Basic Mechanics Reinterpreted

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Following on from recent papers reinterpreting energy and stable orbits by including the components of particle spin kinetic energy, this paper sets out to reinterpret the basic mechanics of simple gyroscopes, bicycle wheels, Newton's bucket and stable orbits.

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I. WHY A REINTERPRETATION IS NEEDED

There are basic inconsistencies in some formulae used in current mechanics. They are calculated and the results used without understanding what they really mean. That is not to say that the results are not useful – just that what they mean has been wrongly interpreted and that has led to many other forced interpretations in related areas.

In this paper I will show why the most basic is wrong. But I need to start by explaining the basis of my interpretation of the mechanics and what it is based on.

II. NEW MECHANICS

Symmetry and only two types of energy are the foundations of the new interpretation. Every particle has equal amounts of both energies and these different energy types always sum to zero for each and all particles. The energies are due to fundamental mass and fundamental charge. The key is recognising how the same types of energies interact between particles, giving rise to different actions.

Alongside the well-known charge interactions, with same charges repelling and opposite charges attracting, are the fundamental mass interactions where same mass types attract and opposite types chase. It is not appropriate to consider the latter here since all particles have a total fundamental mass energy summing to zero, leaving only the particle rotational frequency, which defines its size and effect in deflecting space, as a proxy for what we call its mass.

The same summing to zero in a particle is also the case for fundamental charge, however there are second order effects that produce what we observe as electronic charge, balanced by internal spinning (called twisting, to differentiate from the spin of a particle). Twist provides a product factor for the amount of mass that we observe a particle to have. Both these second order effects have fractional values in different particles of 0, 1/3, 2/3 and 1.

The two fundamental energies, despite each summing to zero, also provide what we observe as the mass and spin energies of a particle. The size of these is the same, but different in type, and sum to zero overall. So when we look at mass-mass interactions, we ought also to consider spin-spin interactions. The mass is due to the motion of fundamental mass and the spin is due to the motion of fundamental charge.

The mass-mass interactions are all due to depressions of space and so appear to be attractive forces (aside from photon-photon interaction, which are of a chase type). The spin-spin interactions are strongly orientation-linked, so where particles have spins aligned parallel or anti-parallel are at their strongest. In a large body like the Earth the spins of its constituent particles will not generally be aligned, so direct spin-spin energies between large bodies will be small. In a small system like an atom, there will be significant alignments present and so direct spin-spin energies will be relatively large.

For both mass and spin, there will be a kinetic energy as the particles move, of the same size and direction of action. For why the gravitational constant *G* hides the equality and strength of mass and charge (spin is charge in motion) the fundamental papers explain [1,2] as well as providing more detail on the foundations briefly outlined here.

III. THE ORBIT

When considering, as in Figure 1, the mutual orbiting of the Earth around the Sun, the potential and kinetic energies of their constituent particles' masses and spins both need to be considered. By omitting the spin energies, as currently practiced, this most basic equation is wrong.

The formula for a stable orbit, (in adjusted SI units which exclude G[1]) using M and m for object mass, Q for object net charge and S and s for object net spin, would strictly be,

$$\frac{m_E M_S}{r} \pm \frac{Q_E Q_S c^2}{r} \pm \frac{s_E S_S}{r} = \frac{1}{2} m_E v^2 (mass\ KE) + \frac{1}{2} s_E v^2 (spin\ KE)$$

The point us that, even if the net charge and spin of each body overall is close to zero, with randomly aligned particle spins, the kinetic energies of the moving body's particles' spins still exist and still act in the same way as the kinetic energy of mass. And since the energies of mass and spin are equal in size then $|m_E| = |s_E|$ and the formula can be simplified to

$$\frac{m_E M_S}{r} = m_E v^2$$

With the straightforward division by r, we get the force equation between the two bodies of

$$\frac{m_E M_S}{r^2} = m_E v^2 / r$$

This says that the attractive gravitational (inward) force is balanced in a stable orbit by the (outward) motional energy of the (relatively) moving body, both relative to the centre of rotation.

So two important points follow immediately.

1 That energy is a vector, acting outwards from a centre of rotation and along the same line as its associated force.

2 That the sum of motional and potential energies, in a stable orbit, is zero.

There is no need to consider acceleration and concoct strange ways of limiting how to move from the energy of a body to the forces acting on it.

