Gravity or the phenomenon of mutual attraction of objects

Newton Revisited

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Introduction

Objects consist of MATTER.

Matter is what IS. The structure of matter (Mendeleev's periodic table, atoms, nuclear physics, etc.) clarifies HOW matter is, but not WHAT it is. That is a question without an answer.

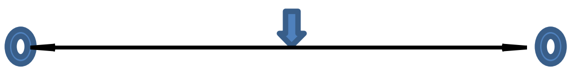
Matter has the following property: two objects in space move towards each other spontaneously, without an external cause.

Newton simply could not believe this. (Addendum; ref. 1)

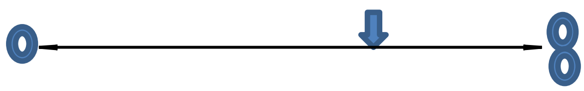
But he pondered the question: HOW do two objects move towards each other? And can this "HOW" be captured in a mathematical formula? The fact that the objects move towards each other without an external cause is an essential property of matter.

1. How do two objects move

Below, we describe the "HOW" of this motion by means of thought experiments.

a) 

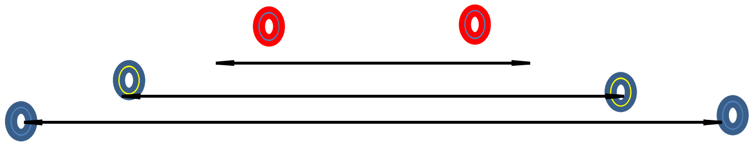
a) Consider two golf balls at a certain distance from each other. They move towards each other and touch halfway. The same is true for two cannonballs.

b) 

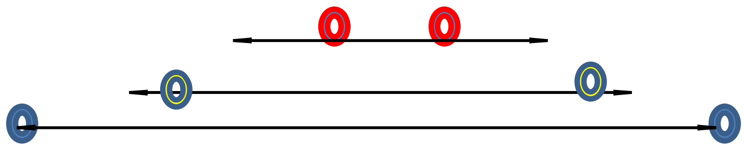
b) In cases a) and b), the objects will touch each other at the same "moment" if they leave rest at the same 'moment'. **(TRUE OR FALSE?)**

c) The motion towards each other from a standstill begins first with objects at a shorter distance from each other.

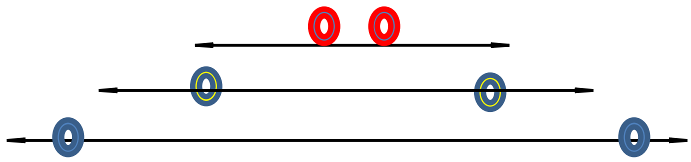
First, the two objects closest to each other start moving; the other two pairs of objects do not move yet:



Then the second pair of objects begins to move, the first pair advances, the third pair remains stationary:



And finally, the third pair also gets moving:



d) The further apart the objects are at rest, the smaller the initial displacement.

2. Parameters of the mutual attraction of objects

To mathematically describe the spontaneous motion of objects, we must define numbers for position, distance, mass, time, and velocity. These are the so-called parameters that determine the spontaneous motion of the objects.

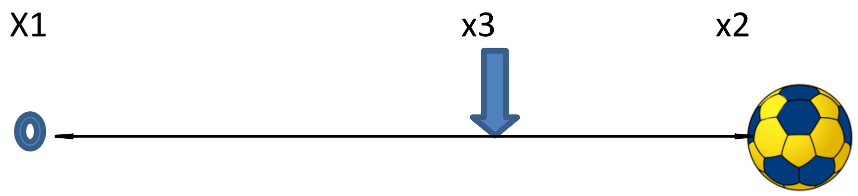
Position of an object in space : a triplet of numbers. For excel simulations we have limited ourselves primarily to one dimension. (But see Addendum 4.)

Distance between two places: that is a positive number calculated from the position numbers of the objects. The most common way to calculate distance in one dimension is to take the difference between the two position numbers. (Euclidean versus Riemann space)

Mass of an object: that is a number M that we assign to an object according to the following rule:

1) Choose an object and assign the number 1 to it; this is the so-called reference object (for example, the golf ball).
2) Let the object (the soccer ball) with the mass number M to be determined and the reference object move towards each other from arbitrarily chosen starting points x1 and x2 (greater than x1). The reference object starts at point x1. They meet at point x3, located between x1 and x2.

