A brief history of Gravity – from Newton to the present

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Gravity is a very simple phenomenon like an apple falling down to the ground and not flying of the trees. Newton gave a simple explanation: Every body attracts every other body. Newton's equation still remains the simplest and the most useful tool for calculating gravitational force. However, Newtonian gravity is imperfect as a theory. Since Newton, many changes have happened in the field of theoretical physics that not only gravity, but all the basic tenets of Classical Newtonian physics are being questioned now. Gravity now seems to be the most complicated concept.

Gaps in Newtonian gravity:

Any theory contains some arbitrary assumptions that agree with observations. If the theory is to be perfect, such assumptions should be adequately explained. Lack of clarity in the basic assumptions is the main drawback of many theories in physics. In Newtonian gravity, the basic assumptions are the concepts regarding mass, gravity, motion and force.

Mass is the amount of matter in a body, and a body has a definite mass – as an assumption this is very clear. Bodies have gravity, but gravity has no definite value. This seems absurd; for clarity, Newton should have proposed how-much gravitational force a given amount of matter possesses.

Motion is something imposed on bodies; force imposes motion. Inertial force comes from the motion of another body. From where did that body get motion? Gravity is a force, but not an 'inertial force'. Both depend on mass, but are unrelated, why? Like inertial force, gravity also can impart motion to bodies. Where does the motion come from? Thus in fact, Newton has not explained from where bodies acquire motion. Also, he did not state whether there is any relation between inertial force and gravity.

Laws in physics – physical or mathematical ?

The inverse-square law of gravity is regarded as a physical law, rather than a mathematical law (one may ask, what difference does that make). If it is a physical law, we can arrive at some physical conclusions from it, like, 'gravity can be infinite', 'distance between bodies can be arbitrary', etc.. If it is just 'a mathematical law' that gravity follows, we cannot arrive at such conclusions. Whether gravity can be infinite or whether the distance between bodies is arbitrary has to be decided based on observations and not on the law.

Whether Newton regarded his law as 'physical' is debatable. He had indirectly hinted[1] that 'what gravity actually is' does not depend on his law, and this remark can be argued to be in favor of 'mathematical' law. Then, why do bodies follow mathematical laws?

When bodies accumulate, their properties get added up, and this adding up has to follow mathematical laws. The pattern of adding up is different for different properties. To ascertain the mathematical law that each property follows, we have to depend on observation and logic. For example, mass can be calculated by just adding up the individual masses; but volume depends on how the bodies are packed; to add up motion, we have to to add up the squares of the speeds and then find the square-root. These mathematical laws are not specially made for physics; these are general and applicable to all similar situations. That is, there are no physical laws; bodies follow relevant mathematical laws that are applicable to each of their properties.

However, at present, physicists generally treat the laws as physical, and arrive at conclusions regarding the physical world from the laws, and this often creates 'mathematical-artifacts'. For example, the concept of 'spacetime' in Special Relativity is a mathematical-artifact having no physical meaning; the concept was inferred from the equations (laws) for the motion of light, and not from observation.

Wrong interpretation of Newton's law:

The wrong interpretation of Newton's law as a 'physical law' resulted in the following wrong conclusions: (i). gravitational interaction is instantaneous, (ii). gravity can cause singularity (iii). the orbits of planets are static. And these are held as drawbacks of Newtonian gravity! For instantaneous action, speed should be infinite and for singularity, gravity should be infinite. Newton has not proposed any limit for speed or gravity; that is merely a gap in his theory; but the prediction of infinite speed and infinite force is due to wrong interpretation (and cannot be blamed on Newton).

Gravitational law just gives the mathematical relation between the distance of the orbiting body and its speed, nothing more. The law does not imply that orbits have to be static; the distance can vary and the speed can vary; that is why elliptical orbits are physically possible (not because of the mathematical fact that circle is a special case of ellipse). Precision of elliptical orbits is natural (it does not require General Relativity to explain it); the wrong notion of 'static orbits' made 'precision' appear to be something unnatural.

