Gravity as Longitudinal Waves

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Abstract

Describing the world as a sea of dots, this article presents a theory on the nature of gravity.
Calculated gravity is proportional to the square root of Newton's before length adjustment.
Knowing gravity at short distance, it is shown that it has the characteristics of strong force.

Inverse Proportionality

Nothing other than dots exist in the most fundamental form of our world, let us assume.

Object can be affected by gravity from a distance means gravity must be a signal.
Gravity can travel very far means the signal must be a wave.
Having only dots and no other structure, the wave must be longitudinal.

Let us consider a wave travelling outward.
Its energy decreases as the surface area increases.
Because of this, the inner amplitude is larger than the outer amplitude.

Let

- r be the distance travelled
- a be the amplitude at r
- x be the maximum displacement from r

Using

- surface area of a sphere of radius $r = S(r) = 4\pi r^2$
- energy of a wave of amplitude $a = E(a) \propto a^2$

We have

$$\begin{aligned} E(x) &= E(a)\frac{S(r)}{S(r+x)} \\ x^2 &= a^2\frac{r^2}{(r+x)^2} \\ x &= \frac{1}{2}(-r \pm \sqrt{r}\sqrt{r \pm 4a}) \end{aligned} \tag{1}$$

Picking x with the least magnitudes

$$\begin{cases} x_{\max} &= \frac{1}{2}(-r + \sqrt{r}\sqrt{r+4a}) \\ x_{\min} &= \frac{1}{2}(-r + \sqrt{r}\sqrt{r-4a}) \end{cases} \tag{2}$$

Comparing $x_{\max} + x_{\min}$ to $-\frac{1}{r}$

$$\lim_{r\to\infty} \frac{x_{\max} + x_{\min}}{-\frac{1}{r}} = 2a^2 \tag{3}$$

When $a = 1$, the above converges to 2 rapidly as r increases

r	value
10	2.109369
100	2.001001
1000	2.000010

So, the average displacement of dot is

$$\begin{aligned} d &\propto \int_0^{\pi} x_{\max}\ \sin(t)\ dt + \int_{\pi}^{2\pi} (-x_{\min})\ \sin(t)\ dt \\ &\propto x_{\max} + x_{\min} \\ &\propto -\frac{1}{r} \end{aligned} \tag{4}$$

Magnitude

Using the Harmonic Addition Theorem, when n dots send out waves with the same amplitude, the resulting wave is

$$\begin{aligned}\psi &= \sum_{i=1}^{n} a\ \cos(\omega t + \delta_i) \\ &= A\ \cos(\omega t + \delta)\end{aligned} \tag{5}$$

where

$$\begin{aligned}A^2 &= \sum_{i=1}^{n}\sum_{j=1}^{n} a^2\ \cos(\delta_i - \delta_j) \\ &= \sum_{i=1}^{n} a^2 + 2\sum_{i=1}^{n}\sum_{j>i}^{n} a^2\ \cos(\delta_i - \delta_j)\end{aligned} \tag{6}$$

Since $(\delta_i - \delta_j)$ is random and the expected value of $\cos(\theta)$ is zero

$$\begin{aligned}\mathbb{E}(A^2) &= \sum_{i=1}^{n} a^2 \\ \mathbb{E}(A) &= \sqrt{n}\, a\end{aligned} \tag{7}$$

Therefore, when M masses send out waves, the average displacement of dot is proportional to $\sqrt{M}$.

Relationship Between Dot Displacement and Force

Dot displacement is the only property which has a resemblance to force.
No one knows what is mass and how it moves. So, there is no way to prove it.

But let's imagine.
Since mass can move very fast in dots, mass should be incorporeal.
Since the speed of light is a constant, mass should be a wave, too.
Since mass can move slower than light, mass should have a non-wave component.

Let's say mass is the burning of dots. This generates waves which trigger other dots to burn.
The average displacement of dot distorts the waves and changes how far the burning spot moves.
The farther the wave travels, the more it changes.

