wir darauf verzichten, in den durch die Gleichungen (2) definierten t^α_σ die Energiekomponenten des Gravitationsfeldes zu erblicken; damit würde aber zunächst auch die Bedeutung der „Erhaltungssätze" (s. A. Einstein l. c.) fallen und die Aufgabe erwachsen, diesen integrierenden Bestandteil der Fundamente neuerdings sicher zu stellen. — Halten wir jedoch an den Ausdrücken

(Source: Schrödinger, Erwin. 1918. Die energiekomponenten des gravitationsfeldes. *Physik Zeitschrift* XIX, p. 6.)

Physik. Zeitschr. XIX, 1918. Smekal, Zum Beweise des Boltzmannschen Prinzips. 7

(2) fest, dann lehrt unsere Rechnung, daß es wirkliche Gravitationsfelder (d. i. Felder, die sich nicht „wegtransformieren" lassen) gibt, mit durchaus verschwindenden oder richtiger gesagt „wegtransformierbaren" Energiekomponenten; Felder, in denen nicht nur Bewegungsgröße und Energiestrom, sondern auch die Energiedichte und die Analoga der Maxwellschen Spannungen durch geeignete Wahl des Koordinatensystems für endliche Bezirke zum Verschwinden gebracht werden können.

charakterisieren zu können, bedient sich Ehrenfest desselben Weges, den P. Debye[1]) zur Ableitung der kanonischen Verteilung (der Name bezieht sich eigentlich auf die formal übereinstimmende Verteilung im γ-Raum) auf Grund der Boltzmannschen Annahme (2) benutzt hat. Die Verteilung die er erhält, kann auch formal in den γ-Raum übertragen gedacht werden und ist in diesem Sinne als Verallgemeinerung der kanonischen Verteilung zu bezeichnen, in die sie für

(Source: Schrödinger, Erwin. 1918. Die energiekomponenten des gravitationsfeldes. *Physik Zeitschrift* XIX, p. 7.)

When $v = c$

$$1.\ U_{\text{ay}} = dv\sqrt{1-\frac{v^2}{c^2}} = dv \cdot 0 = 0 \qquad \text{2-1-12}$$

$$2.\ U_{\text{by}} = -dv \qquad \text{2-1-13}$$

Because the result of Eq. 2-1-12 is zero according to relativity, to maintain consistency, Einstein made the result of Eq. 2-1-13 to also become zero. The speculative and mathematical assumption of closeness to zero for Eq. 2-1-13 is the same as an unlimited differentiation of *dv*.

Because d$v = adt$, $a = \frac{GM}{r^2}$, we obtain

$$dv = \frac{GM}{r^2} \cdot dt$$

$$= \frac{GM}{r^2} \cdot (t_2 - t_1) \qquad \text{2-1-14}$$

According to the uncertainty principle,

$$t_2 - t_1 \neq 0 = t_{\Delta o} \text{ from } \Delta t$$

$$\Delta t \Delta E \geq \hbar$$

$\Delta t \geq \frac{\hbar}{\Delta E} \quad \rightarrow \quad t_{\Delta o} \geq (\frac{\hbar}{\Delta E})_{\Delta o}$

$$dv = \frac{GM}{r^2}(\frac{\hbar}{\Delta E})_{\Delta o} \neq 0 \qquad 2\text{-}1\text{-}15$$

where E is the energy. According to quantum theory, E cannot become zero. That is, this energy E cannot differentiate to zero ($dE \Longrightarrow$ O) as in classical physics. But, according to quantum theory, this is possible as long as $dE \propto \nu$ or $dE = \hbar\nu$. Therefore, the conclusion is that real physical absolute empty space cannot be curved by any mathematical method. If this were the case, however, is it possible that matter can be generated from absolute empty space? In other words, absolute empty space creates all matter in the universe (when pair creation occurs in vacuum, this vacuum is called vacuum of neural emptiness. this vacuum is not empty space according to CFLE theory). Thus, the problem is that the general theory of relativity cannot distinguish matter and geometrical empty space. A more seriously related problem is that the general theory of relativity cannot distinguish mathematics and physics. Yet, the general theory of relativity changes physics to mathematics. Therefore, the general relativity theory essentially becomes incompatible with any real physical theories that compatible with accelerating by electromagnetic field. Good example is Standard Model of particle physics. According to Standard Model electric force, weak force and color force can unify one force (field) theory possible, but Einstein's gravitational force and his gravitational field is an exception 100 years long. Because Einstein's equivalence principle doesn't allow negative mass, under condition of general relativity cannot appear CP violation and accelerating expansion of the universe. Because observed curvature of space of universe is flat, theory of general relativity is useless for future of the universe to predict