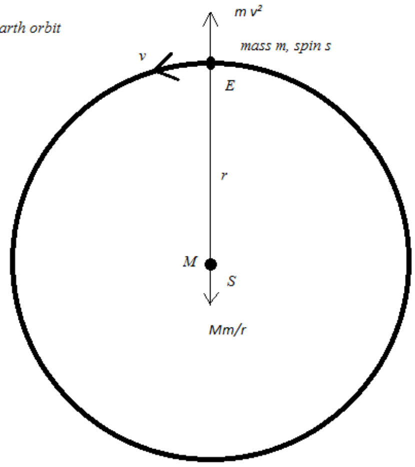
There is no need to wonder why, for example, electron orbitals appear to have negative energy. Their formulae may be slightly more complicated by the need to include spin-spin energies, but the basic point is that in atoms all stable orbitals have no energy in total. If they had energy, they would not be stable.

From these two points, the basic mechanics of other systems can be reinterpreted in a much simpler way.

In the explanations below, the energies or forces in action are used almost interchangeably to make them easier to understand. So the weight or gravitational force effect on an object may be balanced against a motional energy, the difference being only the separation or relative height in the system.

Figure 1

Sun/Earth orbit



IV. THE WHEEL

In Figure 2, the vertical wheel is in contact with the ground between points X and Y. At each point on the wheel circumference there is an outward energy Mv^2, where v is the wheel rotational velocity, M is the mass of the wheel at that point and the total mass of the segment in contact with the ground is SMv^2.

Between points E and F there are Mv^2 outward energies acting on the wheel that balance each other, and the wheel is assumed to have sufficient strength to stay circular. There are similar balancing energies across the wheel at all points on the circumference except at and opposite the segment of contact.

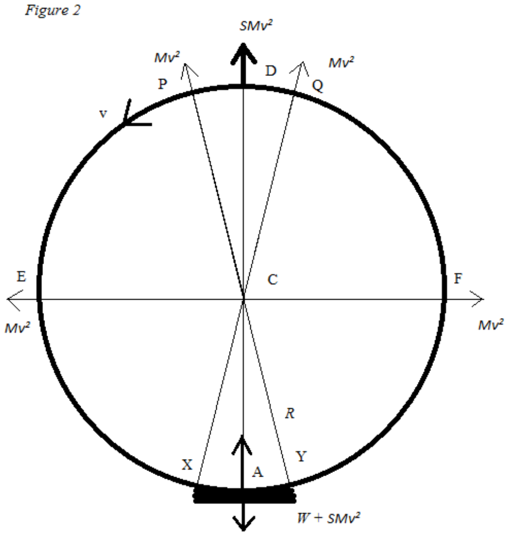
At the segment of contact there is the downward weight of the wheel W plus the motional energy SMv^2 acting, balanced against the upward reaction R, provided the wheel is strong enough not to buckle.

The crucial point here is that there is no balancing energy for the segment PQ opposite the contact segment. The upward energy SMv^2 exists unbalanced and is what keeps the wheel upright until the wheel velocity falls to a point where the wheel starts to tilt and the action of gravity at the centre of mass C of the wheel no longer passes through point A where the wheel is in contact with the ground.

Whilst the upward motional energy remains higher than the downward gravitational energy, the wheel will return to the upright vertical if the tilt is not too large. The wheel will try to retain its angular momentum in the vertical plane and any vertical tilting will turn the wheel about AD, to move that momentum into turning the rotation of the whole wheel about AD.

When the upward motional energy reduces below that of the downward gravitational energy, the wheel will topple.

Figure 2



V. THE GYROSCOPE

In Figure 3, the gyroscope disc is rotating at *w* about the axis AC with centre of segment velocity *v* (for this purpose assumed to be at the edge of the disc). The point A is where it is in contact with a support and point B on the shaft is equidistant from A and C. This latter ensures that the centre of mass of the gyroscope is in its plane of rotation XY. The differential gravitational effects of the height of the disc at X and Y above A is ignored for simplicity.

At A the upward, downward and sideways forces of weight, reaction and friction are in balance, otherwise the point of contact would move.

