*Sam Perry, 16/06/24*

# *Relative Motion Hypothesis: An Anomaly Unifying Principle*

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**Abstract**:
Relative motion induced alterations in the observer-perceived gravity field of a mass results in a change in location of the centre of gravity as perceived by the other mass, shifting it in the direction of the mass's relative motion and causing a subtle additional inward torque on orbiting bodies. The torque effect becomes more noticeable at greater distances under weaker gravity regimes.

In summary, the idea is about how a mass in relative motion's gravity is perceived by the other. The hypothesis proposes that relative motion between two masses results in a mass having an asymmetric gravitational distortion from the other's perspective. This asymmetry of perceived gravity results in a compensatory shift in location of a mass's centre of gravity as perceived by the other mass, causing an additional inward torque which affects the velocity vector of orbiting masses and which is unaccounted for by today's models as they assume a static centre of gravity. Essentially it is suggesting a relative motion induced variable centre of gravity.

In order to come to this hypothesis, the assumptions are few and simple:

- <u>Gravity is continually produced by and propagates from masses at the speed of light, rather than being a static field</u>. Assumed because gravity is caused by the presence of mass, and masses are continually present, so it appears reasonable to assume that gravitational effects are continually produced by masses, and that these effects propagate outward from the mass at c in the same way gravitational waves have been observed as doing so. This occurs in a continuously updating/refreshing fashion. So with Earth for example, it's constantly receiving new gravitational information from the Sun, but because the distances and masses are stable, the field appears static while it is actually dynamically updating.
- <u>The gravitational output of a mass remains balanced across different reference frames</u>. That is, if the net gravity output of a mass is balanced from its own reference frame, it must be balanced from other reference frames simultaneously, for conservation of energy principles.

More specifically, the idea posits that between two masses in relative motion, the gravity of mass 1 is perceived by mass 2 as propagating at above and below c relative to mass 1 in the direction of its relative motion. This happens because mass 1's gravity propagates at c from both reference frames simultaneously. Meaning in the direction of relative motion, a mass is observed by the other as moving into and away from the gravity it is producing, akin to a Doppler effect.

Given this perceived variation in gravity propagation speeds, in order to maintain a balanced gravity output of a mass from both reference frames simultaneously, this results in a perceived compression and decompression of gravity output in the direction of motion from the perspective of the other mass.

As a result, this asymmetric distortion of the perceived gravity well affects the overall gravitational interaction, because masses interact with the gravities they perceive another mass as having, rather than interacting with the uniform gravity observed from the perspective of the mass itself. The key consequence of this perceived asymmetry is that the location of the net gravitational attraction (centre of gravity) shifts slightly toward the direction of compression (or in the direction of relative motion). So the centre of gravity shifts as compensation for the perceived slower/faster than light speed propagation as a way of maintaining the balanced gravitational output of a mass across perspectives.

For the complete picture, when relative motion is zero the perceived centre of gravity begins at the centre of mass. As you increase relative motion up to c it progresses toward the radius of the mass in the direction of compression. This effect means masses in relative motion are attracted to one another from points outside of their centres of mass, which creates an extra inward gravitational torque on orbiting bodies such as stars rotating around a galactic centre.

Based on observations like galactic rotation curves and wide binary stars, I expect that the effect on orbit is more pronounced for masses orbiting under weaker gravity for two reasons:

- the main reason is that the inverse square law reduces gravity requirements for orbit more rapidly than the effect of this unaccounted torque reduces. When orbital gravity requirements are weaker, the impact of this unaccounted torque on orbital curvature becomes more significant on orbital trajectories. So as we move outwards from the centre of the galaxy, we should expect to see a better maintenance of orbital speed when compared to models that assume a static centre of gravity.
- the subtler reason is that as relative motion is increased, the spherical shape of masses means that the ratio of mass on either side of the centre of gravity becomes increasingly more pronounced, such that a greater increase in compression is required for continued balance about the centre of gravity or to continue moving it outward at the same rate. So masses orbiting more slowly and under weaker gravity exhibit a greater than linear

movement of their centre of gravity (as a proportion of the radius) per unit of relative motion (as a proportion of c).

What may be important to mention is that the idea appears compatible with General Relativity, as in regions of strong gravity (like in our solar system) the orbital curves are already tight, such that the results of the implied torque are negligible on orbital curvature and any associated calculations would reflect the same values. However, in regions of weaker gravity (like on the outskirts of galaxies) where GR fails to accurately describe gravity, the torque effect becomes more pronounced due to the wider curve and weaker gravity required for orbit. So it works with GR where GR succeeds, and provides an additional mechanism for explaining gravity in areas where GR fails to accurately describe gravity.

