The Cause of Coriolis Force

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Abstract. **This article introduces 'Axial Coriolis Force' as a new concept which arises in connection with rotation. It is the deflection of a moving element from the transverse direction into the axial direction, and it can be observed in gyroscopes, rattlebacks, and in connection with Ampère's Circuital Law. This article will demonstrate that axial Coriolis force is induced in a similar way to that of centrifugal force and transverse Coriolis force.**

Centrifugal force is the outward radial force that arises in connection with rotation. It is the perpendicular deflection of a moving element from the transverse direction into the outward radial direction, and it is induced as a result of the transverse motion. The ultimate cause of centrifugal force is the aether pressure that is generated in the electron-positron sea when the rotating electron-positron dipoles are angularly accelerated. This angular acceleration is in turn caused by the shear stress that arises when objects move through the electron-positron sea. As such, centrifugal force can also exist as a transverse force that is induced by radial motion when the radial vector is rotating. The 19th century French scientist, Gaspard-Gustave Coriolis used the term 'compound centrifugal force' for this transverse effect although he didn't seem to be aware of the fact that it is exclusively confined to the transverse direction. Transverse Coriolis force arises in cyclones and planetary orbits in connection with the conservation of angular momentum. When an electric current is induced in a wire that is moving at right angles through a magnetic field, a transverse Coriolis force is involved in a manner which bears a close analogy to that which occurs in planetary orbits. It is a common error to think of transverse Coriolis force as being an inertial effect which can only be observed from a rotating frame of reference, and it often becomes wrongly identified with the cyclonic effect that is associated with the rotation of the Earth.

Ampère's Circuital Law

I. Ampère's Circuital Law is the equilibrium solenoidal alignment of vortices along their rotation axes. Maxwell showed at equation (9) in his 1861 paper 'On Physical Lines of Force'[1] that Ampère's Circuital Law is rooted in an expression which takes on the form of the centrifugal force. Maxwell's sea of molecular vortices will now be considered to be a sea of rotating electron-positron dipoles that are aligned solenoidally with their rotation axes tracing out magnetic lines of force. This will be called 'The

Electric Sea'. An electron is an aether sink and a positron is an aether source. The mechanism and driving force behind these sinks and sources is unknown. See fig. 1 below,
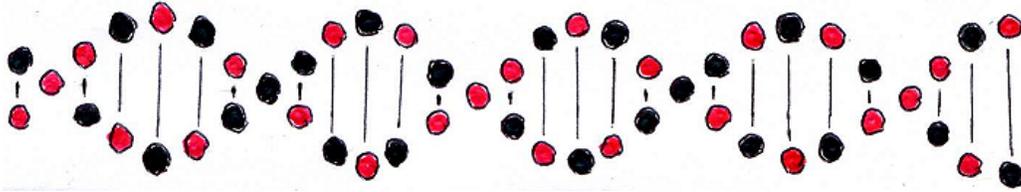

Fig. 1 A close-up view of a single magnetic line of force. The electrons are shown in red and the positrons are shown in black. The double helix is rotating about its axis with a prodigious angular speed, and the rotation axis represents the magnetic field vector H. The diagram is not drawn to scale since the relative dimensions remain unknown.

The electric sea will be held together in its stable equilibrium configuration by forces acting between the electrons and the positrons. These forces can in turn be induced by alterations of the equilibrium configuration. Any stretching of the aether in this equilibrium configuration will ignite additional aether pressure on top of the already existing inter-particle forces. Stretching the aether in the electric sea will have an effect that is reminiscent of the striking of a safety match on a surface. Work will need to be done to ignite this additional aether pressure, and that is the basis of Lenz's law. A single rotating electron-positron dipole that becomes unaligned from the solenoidal magnetic field arrangement will be forced back into line again by a torque which will arise from the induced aether pressure. This torque will cause a rotating electron-positron dipole to precess back into line, and in doing so, it will cause the motion of the electron and the positron to deflect from the transverse direction into the axial direction. This deflection will be called the axial Coriolis force. This axial Coriolis force arises in electromagnetic radiation in the case when it is propagating along the direction of magnetic lines of force. If dipole 1 is caused to precess out of its equilibrium alignment, the stretching of the aether will widen the positron sources in the vicinity and tighten the electron sinks. This will induce aether pressure as per Lenz's law. This induced aether pressure will cause a torque to act between dipole 1 and the neighbouring dipole 2. The torque will force dipole 1 back into line again, and the original aether pressure which forced it out of line in the first place will then be consumed by the electron in dipole 1. Dipole 2 will meanwhile be forced to precess, and the same cycle will repeat in relation to dipole 3. A spiral compression wave will propagate along the double helix of the magnetic line of force in conjunction with a net flow of pressurized aether.

