Orbiting explains Gravity

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Abstract

This manuscript identifies the cause of gravity. Based on this cause the gravitational force is quantified. This leads to a correction of Newton’s gravitational equation for the (very) short distance: instead of an ever growing strength –up to infinity when the distance between two objects approaches 0- we will actually find a finite repelling force instead. This manuscript concludes with 2 case studies that support the here presented outcome for gravity, and with a third case study that may allow verification.

The reason why gravity puzzled scientists is found in the S.I. system. This system imposes a framework for describing and analyzing nature/physics. However, it is -historically- based on observing human perceptions and has its flaws. For this reason this manuscript starts with pinpointing these flaws, and comes up with a more transparent alternative. Thereby no more than two physical properties are introduced: content and whereabouts.

Keywords: Physics, Gravity

1. Units of Measurement

Physics describes nature in terms of units of measurement. These are typically based on the ‘International System’, abbreviated as ‘S.I’. However, the S.I. is not ‘normalized’. This which complicates physics.

For example in defining mass as base unit, one would presume that simple mathematical rules would apply to it, such as: the total mass of two objects \(m_1\) and \(m_2\) equals \(m_1+m_2\). However, e.g. the mass of an iron is about 1% less than the total mass of its constituents: protons, neutrons and electrons. Also, when heating up a piece of iron, we increase its mass.

These examples demonstrate that mass depends on other physical properties. This would not be so if mass were an independent property. More in general: if the S.I. were normalized.

Using the S.I. does not lead to false results as long as we are aware of the mutual dependencies between physical properties. Nevertheless: these dependencies complicate physics.

To avoid this, we will develop a normalized system of units of measurement by introducing no more than two alternate physical properties. Our system thereby is not complete, but it is adequate for the purpose at hand: explaining gravity.

As will be discussed in the following, analysing orbiting systems gives us a good starting point.

a) Orbiting systems stretch distances and slow time.

We envision an object ‘A’ that is propagating forward in an otherwise empty space. At some point the object is suddenly attached to the end of a stretched rope whereof the other end is tightly connected to some fixed point ‘X’ in space. This forces ‘A’ into a circular orbit:

![Fig.1.1: Object ‘A’ is forced into a circular orbit.](image-url)
The now imposed orbiting causes an orbiting frequency ‘ν’ which did not exist before. Regardless the nature of object ‘A’, per Planck’s equation \( E = h \nu \) this frequency is to be associated with a gain in embedded energy. We will refer to this as a gain in content, here specifically: ‘Planck content’ since Planck’s equation quantifies it. (The term content will be addressed later). Where did that ‘Planck content’ come from? How is the conservation principle obeyed?

To answer these questions we analyse two equal point objects ‘A’ and ‘B’, keeping each other in a gravitational orbit around their centre of gravity ‘X’. We position ourselves at some remote point on the axis of the orbiting system, thereby observing:

![Fig. 1.2: equal objects ‘A’ and ‘B’ orbiting (clockwise) around their shared centre of gravity ‘X’.

Next we decide to measure the distance between object ‘A’ and object ‘B’.

Distance measuring is a personal effort (the method is consistent within the S.I.): one uses a local clock (a clock that one holds in his hands) and the velocity of light \( c \) (in vacuum). One measures \( \Delta t_{\text{local}} \) as the time needed for light to travel that distance (through vacuum). With \( c \) being a universal natural constant, this unambiguously delivers the distance:

\[
\text{Distance} = \Delta t_{\text{local}}, c \tag{1.1}
\]

Since we are at a remote position, we ask a person residing on object ‘A’ to measure his distance to object ‘B’ for us. We will name the result ‘\( \text{LOD} \)’ (the Locally Observed Distance):

\[
\text{LOD} = \Delta t_{\text{local}}, c \tag{1.2}
\]

Thereby, due to the orbiting, object ‘B’ isn’t where it is seen. As the Moon isn’t where we see it from Earth. We see the Moon where it resided about 1.3 seconds ago because the distance between Earth and Moon is about 400,000 km, and the velocity of light is about 300,000 km/s. During those 1.3 seconds the Moon has progressed in its orbit.

We review the situation from the perspective of our remote observation location on the orbit axis. We define the ‘\( \text{ROD} \)’ as the Remotely Observed Distance between objects ‘A’ and ‘B’. The \( \text{ROD} \) is the distance as we see it. That is: the diameter of the orbit as shown in figure (1.2).

