the kinetic energy gained from the potential cancel each other out. Therefore, the wavelength of the matter wave will change less than in the case of light, which is affected by the rate at which time flows, and it can be inferred that the object's path will be less affected than that of light, even when using methods based on wavelength changes. Thus, the separation of inertial mass and gravitational mass is not inconsistent with matter wave theory.

This conclusion directly contradicts the equivalence principle of general relativity, which means that by examining the effect of gravity on moving objects, an immediate judgment can be made as to which of the two theories is correct. Since it is a fundamentally simple experiment, it is likely possible with current technological capabilities, or if not yet possible, it should not take too long to become so.

6.7 Relativistic Consistency of Maxwellian Gravity

Gravity possesses a very special property that electromagnetism does not: it can affect the path of light. This also implies that it affects time. General relativity is a theory developed by noting this difference from electromagnetism. On the other hand, Maxwellian gravity, as introduced in this book, is a theory that tries to maintain as many commonalities as possible. From this perspective, Maxwellian gravity might seem like a theory that fails to adequately explain the differences. However, problems such as the Laplace problem for forces transmitted at the speed of light and relativistically consistent acceleration and force transformations between inertial frames have been solved through Maxwellian gravity in this book, issues that general relativity does not even address. Regarding the expectation that an entirely different branch of mathematics exists to handle these problems and that it can be applied to gravity to solve the relativistic acceleration transformation problem and the Laplace problem in its own way, consistent with the approach in electromagnetism, I am pessimistic. In my opinion, a correct theory naturally reaches conclusions in a surprisingly easy way once the initial clues are unraveled, without such forced ideas. In that regard, a slightly disappointing point so far has been that while I could confidently say the relativistic consistency problem for electromagnetism has been completely resolved, some ambiguity still remained for gravity. That ambiguity was the question of how relativistic consistency is maintained for gravity when time dilation due to gravity is considered. Fortunately, that part has also been resolved by chance, so I will now add a description of that. This chapter, added later as the last of my discoveries included in this book, presents a fundamental completion of the Maxwellian gravity theory, of course, as a classical theory of gravity, excluding microscopic aspects.

Initially, I had postponed tackling this phenomenon, anticipating it would be difficult and planning to ponder it slowly as a side project when time permitted. (I have several such pending issues; the very first topic of this book, cosmic particle density, was one of them. I do not expect to resolve them all in my lifetime.) However, about a year after solving the electromagnetic force problem, once my mental fatigue had somewhat subsided, I decided to casually examine the numerical trends out of sheer curiosity. To my surprise, the data intuitively suggested a clear pattern. Acting on a hunch, I verified it, and it matched perfectly. Contrary to my initial assumption of difficulty, within days of starting my inquiry and just a single day after beginning calculations, I had derived an expression explaining the trend. Admittedly, even that one day' s work was far from trivial; it even brought on a mild headache, rare for me. Yet, this serves as a good example reinforcing my belief that nature holds a simplicity prepared in advance that exceeds human expectations. One might even say that in a correct theory, the simpler-than-expected solution is already embedded in the problem. For these reasons, my resolution to the relativistic consistency problem in gravity includes no mathematical derivation. It merely presents calculations that describe the phenomenon without contradiction.

Previously, I mentioned time dilation due to gravity as a characteristic operational element of the gravitational field. The time dilation formula was presented as $1 + \frac{GM}{rc^2}$. This naturally evokes the form $1 + \frac{GM}{rc^2} \to 1 - \frac{1}{c^2} V_r$, which is correct in terms of content. When dealing with the advance of Mercury's perihelion, the form $\left(1 + \frac{GM}{rc^2}\right)^3$ was substituted, but when addressing relativistic consistency issues, one deals with observations from the perspective of a third party outside the gravitational field rather than from the perspective of an object within the gravitational field, so in this case, the time dilation term is simply multiplied without cubing it. The term itself does not disappear because, even from an external observer's viewpoint, this term remains as an increase in acceleration due to the reduction of inertial mass caused by the gravitational potential. After multiplying this time dilation term, comparing the acceleration due to the field in each inertial frame transformed to another inertial frame with the acceleration due to the field in the other inertial frame reveals a relatively simple proportional relationship rather than a complex one. Examining this proportional relationship and focusing on the scalar potential V_r in each inertial frame led to the discovery of the following relationship: $V_v = \frac{1}{\gamma_v} V_r = \frac{1}{\gamma_{\text{id}}} V_u$, where V_v is the value in the v-inertial frame where the source of the field is stationary, so it is identical to the conventional potential calculation value. However, in the stationary inertial frame and the u-inertial frame where the source of the field is observed to be moving, the potential values are calculated differently, and it was discovered that all potentials become identical by multiplying by the γ value of the source of the field in each inertial frame.