Ampère's Circuital Law and the Gyroscope

II. When a gyroscope spins, the all pervading electric sea will flow through it as like water flowing through a basket, since the electron-positron dipoles are probably on the picoscopic scale. Rotation therefore induces a kind of electric current inside a material body. This electric current acts like trolley wires which connect that body with the all pervading electron-positron matrix. The molecules of the gyroscope are tiny vortices on the nanoscopic scale and they will align in the electron-positron wind such as to present a totally symmetrical face to the wind, otherwise there will be a torque acting on the molecules and we would not therefore have an equilibrium. The spin axes of these tiny gyroscopic molecules will then trace out concentric circles around the spin axis of the large gyroscope itself. There will be a radial centrifugal pressure gradient relative to the large gyroscope axis since the gyroscope molecules will be mutually aligned with their equatorial planes in the radial direction within the large gyroscope. The situation will be like a sea of tiny gyroscopes within a large gyroscope, with the equatorial planes of the tiny gyroscopes aligned like radial spokes on the axis of the large gyroscope, and perpendicular to the equatorial plane of the large gyroscope. As the large gyroscope spins faster, more centrifugal aether pressure will be generated from the transverse shear stress in the electron-positron wind as it blows between the tiny gyroscopic molecules. See 'The Cause of Centrifugal Force'[2].

If we now force the gyroscope to precess, the electron-positron wind will change its angle of attack, and a new equilibrium alignment of the gyroscope molecules will be sought. This will cause an axial Coriolis torque to act on the large scale, hence causing the gyroscope's forced precession to be deflected by ninety degrees. This centrifugal pressure barrier in the electric sea can prevent a pivoted spinning gyroscope from toppling over under the force of gravity. The electric sea is a rigid elastic solid that behaves like an arrester hook for precessing objects. However, since modern physics recognizes neither the centrifugal force, nor the Coriolis force, nor the electric sea as being physical realities, this interesting aspect of a gyroscope's behaviour cannot possibly be explained satisfactorily in the modern textbooks.

The centrifugal pressure (centrifugal charge) in the large spinning gyroscope is an effect of the transverse interaction with the all pervading electric sea. It will therefore have no direct effect in terms of centrifugal repulsion on a neighbouring large scale spinning gyroscope, other than that which would arise from any induced magnetic field. The electron-

positron wind itself should take on a solenoidal alignment such as to produce a magnetic field on the large scale around a large scale spinning object. This solenoidal alignment will be perpendicular to the solenoidal alignment of the molecules in the large scale spinning object. This spin-induced magnetism is an extremely weak effect, but it is clearly evident in the case of the planet Saturn. Magnetization by rotation was first detected by SJ Barnett in 1915. See 'Saturn Exhibits Spin-Induced Magnetism'[3].