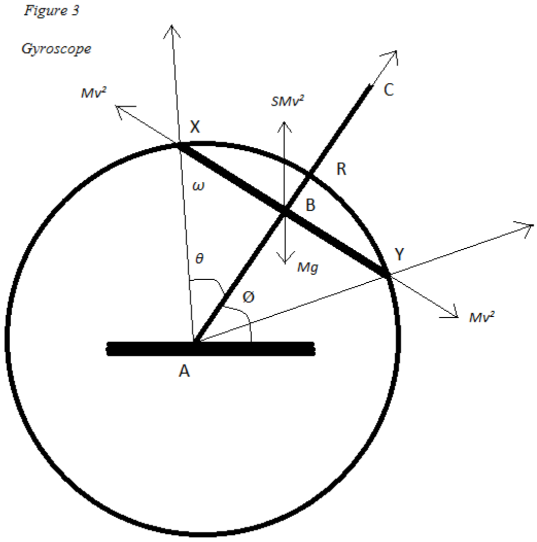
The crucial aspect here is that the rotating disc can be considered as resting on a sphere of radius AR. As in the case of the orbital system, the velocity in the plane of the sphere, in any direction, produces an energy acting outwards from the centre of the sphere, here at point A.

This means that there are energies outward along AX and AY, perpendicular to the sphere, part of a cone of energy encompassing the circumference of the disc from A. Ignoring gravitational effects across the disc, the resultant of these conal energies, the sum SMv^2 of the segment energies Mv^2 around the disc, acts upwards along the shaft AC. The fraction of the conal energies acting in the plane of the disc balance at all points round the disc and provide the angular momentum of the disc with respect to A.

Whilst the vertical component of the conal energies SMv^2, acting at the centre of mass exceeds the weight of the gyroscope, the shaft will tend to remain or return to vertical. As the rotational rate decreases, the shaft will tilt more and precess to try to maintain angular momentum.

Figure 3

Gyroscope



The higher the rotational rate *w*, the less the relative effect of gravity and the more stable in orientation the gyroscope shaft will remain. Without a support point, there will be no spherical effect and the gyroscope will have only the planar energies acting outward equally around the disc, keeping it in the same shaft orientation until disturbed.

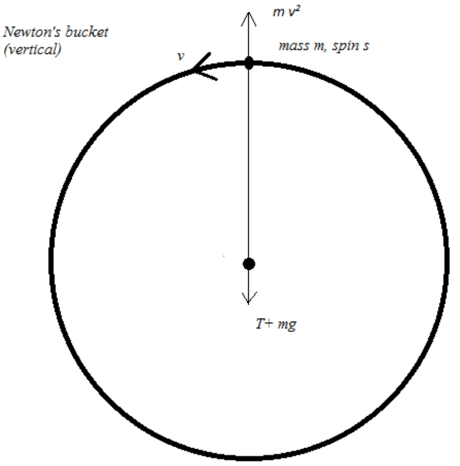
VI. NEWTON'S BUCKET (VERTICAL)

It should be apparent now that the outward energy of rotation is inherent in all rotational systems.

Figure 4 shows the vertical plane of rotation of a bucket with the energies at work when the bucket is at its worst point, at the top of the circle.

Provided the outward energy mv^2 equals the downward tension in the rope plus the effect of gravity, then the water in the bucket will remain in the bucket.

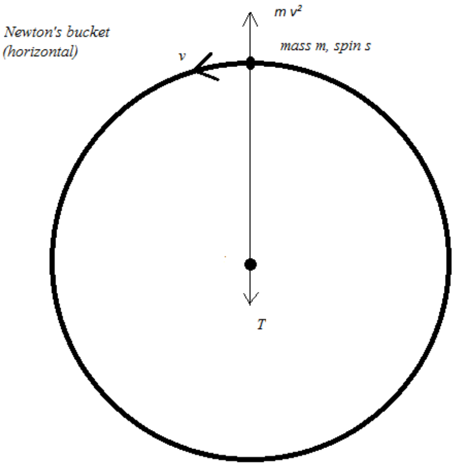
Figure 4



VII. NEWTON'S BUCKET (HORIZONTAL)

In this case, the rotation of the bucket in the horizontal plane requires the same outward energy at all points in the circle such that mv^2 equals only the tension in the rope.

Figure 5



VIII. CONCLUSIONS

The reinterpretation of energy as directional and directly linked to the force at work makes much more sense that the current weakly linked interpretation.

The action of motional energy and force outward from a centre of rotation also makes much more sense, as any cyclist in the rain without mudguards can attest, than the use of acceleration towards the centre.

The total zero energy for stable orbits also makes sense, and the excess upward energy maintaining the stability of a bicycle wheel can be experienced, again by anyone riding a bicycle.

IX. REFERENCES

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