Regarding this, Feynman's Lectures on Physics presents a formula in Chapter 25, without derivation, that appears to be directly inferred by him: $\phi' = \frac{\phi - v_x A_x}{\sqrt{1-v^2}} \to \phi = \frac{\phi'}{\gamma_v} + \vec{v} \cdot \vec{A}$. However, this formula is incorrect. The result of my numerical calculation, which I discovered by chance, is the simpler $\phi = \frac{\phi'}{\gamma_v}$.

This gravitational time dilation due to the gravitational potential can be expressed as $1-\frac{1}{c^2}V \to 1-\frac{1}{\gamma c^2}V$.

The meaning of this equation is simple: gravitational time dilation depends on the gravitational potential in the gravitational source's inertial frame,i.e., the v-frame, not the observer's inertial frame. To interpret this statement, let us briefly consider a thought experiment: how would gravitational time dilation appear when viewed from a different inertial frame? First, an object inside a gravitational field will experience time passing more slowly compared to an object outside it. Second, when an object in that specific inertial frame is viewed from another inertial frame, its time will appear to slow down by a factor of γ. The final slowing-down effect on time will be the product of these two factors. Crucially, the gravitational potential affecting time dilation is that of the gravitational source's inertial frame, not the observer's. This is merely a simple conjecture that this relationship should apply in all cases, regardless of the object's velocity. The time dilation term due to the object's motion can then simply be multiplied to find the rate at which the object's time flows. This offers the simplest possible solution to this problem. Now, a concrete calculation will be performed to see if there are any contradictions when this solution is actually implemented in nature.

The calculations developed for electromagnetic forces can be applied almost unchanged to Maxwellian gravity; we need only incorporate the unique functions specific to Maxwellian gravity.

$(75)->Gr(r,v,a,c)$

$$==\frac{-1}{sq(r)\left(1-\frac{dX(v,r)}{c\sqrt{sq(r)}}\right)^3}\left(\left(1-\frac{sq(v)}{c^2}+\frac{dX(a,r)}{c^2}\right)\left(\frac{1}{\sqrt{sq(r)}}r-\frac{1}{c}v\right)-\left(1-\frac{dX(v,r)}{c\sqrt{sq(r)}}\right)\frac{\sqrt{sq(r)}}{c^2}a\right),$$

$$Us(r,v,c)==\frac{-1}{\sqrt{sq(r)}\left(1-\frac{dX(v,r)}{c\sqrt{sq(r)}}\right)},$$

$$Uv(r,v,c)==\frac{-1}{c^2\sqrt{sq(r)}\left(1-\frac{dX(v,r)}{c\sqrt{sq(r)}}\right)}v$$

LISP output:

(() () ())

Type: Tuple(Void)

I have input the gravitational field formula in Maxwellian gravity theory, $Gr(r,v,a,c)=\frac{-1}{r^2\left(1+\frac{\dot{r}}{c}\right)^3}\left(\left(1-\frac{v^2}{c^2}+\frac{\vec{a}\cdot\vec{r}}{c^2}\right)\left(\hat{r}-\frac{\vec{v}}{c}\right)-\left(1+\frac{\dot{r}}{c}\right)\frac{r\vec{a}}{c^2}\right)$, the scalar potential formula $Us(r,v,c)=\frac{-1}{r\left(1+\frac{\dot{r}}{c}\right)}$, and the vector potential formula $Uv(r,v,c)=\frac{-\vec{v}}{c^2 r\left(1+\frac{\dot{r}}{c}\right)}$, excluding constants except for the sign. The gravitomagnetic field formula $\vec{W}=\frac{\hat{r}}{c}\times\overrightarrow{G}$ is simple, so I will calculate and use it as needed at the relevant locations.

$(76)- > aqv := vector[2.3, -1.9, -2.2];$

$aqd := A(rMaqv, id, c)$;

$aqp := A(aqv, v, c)$;

$gp := Gr(o, v, aqp, c)$;

$gv := Gr(r, vector[0, 0, 0], aqv, c)$;

$tmp := \Lambda utranspose([cons(ct, o)])$;

$rd := vector[tmp(2, 1), tmp(3, 1), tmp(4, 1)]$;

$gd := Gr(rd, id, aqd, c)$;

Type: Vector(Expression(Float))

Instead of the electric fields ep, ev, and ed in each inertial frame that were calculated for the electromagnetic force, the respective gravitational fields gp, gv, and gd are now calculated. The acceleration of the gravitational source aqv and its values in other inertial frames, aqp and aqd, have been replaced with different values.