Electromagnetic Induction

III. Electromagnetic induction is about the induction of aether pressure in the magnetized electron-positron sea. In the purely translational motion of a suitably shaped object, the electron-positron sea will be entrained by gravity with that object, right out to the shear region where its gravitational field meets the gravitational field of neighbouring objects. This will result in a compression of the electron-positron sea on the windward side of the motion, and a rarefaction of the electron-positron sea on the leeward side of the motion. When a wire moves through a magnetic field at right angles to the field lines, it will encounter a kind of centrifugal barrier in the equatorial plane of the rotating electron-positron dipoles. This will result in the compression of these dipoles on the windward side of the motion which will in turn cause an increase in their circumferential speeds. On the leeward side of the wire's motion, a rarefaction will take place and the electron-positron dipoles will become stretched. This will lead to the induction of aether pressure as per Lenz's law and it will also lead to a reduction in the circumferential speeds of the dipoles. The result will be an aether vorticity gradient around the wire. The aether pressure will then be discharged at right angles along the conducting material of the wire in a direction determined by the dominant vorticity. The **v**×**B** term of the Lorentz force refers to the fact that the induced aether pressure has been deflected by ninety degrees. This deflection is a transverse Coriolis force. Lenz's law is involved in the overall process and work is done in igniting the aether pressure (positive charge) on the leeward side of the motion. It is the newly generated aether pressure that is deflected transversely. When free particles move in a magnetic field, we are dealing with a transverse Coriolis force without the involvement of Lenz's law. This is because the situation only involves a yielding to the centrifugal barrier which results in a sideways deflection. No work is done.

In the time varying kind of electromagnetic induction, the $-\partial\mathbf{A}/\partial t$ force refers to the aether pressure which has been propagated through the electron-positron sea in the form of electromagnetic radiation, having already been generated by a disturbance such as transverse force at its source. Electromagnetic radiation is a fine-grained vortex flow of pressurized aether which discharges at right angles into a wire. When the electromagnetic radiation is in the equatorial plane of the solenoidal field, the electron-positron dipoles angularly accelerate and the aether pressure can be said to be centrifugal pressure. When the radiation is in the axial plane of the solenoidal field, the electron-positron dipoles precess and the aether pressure can be said to be axial Coriolis pressure. The vector **B** refers to the magnetic flux density. It is a weighted measure of the fine-grained vorticity of the aether that is associated with the rotating electron-positron dipoles. **B** is the curl of **A** which is the aether field momentum per unit volume. Maxwell identified the quantity **A** as a momentum, and he also identified it with Faraday's *electrotonic state*.

The Rattleback

IV. The rattleback is the most mysterious of all the mechanical devices. A spinning rattleback undergoes a complete 180 degree reversal of its angular momentum without any apparent source of reversal torque. The situation is further complicated by the fact that some rattlebacks can work in both directions. Modern physicists cannot explain the rattleback mystery because they deny all three of the vital ingredients that are necessary for its full understanding. We first need centrifugal charge followed by axial Coriolis force. We also need the electric sea in order to induce these convective effects, and also to give the reversal torque something to kick off against, as per Newton's third law of motion. The rattleback is very obviously tangled up in a very subtle elastic medium, but this medium along with the centrifugal force and the axial Coriolis force which are the basis of the interaction with this medium, are denied in modern physics.

Anybody watching a rattleback in action will observe that its initial rotation is first converted into an up and down rocking motion which then gives way to a rotation in the reverse direction. The first impression is that of a 180 degrees precession caused by an axial Coriolis torque. But where it is easy enough to accept that the initial rotation will induce a centrifugal pressure field in the rattleback, it is much more difficult to see

why a Coriolis force should kick in and reverse the direction of rotation, even though it is patently obvious that this is what is happening.

The asymmetrical shape of the rattleback is of course crucial, but it still doesn't automatically explain why an axial Coriolis force should kick in. We might draw the conclusion that with the asymmetrical shape that it is not possible to achieve a stable solenoidal alignment of the molecules of the rattleback within a particular mode of rotation, and that precession of the molecules will continue until equilibrium has been achieved, which may be never. This precession will of course cause a large scale axial Coriolis force to act on the rattleback as a whole. If there were no damping friction and a rattleback were to continue reversing indefinitely, we might then be witnessing a kind of semi-liquid effect in which the individual molecules within the solid material are free to engage in a mutually aligned precessional harmonic motion. This semi-liquid harmonic motion would satisfy the law of conservation of energy providing that the axial Coriolis force does not involve work done, and no work will be done if the axial Coriolis force is generated by a centrifugal barrier, because no stretching of the aether will be involved.