Proposed gap-filling – a stronger equivalence principle:

The gaps in Newtonian gravity can be filled by introducing the following additional assumptions: 'motion is a property of matter' and 'gravity is reaction to motion'. The direct relationship between motion and gravity provides an equivalence principle stronger than the one proposed by General Relativity. If motion is a property, what should be the natural speed of a body? The speed of light is something unique, and so that can be the right choice. This gives some interesting results:

(i). No body can move faster than 'c' because much of the motion remains locked inside the body. (ii). Light is particles moving at the natural speed; due to reaction to motion, these particles follow helical paths, giving light the observed wave-properties. (iii). In an independent system, the 'amount of motion' (energy) is equal to the amount of force (forces of nature), both being $mc^2/2$.

Enough data was available during Newton's time that his law can be verified to some extent. However, compared to the present generation of physicists, he missed much data that would have enabled him to come up with a theory of gravity that has no gaps. Gravitational attraction is an 'action at a distance', that is, something that does not require any mediation. But even Newton was reluctant[2] to accept 'action at a distance'. Now, at a time when 'spacetime' and 'virtual particles' hold the stage, the concepts like, 'action at a distance', 'motion as property of matter' and 'gravity as reaction to motion' are less dubious. At the time of Newton, these would have been extremely dubious.

Later theories – GR and QM:

General relativity (GR) says that gravity arises due to curvature of spacetime. Einstein just assumed that mass and energy can bend space around it. Is 'mass bending space' less dubious than 'action at a distance'? In the case of precision of orbits, what GR did was just removing the static nature of orbits. Newton did not visualize static orbits; as explained, it is a wrong interpretation. Modified Newtonian concepts[3] can correctly predict the precision of orbits, the deflection of light by massive bodies and the gravitational red-shift of light, the three major proofs for GR.

Quantum Mechanics visualizes exchange of 'virtual gravitons' during gravitational interactions. Is exchanging 'virtual particles' less dubious than 'action at a distance'? Anyway, action at a distance is something observed in gravity and electromagnetism; why not accept it as something normal? Newtonian gravity is based on observation, whereas GR and QM explain gravity based on mathematical-artifacts; nobody can ever observe 'spacetime' or 'virtual gravitons'. That makes GR and QM inferior to Newtonian gravity.

GR and QM are mutually incompatible in many respects. For explaining gravity, GR requires spacetime and QM requires virtual gravitons. Mainstream physicists are hunting for Quantum Gravity that can bring the two together and thus enable a lasting solution to gravity. But their attempts have been unsuccessful so far.

Conclusion:

Newtonian gravity (though the concept is simple) has some inherent gaps. GR and QM, the later theories made the concept complicated. Quantum Gravity, a fusion of GR and QM, is bringing out mathematical monsters with defective genes. So let us go back to Newtonian gravity. The modifications (in Newtonian concepts) proposed in this essay are simple and effective. Let the mainstream decide whether these are enough to explain gravity under all circumstances.

The beauty of the proposed modifications is that gravity and motion being opposite, stability of the universe depends on the equilibrium between these two. In three-dimensional space, static equilibrium is unattainable with just two opposing factors. So a static universe can be ruled out; for dynamic equilibrium, the universe should be expanding/contracting. Thus the modified concepts predict a pulsating universe[4].

I pay my tributes to Stephan Hawking who left us silently..... (while this essay was being written). It was from his book 'A brief history of Time' that I learned what a 'physical theory' is. Without that, my ideas would have remained as mere fantasy, and I would never have dared to put forth those as a theory.

Ref:

1. Newton in his essay 'General Scholium', *"I have not yet been able to discover the cause of these properties of gravity from phenomena and I feign no hypotheses ... It is enough that gravity does really exist and acts according to the laws I have explained, ..."*
2. Newton in his third letter to Bentley, *"That one body may act upon another at a distance through a vacuum without the mediation of anything else, by and through which their action and force may be conveyed from one another, is to me so great an absurdity that, I believe, no man who has in philosophic matters a competent faculty of thinking could ever fall into it."*
3. Jose P Koshy, *Relativity Theories – the Greatest Blunders of Einstein,* http://vixra.org/abs/1702.0153
4. Jose P Koshy, *Synchronized-motion of Galaxy-clusters – a Pulsating model of Universe,* http://vixra.org/abs/1602.0069