The following figure illustrates the challenge:

![Fig. 1.3: the Remotely Observed Distance ‘\( \text{ROD} \)’ and Locally Observed Distance ‘\( \text{LOD} \)’

Location ‘C’ is the anticipated location where object ‘B’ (from our remote perspective) will reside by the time a light flash as sent by our helper on location ‘A’ will arrive at ‘B’. The line ‘\( \text{LOD} \)’ therefore represents the direction as well as the path that light will follow from the perspective of our remote observation point.

As figure (1.3) shows:

\[
\text{LOD} < \text{ROD}
\]

The difference between \( \text{LOD} \) and \( \text{ROD} \) depends on the orbit velocity \( v_{\text{orbit}} \). We use the following figure:

![Fig. 1.4: \( \text{LOD}/\text{ROD} \).]

Given an orbit velocity \( v_{\text{orbit}} \), angle BXC (which equals \( 2\alpha \)) is calculated as:

\[
2\alpha = \frac{v_{\text{orbit}} \cdot \text{ROD}/c}{\pi \cdot \text{ROD}} \times 2\pi = \frac{2 \cdot v_{\text{orbit}}}{c} \text{ (radials)}
\]

Thus:
\[ \alpha = \frac{v_{\text{orbit}}}{c} \text{ (radials)} \]

Figure 1.4 shows:

\[ \frac{\text{LOD}}{\text{ROD}} = \cos(\alpha) = \cos \left( \frac{v_{\text{orbit}}}{c} \right) \]

Or:

\[ \text{LOD} = \text{ROD} \times \cos \left( \frac{v_{\text{orbit}}}{c} \right) \] (1.3)

Note that the ratio LOD/ROD does not depend on the diameter of the orbit.

With different line lengths for ROD and LOD in above figure, the question comes up what the ‘real’ distance between object ‘A’ and ‘B’ will be.

Relative to both observers, the region of the orbiting system is not moving. Therefore -per Theory of Relativity- they must find an equal value for the orbiting system’s embedded content, thus for the aforementioned orbiting induced ‘Planck content’. This implicitly demands that both observers must find the same orbiting frequency when applying Planck’s equation \( E = h \cdot v \). The latter demand can only be met when time stretches proportionally to distance.

Therefore, when seen from our remote position (from where we see the longer distance ROD between ‘A’ and ‘B’), we must require the clock at the orbiting system to appear running at a proportionally slower pace. Equation (1.3) therefore not only specifies distance stretching, but also time stretching:

\[ \text{Time}_{\text{Local}} = \text{Time}_{\text{Remote}} \times \cos \left( \frac{v_{\text{orbit}}}{c} \right) \] (1.4)

Thus the local observer on ‘A’ as well as the remote observer will find that the time it takes light to travel the distance from ‘A’ to ‘B’ is equal between them. And when both observers multiply this time with light velocity ‘c’, they therefore will come up with an equal value for the distance between ‘A’ and ‘B’.

**b) Whereabouts**

Given the proportional relationship between distance and time, these two apparently different physical properties can mutually be expressed in one another, and therefore both can be expressed by using one single unit of measurement. Or: in nature distance and time jointly specify one single physical property.

To avoid confusion with existing terminology, we will give that property a unique name: *whereabouts*.

And we give the unit of measurement thereof also a unique name: the Crenel (symbol \( C \)).

**The physical property whereabouts is measured in C(renel).**

![Fig. (1.5): Memory aid: Crenels on top of a castle wall. Their shape can be associated with time and with distance.](image)

Distance and time then are different appearances of the property whereabouts. (We will later justify the term appearance, as opposed to the commonly used term dimension.)

We can specify the property whereabouts by spanning a Cartesian frame of reference, e.g. by using 4 appearances: X, Y, Z and T (also known as ‘Minkowski spacetime’). By using a Cartesian frame we ensure that whereabouts appearance values (=coordinates) are normalized: a change in e.g. the X coordinate does not impact any of the other coordinates. These 4 coordinates then jointly define the whereabouts of an object. Should in some experiment all 4 coordinates be found equal between two objects, we have a collision.

From a mathematical perspective there is no requirement with regards to the number of whereabouts appearances that span a whereabouts frame of reference, thus fully define the whereabouts property. Human visual observations are however restricted to a 3 dimensional spatial space, so in many cases that will do.