2.2 The Fourth Inconsistency

Einstein argued that the equivalence principle and the general relativity principle are universal principles of nature. Therefore, if the observer O_a in Figure 1-3-1 (rest observer in an accelerating rocket, $a_a = K$) observes light moving in a curved path of space along a path as predicted by the general theory of relativity, the observer O_g in Figure 1-3-2 (rest observer in the gravitations field, $a_g = K$) must be observing the same curved path seen by observer O_a. However, if space is not curved by gravity, there must be some existing physical compensating process that can guarantee the universal establishment of the equivalence principle.

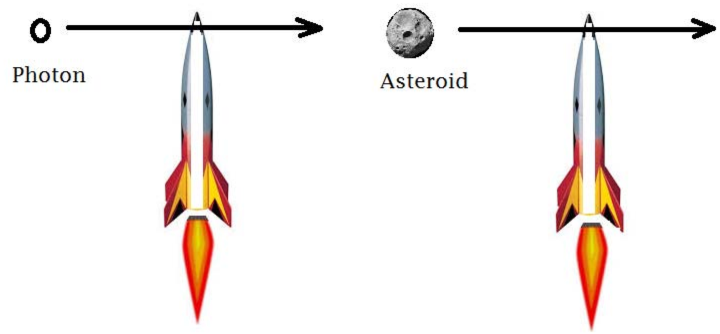

Figure 2-2-1

For observers in two rockets in figure 2-2-1physical behavior of photon and asteroid is equivalent. Because source of gravity (mass) and source of acceleration (for rocket is fuel) is very different, physical property of space of gravitational field must be not same of physical property of space of acceleration. In other word gravitational mass and inertial mass is equivalent. However, physical property of space of gravitational field and physical property of space of acceleration must be not same by two different sources of two systems as different between space with electric charge and space without electric charge.

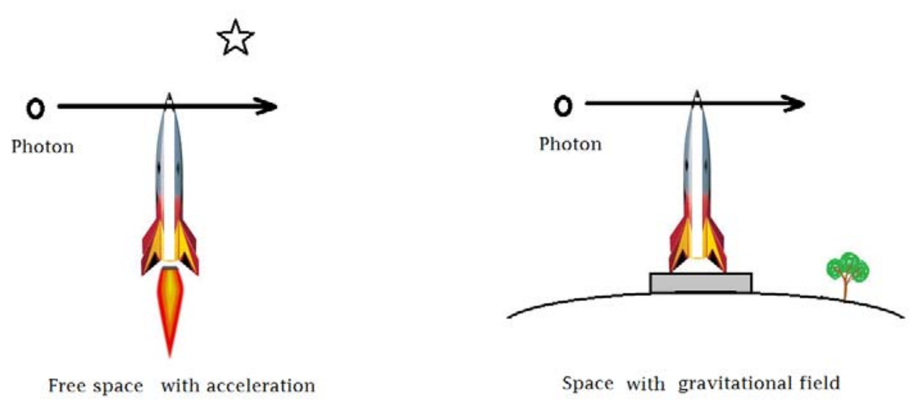

Figure 2-2-2

In the gravitational field asteroid interact with gravitational field by rest mass as figure 2-2-3

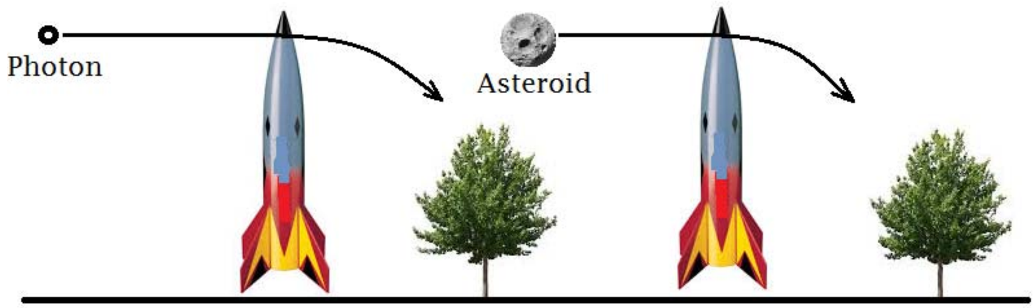

Figure 2-2-3

Therefore, photon has to have any kind of rest mass according to equivalence principle that gravitational mass equivalent inertial mass.