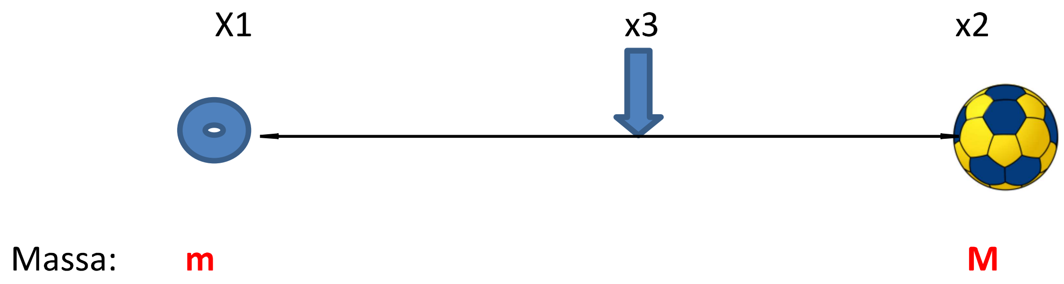
   then: M = (distance x1 to x3) / (distance x3 to x2.)



Experimentally, it can be established that the two glued golf balls have a mass number of two if a golf ball is taken as a reference object.

From the mass numbers of objects determined in this way, it is established that for two objects with mass numbers m and M respectively, the following holds:

m / M = (x2 - x3) / (x3 – x1)



Time

Time is a number t that we assign to a positional 'configuration' of objects. See point 1.d) above: three positional configurations of objects are depicted there.

We assign time numbers to a configuration of objects as follows:

Consider the illustration in 1.d) above.

Let l1, l2, and l3 be the respective distances of the three pairs of objects (from smallest to largest).

We assign numbers t1, t2, and t3 to the configuration where the first, then the second, and then the third pair are set in motion such that (l2 – l1) / (t2 – t1) = (l3 – l2) / (t3 – t2) etc.

So Δl (distance) divided by Δt (time) is a constant c.

In other words, the time values are chosen such that the phenomenon of attraction propagates through space at a constant speed c.

Velocity of motion

With the above definition of time, we can determine Vm(x(t)), the displacement velocity of an object with mass m at a point x at time t in the trajectory between x1 and x2: limit (x(t+Δt)-x(t))/Δt for Δt ➔ 0.

Now suppose we consider two objects, with masses m and M, starting from points x1 and x2. The objects move towards each other with velocities Vm and VM, and these velocities change during their movement towards each other.

The change in the velocities of m and M depends on (is a function of…) all parameters: c; position of m at time t; position of M at time t; their velocities Vm(t) and VM(t); and the mass of the two objects.

3. Formula for the change in velocities of m and M

Delta Vm = ((M/(M+m)) * (c-Vm-VM) * (1/(Xm - XM)^2)

Delta VM = ((m/(M+m)) * (c-Vm-VM) * (1/(Xm - XM)^2)

r(t) = Xm,t – XM,t is the distance between the objects at time t (see further)

The formula consists of three factors.

The first factor, M/(M+m) and m/(M+m), ensures that the time required to collide (distance between the objects is zero) is independent of m and M; in other words, it is the same for any objects (naturally assuming starting from the same initial positions). It also follows from the formula that the ratio 'distances from starting point to collision point' is equal to the ratio m/M; thus m/M = (x2-x3)/(x3-x1) (see simulation in Excel file).

Points 2.a), 2.b), and 2.c are therefore satisfied.

The second factor, (c-Vm-VM), ensures that the two objects collide at the moment their combined velocity, (Vm+VM), is equal to c. Furthermore, the ratio of the velocities is also equal to that of the masses: Vm/VM = M/m when initial velocities are equal to zero.

C is therefore the maximum speed that two objects can reach relative to each other. This corresponds to the fact that c is the propagation speed of the attraction phenomenon. (Addendum; Ref. 2)

The third factor, ($1/r^2$), causes the attraction phenomenon to weaken with increasing distance. The following remarks apply.