**c) Velocity**

Velocity is expressed in distance/time. Per the above distance and time were found two different appearances of one and the same physical property: whereabouts. Thus the ratio distance/time is dimensionless and thereby velocity is dimensionless.

A measured velocity can therefore not be subject to e.g. the Theory of Relativity. This theory only makes dimensions relative. But dimensionless properties are not affected. Other examples thereof are \( \pi \), \( \epsilon \), and the bit, which also are dimensionless and therefore equal to all.
This explains why light velocity ‘c’ - as any other velocity - is found equal between all observers.

**d) Light velocity ‘c’**

It is a practical choice to then set a numerical value of 1 to light velocity ‘c’. Therefore we now define:

\[ c = 1 \]

In doing so, velocity ranges from 0 to 1.

**e) Content**

The finding that velocity is a dimensionless property shines light on Einstein’s equation: \( E = m \cdot c^2 \). With velocity ‘c’ being dimensionless, ‘E’ and ‘m’ in this equation must be of same dimension and therefore both represent a shared - more fundamental - physical property underneath. Again, to avoid confusion in terminology, we give that property a unique name: content (which term we already used on page 2). And we will give the unit of measurement thereof also a unique name: the Pack (symbol \( P \)).

The physical property content is measured in \( P(\text{packs}) \).

Energy and mass are two different appearances of the property content. (As said: we will later justify the term appearance, as opposed to the commonly used term dimension.)

At this point we have completed the introduction of alternate physical properties

**f) Planck’s constant ‘h’**

In Planck’s equation:

\[ E = h \cdot v \]

Energy ‘E’ is expressed in Packs.

In the S.I. frequency ‘v’ is expressed in seconds\(^{-1}\). The counterpart for seconds\(^{-1}\) is Crenel\(^1\). Thus, in our system of units of measurement we find for Planck’s constant ‘h’:

\[ h = 1 \cdot C \cdot P \]

**g) Gravitational constant ‘G’**

Within the S.I. acceleration is expressed in \( m/s^2 \). In our system acceleration therefore is to be expressed in \( C/C^2 \) or \( C^1 \). Using Newton’s equation \( F = m \cdot a \) we find that force is to be expressed in \( P/C \).

When we substitute the new units of measurement into Newton’s gravitational equation:

\[ F = G \cdot \frac{M_1 \cdot M_2}{d^2} \]

We find for the Gravitational constant \( G \):

\[ G \equiv 1 \cdot \frac{C}{P} \]

**h) Conversion factors (Planck Units)**

With three natural constants \( c \), \( G \) and \( h \) now being defined, we can explore the following three forthcoming equations:

For light velocity \( c \):

\[ 1 \text{ (dimensionless)} = c \text{ (m.s\(^{-1}\))} \quad (1.5) \]

For Planck’s constant \( h \):

\[ 1 P.C = h \text{ (N.m.s)} \quad (1.6) \]

For the gravitational constant \( G \):

\[ 1 C.P^4 = G \text{ (N.m\(^2\).kg\(^{-2}\))} \quad (1.7) \]

The left side in these three equations expresses the universal natural constants \( (c, h \text{ and } G) \) respectively in the newly defined fundamental units of measurement Crenel and Package, whereas the right side expresses these per the S.I.

Using 3 preparation steps, we can extract \( P \) and \( C \), and express these in S.I. units of measurement as follows:

**Preparation step 1:**

Equation (1.5) can be rewritten as: \( 1 \text{ (s)} = c \text{ (m)} \).

**Preparation step 2:**

Based on the above, in equation (1.6), ‘s’ can be replaced by \( c \text{ meter} \).

This results in:

\[ 1 P.C = h \cdot c \text{ (N.m\(^2\))} \quad (1.8) \]

**Preparation step 3:**

Based on Einstein’s \( E = m \cdot c^2 \). 1 kg is equal to \( c^2 \text{ Joule} \) or \( c^2 \text{ (N.m)} \). In equation (1.7) the kg\(^2\) can therefore be replaced by \( c^4 \text{ (N}^2\text{.m}^2\)\): 1 C.P\(^4\) = \( G \cdot c^4 \text{ (N.m\(^2\).N}^2\text{m}^2\) = \( G \cdot c^4 \text{ (N}^4\) \quad (1.9) \)

We divide equation (1.8) by equation (1.9):

\[ p^2 = \frac{h \cdot c^5}{G} \text{ (N}^2\text{.m}^2\) = \( \frac{h \cdot c^5}{G} \text{ (Joule}\^2\) \]