Here, equivalence between inertial mass and gravitational mass is very important for rest mass of photon to have. Under such physical condition light have to move in a curved path only through a gravitational field, and furthermore photon has to have a rest mass and a rest mass in accordance with its movement in order to have interaction with a gravitational field. According to the special relativity theory, light has quantized spin angular momentum$\pm\hbar$, which should play the role of quantized neutro-lateral rest mass. In superconductor magnetic field B is

$$\nabla^2\vec{B} - \frac{4\pi q^2}{mc^2}|\psi|^2\vec{B} = 0 \qquad 2\text{-}2\text{-}1$$

Eq. 2-2-1 means that photon should be massive.

Especially in Higgs mechanism (physical essence is same for U(1), SU(2) and SU(3))gauge symmetry is broken as

$$\mathcal{L} = -\frac{1}{4}F_{\mu\nu}F^{\mu\nu} + \frac{1}{2}q^2v^2A_\mu A^\mu + \frac{1}{2}(\partial_\mu\eta)^2 + \frac{1}{2}(\partial_\mu\xi)^2 - v^2l\eta^2$$

$$-qvA_\mu\partial^\mu\xi + \mathcal{O}(fields^3) \qquad 2\text{-}2\text{-}2$$

Now, gauge boson couples with goldstone boson and obtain rest mass.

Because U(1) gauge symmetry is kept in Eq2-2-2, photon has to move $v = c$ with any kind of rest mass

However, a factor from the special relativity theory

$$k = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \qquad \text{2-2-3}$$

interferes with this quantized energy of light, because relativistic mass is

$$m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} \qquad \text{2-2-4}$$

Light has velocity $v = c$, so when a photon has any small rest mass, its kinetic mass becomes infinite mass.

Now, the important fact about a photon is that it is a gauge particle under U(1) gauge symmetry, and gauge particles should not have rest mass. But, despite that a gauge particle has mass, its renormalization should be physically possible (cf. §6.2), and it should be physically possible to maintain gauge symmetry. However, the above-mentioned factor k from the special relativity theory makes it impossible for a photon to have any rest mass and to have any related kinetic mass. That is to say, this factor does not allow spontaneous gauge symmetry breaking. Therefore, the special relativity theory becomes incompatible with any gauge theory. Because negative infinity of special relativity doesn't permit any quantum quantity, this theory cannot predict and calculate any quantum physical phenomena. Good example is mass gab problem in quantum chromo dynamics. Because positive infinity of special relativity doesn't permit renormalization, this theory cannot predict and calculate unified theoretical phenomena. Good example is what dark matter is.

2.3 The Third Inconsistency

The main basis for Einstein's proposed curved space theory is the factor $k = \frac{1}{\sqrt{1-\frac{v^2}{v^2}}}$ from

$$U_{\text{ay}} = \mathrm{d}v\sqrt{1 - \frac{v^2}{c^2}} \qquad 2\text{-}3\text{-}1$$

The process that this factor k induces is a process that the special theory of relativity induces; consequently, the physical and theoretical justifications of the process induced by the special relativity theory are suspicious. When such points of view are investigated, this process is revealed as a serious inconsistency of the special relativity theory, as follows. Before the special theory of relativity, Galilean transformation and velocity transformation were used in mechanics. That is

$$x' = x - vt \qquad 2\text{-}3\text{-}2$$

$$y' = y \qquad 2\text{-}3\text{-}3$$

$$z' = z \qquad 2\text{-}3\text{-}4$$

$$v_n = v_f + v_n$$

Because the velocity of light is said to be constant for any observer, the Galilean transformation and velocity transformation are naturally the variables expected to change. Accordingly, the simplest equations of transformation are

$$x' = k\,(x - vt) \qquad 2\text{-}3\text{-}5$$

$$x = k\,(x' + vt') \qquad 2\text{-}3\text{-}6$$

To obtain t', the x' of Eq. 2-3-5 is inserted into Eq. 2-3-6

$$x = k\,[k(x - vt) + vt'] \qquad 2\text{-}3\text{-}7$$

Equation 2-3-7 expands about t' to give

$t' = kt + (\frac{1-k^2}{kv})\, x$ 2-3-8

To determine the value of *k*, the two frames must be

$x = x' = 0$ 2-3-9

$t = t' = 0$ 2-3-10

To compare the viewpoint of the two frames from which the same speed of light can be observed, we put Eqs. 2-3-6 and 2-3-7 into Eq. 2-3-11

