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An Examination of Newton's 3rd Law, Acceleration, and the Force of Gravity ©

Abstract

A falling object in Earth's Gravity is subject to more than the Force (F_G) generated by the Gravitational Mass (GM or M_G) emanating from the planet's consolidated matter isotropic gravity force field. A different perspective given here does not change what is observed but offers an alternative detailed explanation as to what is happening to give a clearer understanding of the phenomenon. That falling object of Inertial Mass (IM or m_I) is also experiencing the effect indicated be Newton's force equation and his 3rd Law but has been misunderstood and dismissed by traditional physics. A falling accelerating object, an Inertial Mass, is a recipient of an Inertia Force (F_I) emerging from the Gravity Energy Field of Space itself as a response to the acceleration of mass in addition to the recognized classical Newtonian gravity force.

Newton's Laws, Force and Acceleration

Newton's First Law tells us an object will remain at rest or move at a constant velocity unless acted upon by an outside force.

The Second Law describes this outside force as a product of the object's mass and its acceleration, $F_I = ma$

Newton's 3rd Law has been stated in various ways:

"If an object A exerts a force on object B, then object B must exert a force of equal magnitude and opposite direction back on object A." [1]

"When one body exerts a force on the other body, the first body experiences a force which is equal in magnitude in the opposite direction of the force which is exerted". [1]

"According to Newton, whenever objects A and B interact with each other, they exert forces upon each other. When you sit in your chair, your body exerts a downward force on the chair and the chair exerts an upward force on your body. There are two forces resulting from this interaction - a force on the chair and a force on your body. These two forces are called action and reaction forces and are the subject of Newton's third law of motion." [2]

"The above statements mean that in every interaction, there is a pair of forces acting on the interacting objects. The magnitude of the forces is equal and the direction of the force on the first object is opposite to the direction of the force on the second object." [1]

These comments clearly state this force exchange is between physical objects. It seems to be a reasonable explanation when considering that if not for the reaction force the chair would go through the floor. When this acceleration takes place between two bodies A & B, such as a ball (A) thrown against a wall, the wall (B) is providing the equal and opposite force.

Given: All Objects fall at the Same Acceleration Rate in Earth's Gravity Field

$$F_I = m_I a = m_I a \qquad \text{and} \qquad a = F_I / m_I$$

Regardless of the mass, an elephant vs. a mouse, both accelerate at the same rate 9.8 m/s/s[5]

The equation shows that acceleration depends on both the force and the mass. But since it is known that the acceleration is same for all objects, the ratio of the force to the mass is a constant. Thus, for some reason, the mass has an inverse effect on the acceleration and the larger elephant mass adjusts the ratio to achieve the same acceleration as the small mouse mass. Physics says this is because the ratio, F_I / m_I is the Gravitational Field Strength of 9.8 N/kg at Earth's surface and all objects within this gravitational field will experience the same field strength regardless of their mass. The GFS causes the acceleration rate 9.8 m/s/s at ground zero. [6]

A Modified View

This paper offers the proposition that **the exchange of forces can also involve Space**, that is, the energy fields of Space. It is a place of residence for an unknown quantity of energy fields; that Space is where Gravity resides and it emerges with its detection of acceleration with interaction with any matter at any scale[3]. It is from Space that Gravity emerges because of *acceleration* at any scale but only the macro scale is being examined here.

It also happens when an object (A) accelerates against the energy field of the "vacuum" of Space (B). In this case, it is Space that has detected the force from "A" triggered by the accelerating inertial mass and it is Space that provides the reaction force. This force has been viewed as a pseudo-force, commonly referred to as the G force.

It is proposed that the reaction force is not exactly equal as noted in a previous paper[4], in that the 2nd Law of Thermodynamics requires that some energy be given to the surroundings because this reaction response is spontaneous and a tax must be paid to the cold sink of Space as work is being done.

Newton's gravity force equation: $F_{G} = GM_Gm_I/R^2$

G = Gravitational Constant

M_G = Gravitational Mass of Earth

m_I = Inertial Mass of falling object

R = Radial distance between the mass centers

This provides his explanation for the force that is experienced by a falling object resulting in a positive acceleration towards the Earth of 9.8 m/sec/sec. Based on the position offered above, it is claimed here that the accelerating object will also experience an inertia reaction force from Space with an opposite *negative* acceleration vector defined by $F_I = m_Ia$.

The positive acceleration to the falling object from Earth's gravitational force provided by the GM plus the *negative* acceleration to the falling object (m_I) provided by the reaction force from Space gives the resultant positive acceleration vector of 9.8 m/sec/sec.

$$GM_Gm_I/R^2 + (-m_Ia) = m_Ia$$

$$GM_G\cancel{m_I}/R^2 = 2\cancel{m_I}a$$

Yes, the *negative* acceleration of the falling object varies according to its mass; but that inertial mass of the falling object cancels out and thus it is not a factor in the acceleration.

The force provided by the Earth is found to be twice the force of the inertial mass action-reaction so the object continues to fall and accelerate which is why someone would not feel his weight; not because there is no force pushing back but because there is no sense of the reaction force as the reaction force cannot hold him to a fixed coordinate position in the reference frame. There is just free-fall and the sense of weightlessness.

The reaction response force from Space contributes to the resultant force total. The Earth also has an acceleration vector as it goes around the Sun but that is not a factor for the falling object.

Viewing the video of an aircraft providing a Zero G simulation shows[7] riders are in free-fall in the aircraft reference frame. Interestingly, liquids in a glass or small items released are all free-falling in the same reference frame but they do not stay in place and fall with the riders at the same rate but first move upward as if under a negative force vector.

Conclusion

The action-reaction exchange that takes place should include Space as an additional "object" when considering the application of Newton's 3rd Law. To be consistent, Space itself is also a part of the phenomenon when falling objects accelerate at the same rate because their mass does cancel from the total force equation when the reaction force generated according to Newton's Laws is taken into consideration. The sensation of weightlessness is the result of no force being present that will hold an object to a fixed set of coordinates in the given reference frame and the object is in free-fall under the illusion that the only force present is Earth's gravitational field until the object reaches ground level. This perspective is based on considering that Space is real and part of Universe and does exchange energy with mass even at a macro scale. Observing the movement of small objects and liquids seen on a video of a jet plane Zero G simulation possibly gives support to the theory that an action-reaction response from Space is a real energy field response to an accelerating falling object at the macro scale.

1. https://byjus.com/physics/newtons-third-law-motion/#newtons-third-law-of-motion

2. https://www.physicsclassroom.com/class/newtlaws/Lesson-4/Newton-s-Third-Law

3. https://www.gsjournal.net/Science-Journals/Essays/View/8227

4. https://www.gsjournal.net/Science-Journals/Research%20Papers/View/7442

5. https://www.physicsclassroom.com/Class/newtlaws/u2l3e.cfm

6. https://www.physicsclassroom.com/Class/newtlaws/u2l3e.cfm

7. https://www.gozerog.com/