$(77)- > digits(20);$

$ar := \frac{1}{Gm(u,c)}\left(1 - \frac{1}{c^2 Gm(v,c)}Us(o, v, c)\right)\left(gp + \frac{1}{c}cX(u, cX(ro, gp)) - \frac{1}{c^2}udX(gp, u)\right),$

$av := \frac{1}{Gm(d,c)}\left(1 - \frac{1}{c^2}Us(r, vector[0, 0, 0], c)\right)\left(gv + \frac{1}{c}cX\left(d, cX\left(\frac{1}{\sqrt{sq(r)}}r, gv\right)\right) - \frac{1}{c^2}ddX(gv, d)\right),$

$au := \left(1 - \frac{1}{c^2 Gm(id,c)}Us(rd, id, c)\right)gd$

Cannot compile map: sq

We will attempt to interpret the code.

$[[0.2966275202\_0551364995, -0.5726207428\_6267250178, -0.5788369883\_016331711],$
$[0.3358789533\_4193427242, -0.6338380233\_6438419021, -0.6259519122\_9579306834],$
$[0.3408251779\_4982326225, -0.6346702390\_0374051834, -0.6268601758\_3652195691]]$

Type: Tuple(Vector(Expression(Float)))

The acceleration of an object due to gravitational and gravitomagnetic fields in the rest inertial frame is given by $\vec{a}_r = \frac{1}{\gamma_u}\left(1 - \frac{1}{c^2\gamma_v}V_p\right)\left(\vec{G}_p + \vec{u} \times \vec{W}_p - \frac{1}{c^2}\vec{u}(\vec{G}_p \cdot \vec{u})\right)$, while in the v-inertial frame (the source's frame of reference), the acceleration due to gravitational and gravitomagnetic fields is $\vec{a}_v = \frac{1}{\gamma_d}\left(1 - \frac{1}{c^2}V_v\right)\left(\vec{G}_v + \vec{d} \times \vec{W}_v - \frac{1}{c^2}\vec{d}(\vec{G}_v \cdot \vec{d})\right)$. For the u-inertial frame (the object's own frame of reference), the acceleration due to gravitational field alone is $\vec{a}_u = \left(1 - \frac{1}{c^2\gamma_{\mathrm{id}}}V_d\right)\vec{G}_d$. All these were calculated by applying the effect of the gravitational time dilation term $1 - \frac{1}{\gamma c^2}V$. Of course, the observer's perspective is from outside the gravitational field.

Comparing these results through the acceleration transformation formulas between inertial frames reveals that:

$(78)- > A(au,u,c)-ar = dA(au,u,vector[0,0,0],c)-ar,$
$rA(ar,u,c)-au = dA(ar,-u,u,c)-au,$
$A(rMrA(av,d,c),u,c)-ar = dA(av,v,d,c)-ar,$
$rrMA(rA(ar,u,c),-rMd,c)-av = dA(ar,-v,u,c)-av,$
$rMrA(av,d,c)-au, rMdA(av,-d,d,c)-au, dA(dA(av,v,d,c),-u,u,c)-au,$
$rrMA(au,-rMd,c)-av, rrMdA(au,rMd,vector[0,0,0],c)-av,$
$dA(dA(au,u,vector[0,0,0],c),-v,u,c)-av$

$[[0.7E-20, 0.3E-20, 0.1E-19] = [0.7E-20, 0.3E-20, 0.1E-19], [-0.8E-20, 0.0, -0.1E-19] = [0.2E-20, -0.1E-19, -0.2E-19], [0.7E-20, -0.2E-19, 0.0] = [-0.2E-20, -0.7E-20, 0.0], [-0.2E-20, 0.1E-19, 0.7E-20] = [0.0, 0.7E-20, 0.7E-20], [0.0, -0.2E-19, -0.1E-19], [0.2E-20, -0.2E-19, -0.1E-19], [0.2E-20, -0.2E-19, -0.2E-19], [0.7E-20, 0.1E-19, 0.2E-19], [0.7E-20, 0.1E-19, 0.2E-19], [0.8E-20, 0.1E-19, 0.1E-19]]$

Type: Tuple(Any)

They all match, confirming that Maxwellian gravity is relativistically consistent.

Performing these steps all at once,

$(79)- > digits(200);$
$c := 1.5;$
$r := vector[0.3, -0.5, -0.4];$
$d := vector[-0.5, -0.6, 0.7];$
$v := vector[0.3, 0.3, -0.2];$
$u := U(v,d,c);$
$aqv := vector[2.3, -1.9, -2.2];$
$\Lambda v := eval\left(\Lambda M, \left[\beta_x = \frac{v.1}{c}, \beta_y = \frac{v.2}{c}, \beta_z = \frac{v.3}{c}\right]\right);$
$i\Lambda v := eval\left(\Lambda M, \left[\beta_x = \frac{-v.1}{c}, \beta_y = \frac{-v.2}{c}, \beta_z = \frac{-v.3}{c}\right]\right);$
$\Lambda d := eval\left(\Lambda M, \left[\beta_x = \frac{d.1}{c}, \beta_y = \frac{d.2}{c}, \beta_z = \frac{d.3}{c}\right]\right);$
$\Lambda u := eval\left(\Lambda M, \left[\beta_x = \frac{u.1}{c}, \beta_y = \frac{u.2}{c}, \beta_z = \frac{u.3}{c}\right]\right);$
$i\Lambda u := eval\left(\Lambda M, \left[\beta_x = -1\frac{u.1}{c}, \beta_y = -1\frac{u.2}{c}, \beta_z = -1\frac{u.3}{c}\right]\right);$
$\Lambda R := i\Lambda u \Lambda v \Lambda d;$
$r\Lambda R := \Lambda d \Lambda v i\Lambda u;$