With certain asymmetrical shapes, we can visibly see how the centrifugal pressure barrier will have a component that is pointing in such a direction as to appear to be resisting the rotatory motion. In these cases the rotation axes of the individual molecules of the asymmetric rattleback will no longer exactly trace out concentric circles around the rotation axis of the rattleback. The rotation axes of the molecules will be deflected from the transverse direction, and their equatorial planes will be tilted into the direction of motion, and asking to be resisted by the electron-positron wind. Ampère's Circuital Law will be skewed. The rotation axes of the molecules will of course still be aligned in the equatorial plane of the large scale spin of the rattleback. The centrifugal force that is acting in the equatorial plane of these molecules will present a centrifugal barrier against the oncoming electron-positron wind, and so we would expect some kind of axial deflection to occur based on the vortex to vortex interaction between the molecules and the electron-positron dipoles in the wind. That axial deflection might be either up or down, and if the effect is equal on both limbs of the rattleback, we might even expect that effect to cancel. On the other hand, if the effect on each limb were to cancel, the equilibrium may be unstable, resulting in a rocking motion in conjunction with gravity.

This leads us to another interesting feature of the rattleback. In order for the rocking motion to be enabled, we need to have static friction for the

purposes of rolling. Without static friction, the rattleback will slide, and the effect will be damped out. A rattleback does not work very well on a slippery surface such as ice or soap. The necessity of static friction has caused the erroneous belief amongst modern physicists that friction contributes towards the mysterious reversal torque. But everybody ought to know that friction couldn't possibly supply a pro-active effect. Sliding friction is only a damping force that absorbs energy, and static friction only holds an object in a fixed position.

Kepler's Laws of Planetary Motion

V. Kepler's laws of planetary motion are based on a number of effects working together in tandem. A planet's gravity will entrain an extended region of the electric sea with it in its orbital path. This region, known as the gravitosphere will slide against the gravitosphere of the other planet. Centrifugal pressure will arise as a result of transverse shear stress in the electric sea. This shear stress causes the rotating electron-positron dipoles of the electric sea to angularly accelerate. The angular acceleration causes vorticity in the aether which widens the positron aether sources and tightens the electron aether sinks. Hence aether pressure (positive charge) is generated. Transverse motion will hence cause a centrifugal force to act in the outward radial direction as well as both up and down in the axial direction. The former effect will be counteracted by the radially inward gravitational force while the latter effect will mutually cancel. The transverse motion of the planet will cause a compression of the electric sea on the windward side of the motion and a rarefaction on the leeward side of the motion. This will produce a vorticity gradient in the transverse direction across the gravitosphere. If the orbit is non-circular, the radial motion will induce a further transverse centrifugal pressure on both the windward side of the motion and the leeward side of the motion. These two induced transverse effects will cancel mathematically, hence leading to the conservation of angular momentum, which in the circumstances is Kepler's second law of planetary motion. When conservation of angular momentum occurs, the radial centrifugal force then becomes the inverse cube law repulsive force that is associated with an electric dipole field. Gravity on the other hand is the inverse square law monopole field that arises due to tension in the large scale aether flow which percolates through the electric sea as it is being pulled into sinks. The two mutually cancelling transverse centrifugal forces do not however physically cancel each other. They collectively cause a transverse aether pressure, and the vorticity gradient causes them to produce different effects. According to

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whether the radial motion is inwards or outwards, the windward centrifugal force will either cause the direction of the planet to deflect into the transverse direction or cause the transverse speed of the planet to reduce. This will be reversed on the leeward side. When the transverse centrifugal force causes a transverse deflection of the radial motion, it takes on the normal mathematical expression m$\mathbf{v}\times\boldsymbol{\omega}$ but with the circulation $\boldsymbol{\omega}$ doubled as compared to the case of the radial centrifugal force. The doubled circulation is explained on the basis that the motion is the equivalent to that of a radial motion through a vortex which is rotating as one large rigid solid. This rigidity doubles the shear stress between the electron-positron dipoles that arises due to the radial motion in the sea, as compared to in the case of the mutual transverse motion where the interaction is more like that which would occur between two fluids in relative motion. This transverse centrifugal force was named 'compound centrifugal force' by the 19th century French scientist Gaspard-Gustave Coriolis but it would seem that he didn't realize that it is a purely transverse effect. It is nowadays named the Coriolis force in his honour.