$x = ct, \quad x' = ct'$ 2-3-11

and obtain

$k\,(x - vt) = c\,[kt + (\frac{1-k^2}{kv})\, x]$ 2-3-12

Expanding about *k* gives

$x = ct\,[\frac{1+\frac{v}{c}}{1-\left(\frac{c}{v}\right)(\frac{1}{k^2}-1)}]$ 2-3-13

$ct = ct\,[\frac{1+\frac{v}{c}}{1-\left(\frac{c}{v}\right)(\frac{1}{k^2}-1)}]$ 2-3-14

$k = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$ 2-3-15

At first glance, this process that was expanded by Einstein looks perfect, but the processes of Eq. 2-3-9 $\Longrightarrow x = x' = 0$ and Eq. 2-3-10 $\Longrightarrow t = t' = 0$ produce a serious contradiction with the uncertainty principle $\Delta mv\Delta x \geq \frac{\hbar}{2}$ established by Heisenberg, as follows. Both frames move relative to each other with constant velocity, $v = k$ (because the theory of relativity is established by the inertial frame that moves with constant velocity, $v = k$). However, the relative impulse of both frames is not *mv*, but rather $mv_{\Delta o}$ from Δmv, and the position is not *x*, but rather $x_{\Delta o}$ from Δx (at this point, velocity v is constant because of the law of inertia).

Yet, a degree of unlimited certainty is granted here by Einstein who overlooked the uncertainty principle of Heisenberg. Of course, the uncertainty principle does not restrict any unlimitedly accurate measurement of a position where $x = x' = 0$. In other words, independent of mv, the observer can measure an unlimitedly accurate position x, but when the observer uses the unlimitedly accurate position x at this point, the impulse mv could be any value, because the property of matter is dualistic (a wave–particle).

Objects are groups of matter–waves, where the component matter–waves are almost infinitely large. Consequently, trying to measure an unlimitedly accurate position x of physical objects at $x = x' = 0$ will only serve to measure the specific wavelength of a specific component wave.

In this case, according to $\lambda = \frac{\hbar}{mv}$, the observer can only obtain a specific mv of a specific component wave, so any measurement of the resting mv of a resting matter-wave becomes abandoned. To obtain a meaningful result of any physical relevance, the observer has to be able to measure both the impulse mv and the position x at the same time in order to satisfy wavefunction collapse universally (microscopically and macroscopically).

Moreover, according to $\Delta E \Delta T \geq \frac{\hbar}{2}$, the observer also has to measure both $t_{\Delta o}$ from Δt and energy $E_{\Delta o}$ from ΔE at the same time. But, because Einstein had granted unlimited accuracy to time measurement only, according to the uncertainty principle, such attempt at measurement is physically meaningless. The results of such an attempt are always the same: it predicts the bringing into physics of meaningless and destructive infinity that cannot be renormalized.

Thus, once again, the theory of relativity becomes incompatible with quantum theory that can only be renormalized with the uncertainty principle. The formal Heisenberg's inequality relating the standard deviation of position σ_x and the standard deviation of momentum σ_p

was derived E.H .Kennard later that year and by Hermann Weyl in 1928.That is

$$\sigma_x \sigma_p \geq \frac{\hbar}{2} \qquad \text{2-3-16}$$

Recently, rigorous and general theoretical-treatments of quantum measurements have revealed the failure of Heisenberg's relation, and derived a new universally valid relation by Ozawa Masanao in 2012, given by

$$\Delta x \Delta p \ + \Delta x \ \sigma(p) + \sigma(x) \Delta p \geq \frac{\hbar}{2} \qquad \text{2-13-17}$$

Where $\sigma(x)\Delta p$is quantum fluctuation of position before measurement,

$\Delta x \sigma(p)$ is quantum fluctuation of momentum before measurement.

However, in special theory of relativity term of $\Delta x \sigma(p)$is not necessary. Because one condition of special theory of relativity that in this inertial frame velocity v is constant, there is no quantum fluctuation of momentum $\sigma(x)\Delta p$ before measurement, and because of other condition of special theory of relativity that two flame move relatively an x axis, there is no quantum fluctuation of position $\Delta x \ \sigma(p)$ before measurement. Therefore in special theory of relativity is needed only Heisenberg's inequality $\Delta x \Delta p \geq \frac{\hbar}{2}$.