> Here we assume that the attenuation increases with the square of the distance. But a linear attenuation or an attenuation with the third degree of r is also possible. Who can say? Well, from the formula extended to two dimensions, the elliptical orbit of a planet around the sun should be calculable, as well as Kepler's laws. That is the ultimate test of the formula's correctness. (see Addendum 4)
>
> As **r(t)** approaches zero, this factor goes to infinity, but **(c-Vm-VM)** meanwhile goes to zero, and the product of the two factors goes to zero .
>
>> Note that c must be greater than the initial velocities Vm(t=0) and VM(t=0) for the formula to apply.

4. From difference to differential

The above "difference" equations for the velocity V and position x of the masses m and M as a function of t become differential equations as the time difference Δt→ **0**.

Excel simulations of the difference equations yield the above expected results.

All the above assumes "point objects" which of course don't exist as such.

This mathematical "idealization" yields "asymptotic" solutions for Vm(t), VM(t) and r(t).

Objects have a diameter which is the lower limit of r(t) (rather than zero.) Also, for very small objects (at the level of nuclear physics) other "forces" come into play.

5. The Collision Time

The Excel simulation illustrates the following comments.

The collision time is the time between the departure from rest **(L= r(t=o))** of the two objects m and M until the moment they come into contact with each other.

The collision time is the same for any m and M values. The collision time naturally increases as the initial distance increases.

If c = 0, the collision time is infinite; in other words, the objects do not move. If c approaches infinity, the collision time approaches zero; in other words, the objects cover their distance from each other instantaneously.

So, the collision time is determined by two factors: C and the initial distance of the object. The collision time is **L/c**

ADDENDUM

1. Quotes from Newton's sayings

"Thus far I have explained the phenomena of (movement of) the heavens and of our sea by the force of gravity, but I have not yet assigned a cause to gravity."

"I have not as yet been able to deduce from phenomena the reason for the properties of gravity, and I do not feign hypothesis."

"Gravity is sometimes spoken of as something that is essential (fundamental) and inherent (inherent to) matter. But please do not attribute that idea to me, for I do not claim to know the cause of gravity and would need more time to delve into it.."

He would still be delving, for attraction is indeed a phenomenon inherent to matter itself. ***It is an ACTION WITH NO REACTION!!!*** *It is interesting that there were people at that time who did possess that insight.*

This same search for the Grail was the search for Ether to explain the propagation of light waves.

2. The maximum speed c

The fact that the attraction of matter propagates at a finite speed c is an essential property of matter. Therefore, it is logical that this factor c plays a role in the speed at which the objects move towards each other.

We imagine that one object sends out an attractive impulse (a jerk) to the other, which propagates at a speed c. The effect of the jerk on the objects also depends on their speed at the moment of impact. Hence c-Vm-VM. See addendum 5.

3. The Definition of Energy

Energy as a measure of motion must be defined for a pair of objects, not for a single object.

Motion of an object is motion relative to a reference point, in this case another object.

Therefore: **Kinetic** Energy of object with mass m and object with mass M is defined as **$(m+M) *(V_m + V_M)^2$** . The **potential** energy at time t is the difference between the maximum attainable kinetic energy and the kinetic energy at t.

The **maximum** energy that a pair of objects can reach is therefor **$(m+M)*c^2$.**

Where have we seen that before?

4. Two dimensional simulation

An Excel simulation of the formula with the parameters below yields a quasi-elliptical orbit (first law of Keppler) . The second and third laws also appear to be satisfied.

However, a simulation using a more suitable programming language is recommended.

5. The factor (c – Vm – VM)

The attraction between the two objects is a continuous process. We approximate this by a succession of “jerks” that they exert on each other.

To describe this in the formula, consider the following analogy:

Take a billiard ball with mass M struck by a golf ball with mass m that collides with the billiard ball at a velocity c.

The billiard ball then begins to roll at a velocity $Vm_{,1} = (m/M)*c$ (conservation of momentum).

A second golf ball with velocity c strikes the billiard ball, but the velocity of impact is now $(c - Vm_{,1})$. The increase in velocity is therefore $(m/M)*(c - Vm_{,1})$. And so on.

Instead of successive “jerks,” the phenomenon of attraction involves “jerks.”