Or:

\[ 1 \text{ Package} = \sqrt[6]{\frac{h \cdot c^5}{G}} \text{ (Joules)} \quad (1.10) \]

From here onwards some other conversion factors can be derived. Because 1 Joule equals \( c^2 \text{ kg} \):

\[ 1 \text{ Package} = \sqrt[6]{\frac{h \cdot c}{G}} \text{ (kilograms)} \quad (1.11) \]

= 4.9033x10\(^9\) J

= 5.4557x10\(^6\) kg
Based on Planck’s \( E = h \cdot v \), equation (1.10) can likewise be converted to frequency (in seconds\(^{-1}\)):

\[
1 \text{ Package} = \sqrt{\frac{\hbar c^3}{G}} \times \frac{1}{h} \text{ (s}^{-1}) = \sqrt{\frac{c^5}{\hbar G}} \text{ (s}^{-1})
\]

or:

\[
1 \text{ Package} = \sqrt{\frac{c^5}{\hbar G}} \text{ (Hertz)} \quad (1.12)
\]

Equation (1.12) delivers frequency as the third appearance in the content arena, besides the already defined appearances mass and energy.

The step from the content arena towards the whereabouts arena is found by multiplying equation (1.8) with equation (1.9):

\[
C^2 = \frac{\hbar G}{c^3} \text{ (meter}^2\text{)}
\]

Or:

\[
1 \text{ Crenel} = \sqrt{\frac{\hbar G}{c^3}} \text{ (meter)}
\]

\[
= 4.0512 \times 10^{-3} \text{ m}
\]

And, because one meter corresponds to \( c/1 \) seconds:

\[
1 \text{ Crenel} = \sqrt{\frac{\hbar G}{c^3}} \text{ (seconds)}
\]

\[
= 1.3513 \times 10^{-3} \text{ s}
\]

Our limited system of only two physical properties - content (in Packages) and whereabouts (in Crenel) - thus delivered a set of yardsticks for energy, mass and frequency in the content arena, and time, distance in the whereabouts arena.

These yardsticks are consistent with the historically known ‘Planck units’, albeit that the above equations hold Planck’s constant \( \hbar \), whereas the ‘Planck units’ hold the reduced Planck constant \( \hbar/2 \pi \) (‘\( \hbar \)’). Had for Planck’s equation \( E = h \cdot v \) the alternate and equally valid version \( E = \hbar \omega \) been used in the above, this would have resulted in full consistency with the ‘Planck units’.

When we now express an object’s content in Packages, the numerical value thereof will be found equal regardless one expresses this in the mass, the energy or the frequency appearance. For example: the content of an electron equals \( 1.6697 \times 10^{-23} \text{ Packages} \), regardless one is measuring or expressing this as mass, as energy, or as frequency. This feature of numerical equality justifies our usage of the term ‘appearance’ of content, rather than ‘dimension’ of content. One can freely swap between appearances without numerical impact. In comparison, in the S.I. for example one kg of mass does not equal 1 Joule of energy or 1 Hertz.

With \( c \) being normalized to the dimensionless 1, within our system of units of measurement we can simplify the found conversion factors:

\[
1 P = \sqrt{\frac{\hbar}{G}} \text{ Energy appearance} \quad (1.15)
\]

\[
1 P = \sqrt{\frac{\hbar}{G}} \text{ Mass appearance} \quad (1.16)
\]

\[
1 P = \sqrt{\frac{1}{\hbar G}} \text{ Frequency appearance} \quad (1.17)
\]

\[
1 C = \sqrt{\frac{\hbar G}{c^3}} \text{ Distance appearance} \quad (1.18)
\]

\[
1 C = \sqrt{\frac{\hbar G}{c^3}} \text{ Time appearance} \quad (1.19)
\]

Equation (1.17) is of key relevance: it shows how content (in Packages) can appear as frequency, which is expressed in Crenel\(^2\), that is: in the inverse of whereabouts.

This conversion option implies that the two base physical properties content and whereabouts are related to one another. And thus these properties are not necessarily normalized. We need to explore that.