Due to the novel nature of this hypothesis, it can only be considered speculative at this stage. However, as mentioned it does appear to be in alignment with several currently unexplained astrophysical phenomena. I will provide a list of phenomena that appear to align with the predictions of this idea, with brief explanations of why they're in alignment, at the end of this message.

So to conclude, according to this hypothesis gravity is a dynamic force constantly outputted by masses at the speed of light from all reference frames simultaneously. As a result, relative motion induces asymmetries in perceived gravity which affects the overall interaction by moving the location of the perceived centre of gravity and providing an additional inward torque on masses orbiting in space. This effect could potentially explain galactic rotation curves (among other phenomena) without invoking dark matter.

## *List of Phenomena in Alignment:*

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While I'm unfamiliar with the relevant data and am yet to mathematically formalise this hypothesis, such that I cannot speak to the proportion of these anomalies that is explained by the principles of this idea, it does appear that each of these anomalies works with rather than against the hypothesis. In researching, every anomaly I came across appeared to work with the idea, and it is the breadth that I found compelling and suggestive of a potential underlying causal relationship.

1. **Galactic Rotation Curves - Outskirts' Unusually Fast Orbit:** Objects orbiting the outskirts of a galaxy require less force to stay in orbit due to the weaker gravitational pull from the central mass following the inverse square law. Subsequently, the relative motion-induced movement of their perceived centre of gravity and resultant torque has a

larger effect on the overall dynamics of their orbits. This causes a more substantial increase in their observed orbital speeds, showcasing the impact of relative motion-induced shifts in perceived centres of gravity on galactic rotation curves.

2. **Recent observation of subtle gravitational waves permeating the entirety of the universe**: According to the idea, this is happening because of the compression/ decompression of perceived gravity caused by relative motion. This compression of gravitational output undergone by all masses in motion (from the perspectives of other masses) is what's being observed, causing a complex fluctuating field of constant perturbations.

3. **Gravitational Lensing in Bullet Cluster:** Relative motion's influence on gravity wells could explain the perceived stronger than expected gravity in the direction of motion, as observed in the Bullet Cluster's gravitational lensing phenomenon. This would occur because light perceives gravity from all reference frames simultaneously, so we observe it interacting with the stronger "compressed" gravity formed in the directions of the clusters' motions. So light is interacting with the gravity of a colliding cluster as it is perceived by the other cluster.

4. **Mercury's Increasing Spin:** Mercury's observed increase in spin over time may be influenced by its relative motion with the Sun, leading to a shift in its perceived centre of gravity tangential to its motion, creating a torque applied directly to its spin as it is axially aligned with the sun's plane. It's difficult to justify an increase in spin after gravitational compression is complete without an additional torque.

5. **Mercury's Spin Acceleration:** The variation in Mercury's spin acceleration, correlating exactly with its maximum and minimum relative motion to the Sun, suggests a potential causal relationship with relative motion-induced distortions in its gravity well.

6. **Older Black Holes' High Spin Rates:** Observations show that older black holes with more surrounding mass tend to spin faster, which aligns with the idea that individual orbiting masses' gravities interact with a distorted perception of the black hole's gravity due to their individual relative motions, leading to a constant accumulation of the black hole's angular momentum over time.

7. **Older Black Holes' Alignment to Galactic Plane:** Observations show that older black holes with more surrounding mass tend to be more aligned with the galactic plane, which is consistent with the idea that the relative motion of surrounding mass and the resultant

distorted gravitational interactions play a role in determining the black hole's spin orientation.

8. **Wide Binary Stars:** The observed higher than expected orbital speeds of binary stars with acceleration beneath 0.1 nanometers per second squared aligns with the idea that the relative motion induced shift in centre of gravity has a greater impact on orbital curvature at larger distances. This occurs because the acceleration requirements for orbit reduce rapidly following the inverse square law, meaning any relative motion induced movement of the centre of gravity has a greater tightening effect on the mass's orbit as distances increase.

9. **Rotation curves of different galaxy shapes:** Spiral galaxies tend to have flatter rotation curves than their elliptical counterparts. This happens because in spiral galaxies, the position of the centre of gravity is in a position such that the torque applied is perpendicular to the direction of motion, whereas in elliptical galaxies most of the time spent in orbit is more moving away/toward the galactic centre in a radial fashion. So in elliptical galaxies, the torque induced by this idea is less directly applied to the orbital curvature when compared to a more circular orbit. So the implied effect aligns with observations of elliptical galaxies having a steeper rotation curve than spiral galaxies.