So, gravity is

$$G_0 \frac{\sqrt{M}}{r} \tag{8}$$

Gravity on Earth

Let

- gravitational constant $G = \frac{G_0}{\gamma}$

Since gravity on Earth is $G\frac{M}{r^2}$, the speed of wave must be $\sqrt{\gamma\frac{r}{\sqrt{M}}}$ so that

$$\begin{aligned}r_{\text{true}} \div \sqrt{\gamma \frac{r_{\text{true}}}{\sqrt{M}}} &= r_{\text{earth}} \\ \sqrt{\frac{r_{\text{true}}^2}{\gamma}\frac{\sqrt{M}}{r_{\text{true}}}} &= r_{\text{earth}} \\ r_{\text{true}} &= \gamma \frac{r_{\text{earth}}^2}{\sqrt{M}}\end{aligned} \tag{9}$$

So, gravity is

$$\begin{aligned}g &= G_0 \frac{\sqrt{M}}{r_{\text{true}}} \\ &= G_0\sqrt{M} \div \gamma \frac{r_{\text{earth}}^2}{\sqrt{M}} \\ &= G\frac{M}{r_{\text{earth}}^2}\end{aligned} \tag{10}$$

Gravity in the Deep-MOND Regime

Since wave requires energy, mass must consume fuel.
The only fuel available is dot. So, dots are flowing to mass.

Let

- ρ be the dot density
- P be the dot pressure
- m be the Mach number
- V be the velocity of the flow
- A be the surface area of a sphere of radius r

Using the conservation laws of fluid dynamics and thermodynamics, the relationship for the flow is given as

$$dP(1 - m^2) = \rho V^2 \left(\frac{dA}{A}\right) \tag{11}$$

Since gravity can escape the flow, the flow must be subsonic.
When r increases, A increases, and so P increases.
When r is large, ambient pressure takes over and the speed of wave becomes a constant.

Using a_0 from MOND

$$\begin{aligned} a_0 &= G\frac{M}{R_{\text{earth}}^2} \\ \frac{R_{\text{earth}}^2}{\sqrt{M}} &= G\frac{\sqrt{M}}{a_0} \\ R_{\text{true}} &= G_0\frac{\sqrt{M}}{a_0} \end{aligned} \tag{12}$$

The speed of wave is

$$\begin{aligned} s &= \sqrt{\gamma\frac{R_{\text{true}}}{\sqrt{M}}} \\ &= \sqrt{G_0\frac{\sqrt{M}}{a_0}\frac{\gamma}{\sqrt{M}}} \\ &= \sqrt{G_0\frac{\gamma}{a_0}} \end{aligned} \tag{13}$$

Gravity is

$$\begin{aligned} g &= G_0\frac{\sqrt{M}}{r_{\text{true}}} \\ &= G_0\frac{\sqrt{M}}{(r_{\text{earth}} - R_{\text{earth}}) \times s + R_{\text{earth}} \times s} \\ &= \sqrt{a_0 G\frac{M}{r_{\text{earth}}^2}} \end{aligned} \tag{14}$$

Using the equation for centripetal force, the rotational velocity of a spiral galaxy is

$$\begin{aligned} \frac{v^2}{r_{\text{earth}}} &= g \\ v^4 &= GMa_0 \end{aligned} \tag{15}$$

Gravity as Strong Force

When $r < 4a$

$$\begin{cases} x_{\max} &= \frac{1}{2}(-r + \sqrt{r}\sqrt{r + 4a}) \\ x_{\min} &= \frac{1}{2}(-r - \sqrt{r}\sqrt{r + 4a}) \end{cases} \tag{16}$$

The average displacement of dot is

$$x_{\max} + x_{\min} = -r \tag{17}$$

At small r, force increases linearly with distance.
At large r, force decreases rapidly until it becomes inversely proportional to distance.
These match the characteristics of strong force.