**i) Normalization**

For that, we start with reviewing the mathematical (and thus universal) steps to convert content into whereabouts:

1. **INVERT** the conversion factor for content (per either equation (1.15) or (1.16)).
   This results in:
   
   \[
   \sqrt{\frac{G}{\hbar}}
   \]

2. **MULTIPLY** the result with Planck’s constant ‘\( \hbar \)’. This results in:
   
   \[
   \sqrt{\frac{\hbar G}{c^3}}
   \]

   which matches equations (1.18) and (1.19).

The exact same steps can be used to reconvert whereabouts into content:

1. **INVERT** the conversion factor for whereabouts (per either equation (1.18) or (1.19)).
   This results in:
   
   \[
   \sqrt{\frac{1}{\hbar G}}
   \]

2. **MULTIPLY** the result with Planck’s constant ‘\( \hbar \)’. This results in:
   
   \[
   \sqrt{\frac{\hbar G}{c^3}}
   \]

   which matches equations (1.15) and (1.16).
The equality between the conversion and reconversion steps is remarkable. The failsafe approach to reconvert to the original is to undo each conversion step in reverse order. In this case however, each of the following statements hold true:

a. Applying the conversion procedure twice results in the original value, regardless of whether one starts with the Package or with the Crenel.

b. Applying the conversion procedure twice has the same impact as a multiplication with dimensionless 1.

From a mathematical perspective it is exclusively the 'multiplicative inverse' operation which has this property. We apply this mathematical insight to the above two equal conversion procedures. Mathematics says that:

\[
\text{Content (in Packages) is equal to inverted whereabouts (in Crenel)}
\]

And vice versa:

\[
\text{Whereabouts (in Crenel) is equal to inverted content (in Packages)}
\]

However, the conversion/reconversion procedure that we found consists of two mathematical steps rather than one single step. This does not contradict the above mathematical conclusion. To verify this, we take a closer look at the second step of the procedure.

Given the above mathematical perspective that the Package and Crenel are found reciprocal, their product \( C.P \) must equal a dimensionless 1. This implies that Planck’s constant:

\[
h = 1 \, C.P \equiv 1
\]

Within our model Planck’s constant \( h \) (mathematically) therefore equals the dimensionless 1, and a multiplication with Planck’s constant (step 2 of the procedure) has no mathematical impact on the outcome. Yet we found that such multiplication nevertheless results in a physical property swap between Crenel and Package.

This gives a deeper insight into the conversion procedure. From a mathematical perspective, the first step (the inversion step) is the swap between Crenel and Package. The second step (multiply with Planck’s constant ‘\( h \)’) only ensures that this swap is processed dimensionally without impacting the result. After all, from a mathematical perspective this second step is indeed no more than a multiplication by 1.

Planck’s constant is the ‘inner product’ (also referred to as ‘scalar product’) \( P.C \) of the two physical properties \( P \) and \( C \) respectively. This inner product \( P.C \) must equal dimensionless 1. If not, the sequential applying of the conversion and reconversion procedures would not result in the original result, as demanded by mathematical rules. From a physical perspective it would violate the conservation principle should the original result not materialize.

The inner product of ‘\( P(\text{ackage}) \)’ and ‘\( C(\text{renel}) \)’ being equal to dimensionless 1 implies that these properties are perpendicular (independent) relative to one another.

In conclusion:

The currently defined system of units of measurement with two fundamental physical properties (content and whereabouts) is indeed normalized.

\( j \) The conservation principle’s bottom line.

By revealing that content (in Packages) is inverted whereabouts (in Crenel), and vice versa, our model gives the deepest view on the conservation principle.

The exchange rate between whereabouts and content can be found by rewriting the definition of the gravitational constant \( G=1 \, C/P \) as:

\[
C = G \times P
\]

\((1.20)\)

Or: whereabouts (in Crenel) equals the gravitational constant \( G \) multiplied with content (in Packages). This finding is our first glimpse of the physical meaning of the gravitational constant \( G \).
2. Gravity.

We found why at orbiting systems distances appear stretched when remotely observed (see equation (1.3)). And we concluded that -based on the conservation principle- time must appear to run proportionally slower (see equation (1.4)).

Thus at the orbiting system we see an apparent widening of whereabouts gridlines relative to these same gridlines in empty deep space, and also relative to our own Cartesian frame of reference. Apparently whereabouts embed a physical property that can be compared to e.g. a pressure in the Earth’s atmosphere. In this comparison we would describe the widening of gridlines as a whereabouts depression at the orbiting system.