The Cyclones

VI. Real transverse Coriolis force is present in all vortex phenomena. The visible presence of real Coriolis force in the oceans and in the atmosphere follows from the conservation of angular momentum as in the case of Kepler's law of areal velocity. We can clearly observe the radial motion in a vortex being continually deflected into the transverse direction. However, modern physics teaches that the Coriolis force in the cyclones and the ocean currents is caused by the Earth's rotation. The Earth's rotation does indeed cause the inertial cyclonic behaviour of these effects by setting the original direction of the angular momentum. But the Coriolis force itself is a real hydrodynamical effect which has got nothing to do with the Earth's rotation. North-south air currents will only co-rotate totally with the Earth's rotation if the co-rotating atmosphere can supply the necessary 'pole centred' Coriolis force on these moving north-south air currents within it. This clearly doesn't happen and so these north-south air currents will be deflected into the east-west direction relative to the surface of the Earth, due to their linear momentum. East-west air currents will cause a tightening up or a slackening of the centrifugal force within the co-rotating atmosphere, hence leading to a kind of Archimedes' principle which will cause a north-south deflection. These deflections will set the initial direction for the angular momentum of a large cyclone. Conservation of angular momentum will then cause

the real 'cyclone centred' Coriolis force which can be observed from outer space. The rotational behaviour in cyclones cannot be caused by a fictitious effect as is taught in modern textbooks. Modern textbooks teach that Coriolis force is only a fictitious effect which is observed from rotating frames of reference, but that nevertheless it is the cause of the large scale cyclonic effects in the atmosphere which can be viewed from outer space. The explanation in modern textbooks does not add up.

Conclusion

VII. In modern physics, the Coriolis force has lost its original meaning. Rotating frames of reference have been introduced like a hall of mirrors to confuse the entire subject. Coriolis force is considered to be a fictitious effect which is only observed from rotating frames of reference. This means that it is being used to explain phenomena that are more correctly related to a lack of Coriolis force. Coriolis force needs to exist in conjunction with a constrained rotating radial motion. When we observe any free motion from a rotating frame of reference, a circular motion will be superimposed on top of that motion. This apparent transverse superimposition is not Coriolis force, and it is not accurately described by the $2m\mathbf{v}\times\boldsymbol{\omega}$ Coriolis term. Yet it is this negative effect that modern physicists believe to be Coriolis force. The Coriolis force has been belittled by modern physicists into the realms of illusion, along with the centrifugal force. There is no recognition of real Coriolis force in modern physics, hence leaving electromagnetic induction, gyroscopes, and rattlebacks totally unexplained.

Anybody watching a rotating rattleback reversing can see that it is tangled up in an all pervading elastic medium that possesses a fine-grained rotational nature. The behaviour is reminiscent of an elastic torque that causes a recoil. It should only have been a question of establishing what this medium is and how the rotating rattleback hooks onto it. With the centrifugal force and the Coriolis force relegated to the realms of illusion, and the aether relegated to history, it is likely that any attempts to explain this elastic recoil effect will belong to the realms of delusion. There are official existing explanations, often by very skilful mathematicians. But no matter how skilful these mathematicians may be, their explanations are somewhat reminiscent of the spectacle of a skilful archer pretending to shoot an arrow from a bow without a string. In the official literature on rattlebacks, we might see an equation of motion in which one of the terms is reserved for the reversal torque. The problem is

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that they don't know what is causing the reversal torque, and no amount of mathematical manipulations with the known forces such as friction, gravity, or air resistance are likely to reveal that cause, anymore than the skilful archer will be able to shoot the arrow with the stringless bow. The reversal torque term in the equation of motion sits there like an empty seat waiting to be occupied when the reversal torque decides to reveal itself. But just as you can't swim without water, neither can you explain the rattleback or the gyroscope without involving the aether and the electric sea. We need to physically identify the arrester hook.

In one very recent attempt to explain the mystery of the rattleback [4], the Coriolis force is actually mentioned by name. But it is not explained how the Coriolis force can be real enough to cause a very real reversal torque, in view of the official position that the Coriolis force is only a fictitious force that is observed from rotating frames of reference.

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