$$rM := \begin{pmatrix} \Lambda R(2,2) & \Lambda R(2,3) & \Lambda R(2,4) \\ \Lambda R(3,2) & \Lambda R(3,3) & \Lambda R(3,4) \\ \Lambda R(4,2) & \Lambda R(4,3) & \Lambda R(4,4) \end{pmatrix};$$

$$rrM := \begin{pmatrix} r\Lambda R(2,2) & r\Lambda R(2,3) & r\Lambda R(2,4) \\ r\Lambda R(3,2) & r\Lambda R(3,3) & r\Lambda R(3,4) \\ r\Lambda R(4,2) & r\Lambda R(4,3) & r\Lambda R(4,4) \end{pmatrix};$$

$id := rM - d$;
$p := rr(v, r, c)$;
$t := \frac{(i\Lambda vtranspose([cons(0,r)]))(1,1) - \left(i\Lambda vtranspose\left(\left[cons\left(-\sqrt{sq(r)},[0,0,0]\right)\right]\right)\right)(1,1)}{c}$;
$o := p + tv$;
$ro := \frac{1}{\sqrt{sq(o)}}o$;
$aqd := A(rMaqv, id, c)$;
$aqp := A(aqv, v, c)$;
$gp := Gr(o, v, aqp, c)$;
$gv := Gr(r, vector[0, 0, 0], aqv, c)$;
$tmp := \Lambda utranspose([cons(ct, o)])$;
$rd := vector[tmp(2, 1), tmp(3, 1), tmp(4, 1)]$;
$gd := Gr(rd, id, aqd, c)$;
$ar := \frac{1-\frac{1}{c^2Gm(v,c)}Us(o,v,c)}{Gm(u,c)}\left(gp + \frac{1}{c}cX(u, cX(ro, gp)) - \frac{1}{c^2}udX(gp, u)\right)$;
$av := \frac{1-\frac{1}{c^2}Us(r,vector[0,0,0],c)}{Gm(d,c)}\left(gv + \frac{1}{c}cX\left(d, cX\left(\frac{1}{\sqrt{sq(r)}}r, gv\right)\right) - \frac{1}{c^2}ddX(gv, d)\right)$;
$au := \left(1 - \frac{1}{c^2Gm(id,c)}Us(rd, id, c)\right)gd$;
$A(au, u, c) - ar = dA(au, u, vector[0, 0, 0], c) - ar$,
$rA(ar, u, c) - au = dA(ar, -u, u, c) - au$,
$A(rMrA(av, d, c), u, c) - ar = dA(av, v, d, c) - ar$,
$rrMA(rA(ar, u, c), -rMd, c) - av = dA(ar, -v, u, c) - av$,
$rMrA(av, d, c) - au, rMdA(av, -d, d, c) - au, dA(dA(av, v, d, c), -u, u, c) - au$,
$rrMA(au, -rMd, c) - av, rrMdA(au, rMd, vector[0, 0, 0], c) - av$,
$dA(dA(au, u, vector[0, 0, 0], c), -v, u, c) - av$

Cannot compile map: sq
We will attempt to interpret the code.
Cannot compile map: sq
We will attempt to interpret the code.
Compiling function cX with type (Vector(Float), Vector(Expression(
Float))) -> Vector(Expression(Float))

$[[0.4E-199, -0.2E-198, -0.2E-198] = [0.4E-199, -0.2E-198, -0.2E-198], [-0.6E-199, 0.2E-198, 0.3E-198] = [-0.6E-199, 0.2E-198, 0.3E-198], [0.2E-199, -0.3E-199, -0.1E-199] = [0.2E-199, -0.3E-199, -0.3E-199], [-0.2E-199, 0.3E-199, 0.3E-199] = [-0.2E-199, 0.4E-199, 0.2E-199], [-0.3E-199, 0.2E-198, 0.3E-198], [-0.3E-199, 0.2E-198, 0.3E-198], [-0.3E-199, 0.2E-198, 0.3E-198], [0.7E-200, -0.1E-198, -0.1E-198], [0.7E-200, -0.1E-198, -0.1E-198], [0.7E-200, -0.9E-199, -0.1E-198]]$

Type: Tuple(Any)