And as air moves from high pressure regions to low pressure regions whereby the (local) gradient in air pressure is the driving force, we can explain the gravitational force in that content will be likewise pulled towards a whereabouts depression, whereby the driving force is the gradient in the widening of gridlines.

At the same time, we associated orbiting systems with ‘Planck content’.

If now we hypothesize that the orbiting objects had zero content prior to the start of the orbiting so that there is no bias to take into account, and that thus all embedded content is orbiting induced ‘Planck content’, we have a case to test this hypothesis for its consistency and outcome.

a) A Photon’s Path curving

In the previous paragraph we found that we see orbiting systems magnified:

\[ \text{LOD} = \text{ROD} \times \cos \left( \frac{\text{orbit}}{c} \right) \]  

(2.1)

Although we see the photon incoming from an orbit with diameter ROD, within our own Cartesian frame of reference we must reckon that it was locally emitted from an orbit with the shorter diameter LOD.

The difference between ROD and LOD tells us how the photon changed course within our own Cartesian frame of reference. We will name the angle of the course change \( da \).

Within our Cartesian frame of reference, this angle \( da \) equals the total curving of the photon’s path, which curving implicitly equals the total curving of the whereabouts gridline which connects the reckoned local emission point to our remote observation point.

We use the following figure to calculate aforementioned angle \( da \). As the figure makes clear, this angle depends on the distance \( x \) towards the centre of the orbiting system:

Fig. 2.1: photon course change \( da \).

In figure (2.1):

- Angle \( \alpha_{\text{ROD}} \) is the angle relative to the orbit axis, at which we actually see the photon incoming.
- Angle \( \alpha_{\text{LOD}} \) is the angle towards the reckoned emission point.
- Angle \( da \) is the difference between both.

We define \( R_R \) as the remotely observed orbit radius:

\[ R_R = \text{ROD}/2 \]  

(2.2)

And we define \( R_L \) as the locally observed orbit radius:

\[ R_L = \text{LOD}/2 \]  

(2.3)

The tangent of \( \alpha_{\text{ROD}} \) then equals:

\[ \tan(\alpha_{\text{ROD}}) = \frac{R_R}{x} \]  

(2.4)

And the tangent of \( \alpha_{\text{LOD}} \) equals:

\[ \tan(\alpha_{\text{LOD}}) = \frac{R_L}{x} \]  

(2.5)

Per equation (2.1): \( \text{LOD} = \cos \left( \frac{\text{orbit}}{c} \right) \cdot \text{ROD} \)

Or: \( \frac{\text{LOD}}{2} = \cos \left( \frac{\text{orbit}}{c} \right) \cdot \frac{\text{ROD}}{2} \)

Or: \( R_L = \cos \left( \frac{\text{orbit}}{c} \right) \cdot R_R \)

We substitute this in equation (2.5):

\[ \tan(\alpha_{\text{LOD}}) = \frac{\cos(\frac{\text{orbit}}{c}) \cdot R_R}{x} \]  

(2.6)

The angle \( da \) equals:

\[ da = \tan^{-1} \left( \frac{R_R}{x} \right) - \tan^{-1} \left( \frac{\cos(\frac{\text{orbit}}{c}) \cdot R_R}{x} \right) \]  

(2.7)

This equation can be normalized by expressing distance \( x \) in number of \( R_R \)’s. This makes \( R_R \) the new measure for distance. To achieve this, we define a new distance unit of measurement named \( x_R \), whereby \( x_R = \frac{x}{R_R} \).

Equation (2.7) then normalizes to:

\[ da = \tan^{-1} \left( \frac{1}{x_R} \right) - \tan^{-1} \left( \frac{\cos(\frac{\text{orbit}}{c})}{x_R} \right) \]  

(2.8)

\( (x_R \) expressed in orbit radiuses \( R_R \))

Figure (2.3) shows \( da \) per this equation as a function of distance \( x_R \) from the orbit centre.
We thereby opted for the maximum possible orbit velocity case whereby \( v_{\text{colo}} = c \).

![Image](57x254 to 274x407)

Fig. 2.2: \( da \) as a function of distance \( x_R \) (\( x_R \) expressed in number of \( R_x \)’s from the orbit centre, whereby the orbit velocity \( v_{\text{colo}} = c \)).

The gradient in whereabouts is quantified by the steepness and direction of the slope in the above shown curve of \( da \). It equals:

\[
\frac{da}{dx_R} = \frac{x_R^2 (\cos(V_{\text{orbit}}) - \cos^2(V_{\text{orbit}}))}{x_R^2 (\cos(V_{\text{orbit}}) + 1) + x_R^4 + \cos^2(V_{\text{orbit}})}
\]

\((x_R \text{ expressed in remotely observed orbit radiuses } R_x)\) \( (2.9) \)

The following figure embeds the value thereof, again based on the maximum possible orbit velocity case whereby \( v_{\text{colo}} = c \):

![Image](57x598 to 295x734)

Figure 2.3: Gradient \( \frac{da}{dx_R} \)

(as a function of distance \( x_R \) expressed in \( R_x \)’s, based on an orbit velocity \( v_{\text{colo}} = c \)).

The whereabouts gradient curve \( \frac{da}{dx_R} \) was previously identified as the cause of gravity, not necessarily representing the strength of the gravitational force. We will explore that later. Yet, at this point and based on above figure we find a change of sign at the point marked B (at either side of the orbiting centre). This indicates that at this point B the gravitational force changes from attracting towards repelling.

**This is a major finding.** It explains why objects -when approaching the centre of orbiting induced content- will not gravitate under ever growing gravitational force, as would be the case per Newton’s gravitational equation. Instead, figure (2.3) shows a finite maximum repelling force at the content centre (that is: the centre of the orbiting system, the point marked C).

The exact location of point B is found where the nominator in equation (2.9) equals 0:

\[
x_R^2\left(\cos\left(\frac{V_{\text{orbit}}}{c}\right) - 1\right) + x_R^3\left(\cos\left(\frac{V_{\text{orbit}}}{c}\right) - \cos^2\left(\frac{V_{\text{orbit}}}{c}\right)\right) = 0 \quad (2.10)
\]

Equation (2.10) gives the following two values for distance \( x_R \):

\[
x_R = \pm \sqrt{\frac{-4\left(\cos\left(\frac{V_{\text{orbit}}}{c}\right) - 1\right)\left(\cos\left(\frac{V_{\text{orbit}}}{c}\right) - \cos^2\left(\frac{V_{\text{orbit}}}{c}\right)\right)}{2\left(\cos\left(\frac{V_{\text{orbit}}}{c}\right) + 1\right)}} \quad (2.11)
\]

### b) Distance x.

Rather than normalizing equation (2.7), we can also specify the gradient \( \frac{da}{dx} \) thereof:

\[
\frac{da}{dx} = \frac{R_x x^2 \left(\cos\left(\frac{V_{\text{orbit}}}{c}\right) - 1\right) + R_x^3 \left(\cos\left(\frac{V_{\text{orbit}}}{c}\right) - \cos^2\left(\frac{V_{\text{orbit}}}{c}\right)\right)}{R_x^2 x^2 \left(\cos\left(\frac{V_{\text{orbit}}}{c}\right) + 1\right) + x^4 + R_x^4 \cos^2\left(\frac{V_{\text{orbit}}}{c}\right)}
\]

(2.12)

For very large values of distance \( x \) as well as for very small values of \( R_x \), equation (2.12) is estimated by:

\[
\frac{da}{dx} \approx \left(1 - \cos\left(\frac{V_{\text{orbit}}}{c}\right)\right) \times \frac{R_O D}{x^2} \quad \text{large } x \) \( (2.13) \)

Per equation (2.1) the term ‘\( \cos\left(\frac{V_{\text{orbit}}}{c}\right)\)’ can be replaced by LOD/ROD:

\[
\frac{da}{dx_{\text{large } x \text{ or small } R}} \approx \left(1 - \frac{\text{LOD}}{\text{ROD}}\right) \times \frac{\text{ROD}}{x^2}
\]

Or:

\[
\frac{da}{dx_{\text{large } x \text{ or small } R}} \approx \left(\text{ROD} - \text{LOD}\right) \times \frac{1}{x^2} \quad (2.14)
\]

In the above equation the term (\( \text{ROD-LOD} \)) reflects the amount of ‘fake’ whereabouts: from a remote perspective we
‘see’ an orbit diameter equal to the ROD, but we know that we see it stretched, as if looking through a magnifying glass.

The difference (ROD-LOD), being ‘fake’ whereabouts, is to be interpreted as whereabouts that has been converted into content. Thereby, our model demands that one unit of whereabouts converts one-on-one into one unit of content.

We can therefore write equation (2.14) as:

\[
\frac{da}{dx_{\text{large } x \text{ or small } R}} \approx \frac{\text{Content}}{x^2} \tag{2.15}
\]

With -per our model- the gradient \(\frac{da}{dx}\) being identified as the cause of the gravitational force, we can now make a direct comparison with Newton’s gravitational equation:

\[
F_g = G \times \frac{\text{Content}_1 \times \text{Content}_2}{x^2} \tag{2.16}
\]

Newton’s equation says that if we place a content_2 at a distance \(x\) from a content_1, the gravitational force is given by equation (2.16). Newton’s equation is a fundamental equation that must hold within any system of UoM, thus also within our model. Here, the equation holds, even though our model demonstrates that it is no more than a good approximation of the gravitational force at large distances (large, relative to the orbit diameter of orbiting induced content).

To verify Newton’s equation within our model, we rename content in equation (2.15) to content_1, and we substitute this in Newton’s equation (2.16):

\[
F_g = G \times \frac{da}{dx_{\text{large } x \text{ or small } R}} \times \text{Content}_2 \tag{2.17}
\]

Prior to interpreting the physical meaning of this equation, let’s check its dimensional integrity within our model:

\(F_g\) is to be expressed in P/C (see chapter 1)
\(G\) equals 1 C/P
\(\frac{da}{dx_{\text{large } x \text{ or small } R}}\) is in \(P/C^2\)
\(\text{Content}_2\) is in \(P\)

Substituting these dimensions into equation (CP9.23) gives:

\[
\frac{P}{C} = \frac{C}{P} \times \frac{P}{C^2} \times P = \frac{P}{C} \tag{2.18}
\]

Thus we confirm the dimensional integrity of equation (2.17).

As said, per our model the term \(\frac{da}{dx_{\text{large } x \text{ or small } R}}\) in equation (2.17), being the local gradient in whereabouts pressure, was introduced as the cause of the gravitational force. Based on equation (2.17) we can now upgrade the meaning of this gradient: per our model the gradient in whereabouts pressure exactly represents gravity at large distances, without demanding a weight factor. Or: for the term \(G\) in equation (2.17) we can indeed substitute the gravitational constant per our model: \(G\) (being equal to 1 C/P).

In conclusion:

The following equation quantifies the exact gravitational force between an orbiting induced content and some remote content at distance \(x\):

\[
F_g = \frac{R_{\text{R}} \cdot x^2 \cdot \left(\cos \left(\frac{\text{V}_{\text{orbit}}}{c}\right) - 1\right) + R_{\text{R}}^3 \cdot \left(\cos \frac{\text{V}_{\text{orbit}}}{c} - \cos^2\right)(1)}{R_{\text{R}}^2 \cdot x^2 \cdot \left(\cos^2 \frac{\text{V}_{\text{orbit}}}{c} + 1\right) + x^4 + R_{\text{R}}^4 \cdot \cos^2 \left(\frac{\text{V}_{\text{orbit}}}{c}\right)} \times \text{Content} \tag{2.19}
\]

c) Case studies.

1. Imagine an orbiting galactic system, consisting of numerous and homogeneously distributed masses. Per Newtonian laws the net gravitational force at the centre of this system would be equal to 0, since the added gravitational forces of all surrounding masses would compensate each other. And in the vicinity of this centre any object would be pulled towards this centre, so that such system should ultimately take the shape of a perfectly flat disc. In fact we see galactic systems not completely flattened, despite their age.

Per our model, an object which is located near the centre of such galactic system would experience a gravitational repelling force, directed away from the centre. In the regional absence of any other forces (which would virtually be valid near the centre of such a galactic system) this orbiting induced gravitational repelling force would prevent the system to ultimately flatten completely. This fits the actual observations.

2. Imagine a proton and an electron in orbit around their centre of gravity. Per our model an approaching electrically neutral particle would not settle itself at that centre. Here, it would be subject to a repelling gravitational force.

We observe atoms as 3-dimensional objects, not being flat. This observation conceptually fits our model.
3. Imagine a space ship on its way from the Earth towards the Moon. It would thereby pass the centre of gravity of the Earth/Moon orbiting system at relatively close range.
Per our model it would thereby experience a (small) non-Newtonian gravitational force which is directed away from the centre of gravity. Such space ship would -on its way- therefore experience a minor force away from the targeted Moon.
It is not known if such (small) deviation can be confirmed by actual data.