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Law of Physics 20th-Century Scientists Overlooked (Part 5): Centrifugal Effect Negation

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Abstract

Explored is another application of the phenomenally successful DSSU's aether theory of gravity. It is explained how rotational motion with respect to the universal space medium (aether) determines the centrifugal effect. The article details the conditions involved in the attenuation of the Effect; and the extreme condition under which complete negation occurs. Included is a description of how a totally collapsed star —called a Terminal neutron star— is unable to manifest any centrifugal effects; and how, consequently, it can have no theoretical limit on its rate of rotation. Revealed is the fundamental law governing circular motion. This long-overlooked principle of physics leads to a startling and profound implication: Spiral galaxies are able to maintain their structural integrity *without the need for so-called dark matter*.

Keywords: Centrifugal effect, Centrifugal attenuation and negation, Rotation physics, Aether medium, Aether theory of gravity, End-state neutron star, Terminal neutron star, Dark matter, DSSU theory

1. The Basic Centrifugal Effect

The centrifugal effect is a force-like tendency —peculiar to circular motion— that is equal but opposite to the centripetal force that keeps a particle on its curved path. It can be described as the tendency of mass to "pull" away from the center of rotation. For example, a stone attached to a string and whirling in a horizontal circular path produces a centrifugal force-effect that is exactly balanced by the tension in the string.

A simple expression for the centrifugal effect, as it applies to a kilogram unit of mass, is υ^2/r ; where the unit mass is located at distance r from the axis of rotation and υ is its velocity perpendicular to r. Clearly, the effect intensifies with an increase in the speed of rotation and diminishes with an increase in the radial distance.

With these proportionalities in mind, and since this article explores the limits of the centrifugal effect, the gravitating object to be used (in the various studies that follow) will be as small as possible and spin quite rapidly. And since the effect is also proportional to the intensity of gravity, the object must be both extraordinarily massive and unimaginably dense. The neutron star is the ideal structure for the purpose. Also, in order to make this article as easy to understand as possible, the discussion is confined, for the most part, to just one size. The basic gravitating object to be used to explore the concepts will be a spherical mass (of nuclear degeneracy state) with a radius of 10 kilometers. Moreover, naturally occurring centrifugal bulging will be ignored.

There are two factors that limit the centrifugal effect. The first is obvious. Spin the stone on a string too fast and the string will break. Any mass structure that spins too fast will tear itself apart as fragments fly off tangentially (within the plane of rotation). The second factor is one imposed by special relativity. No chunk of mass, no particle of mass, can travel through the space medium with a speed equal to, or greater than, the speed of light in vacuum.

The first factor is examining in more detail:

The point —the state of rotation— at which a structure loses its ability to hold onto its equatorial mass occurs when the centrifugal effect just balances the gravity effect. This point can be determined by equating the two opposing effects as follows:

|Centrifugal effect| = |Gravity effect|;

|mass×(centripetal accel. at equator)| = |mass×(gravitational accel. at equator)|;

$$\left| m_{\text{test}} \left(-\frac{v_{\text{equator}}^2}{R} \right) \right| = \left| m_{\text{test}} \left(-\frac{GM}{R^2} \right) \right|. \tag{1}$$

This simplifies to

$$v_{\text{equator}}^2 = \frac{GM}{R}; \tag{2}$$

where $\upsilon_{\text{equator}}$ is the critical speed of rotation at zero latitude; gravitational constant $G = 6.67\times10^{-11}$ N·m^2/kg^2; M is the structure's mass; R is its spherical radius.

Since G and R are constants, the equation here represents a simply function between the critical rotation speed and the corresponding total mass. Remember, the discussion is confined to stars (mainly neutron stars) of radius 10 kilometers.

The balance between the two effects can be represented by a graph relating the tangential speed at the equator (as the ordinate) and the mass (as the abscissa) as shown in **Figure 1**.

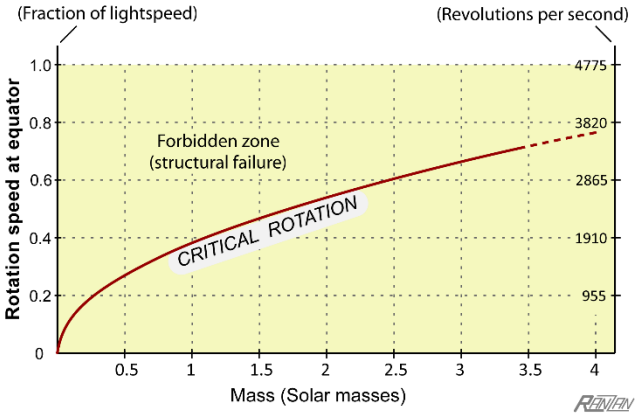

Figure 1. Centrifugal effect increases with rotation; but the rotation rate, in accordance with the conventional view, imposes a limit. The curve traces the critical combination of mass and spin for ten-kilometer-radius structures; combinations where the gravity and centrifugal effects are in balance. Above the curve, structures lose their gravitational cohesion.

For the situations falling along the curve, the centrifugal effect will be maximum (at least nominally). If the rotation speed lies above the "critical rotation" curve, the structure simply flies apart.

Another way to express the first limiting factor is to say that for any given structure the centrifugal effect can never exceed the gravity effect.

Turning to the second factor —the special relativity restriction. Under the simplistic view, the rotation speed can never attain the full speed of light (about 300,000 km/s). However, there is more than one way to define the rotation speed; there are different reference frames to choose from. A proper understanding of the "relativity restriction" depends on how one answers the straightforward question, *rotation speed relative to what?*

2. The Special Relativity Restriction on Rotation

When gravity is treated as a force, the special relativity restriction simply means that the rotation speed at the equator of the rotating mass body must be less than the speed of light. Such is the basic conventional view. But when we include the causal mechanism of gravity —something conspicuously missing in both Newtonian gravity and in Einsteinian gravity— the situation is considerably different.

Consider a neutron star having a mass value of 2.5 Suns. The radius, again, is 10 kilometers. According to the DSSU theory of gravity, the speed of inflow of aether at the surface, and perpendicular to the surface, is 86 percent of the speed-of-light constant *c*. The value is calculated from the basic aether inflow expression $\upsilon_{\text{inflow}}^2 = {}^{2GM}\!/_{r}$ (where *M* is the mass contained inside the radial distance *r*; and *G* is the gravitational constant equal to 6.67×10^{-11} N·m^2/kg^2) (Ranzan, 2016, 2018).

Before adding rotation to this structure, it helps to be clear about what a surface chunk of mass "experiences." Surface mass is subjected to an aether headwind of 0.86 *c* (or about 258,000 kilometers per second, and is safely below the lightspeed limit). This continuous inflow is necessary to sustain the very existence of the interior mass.

As long as the structure is stationary, the surface experiences this perpendicular aether inflow, labelled $\upsilon_{a\perp}$ in **Figure 2a**.

Now when rotation is added, the perpendicular component does not change (as long as the mass and its distribution do not change, the perpendicular component will not change). Rotation, however, introduces a tangential aether-flow component, labelled υ_{aT} in **Figure 2b**. And consequently there is a change in the headwind experienced by the surface mass element. If the rotation speed at the equator is, say, two-fifths lightspeed, then the Pythagorean Theorem tells us that the new headwind there (at the equator) must be 88 percent lightspeed.

If the rotation speed is increased to four-fifths lightspeed, then the equatorial mass will have a relative-to-aether motion of 95 percent lightspeed. See **Figure 2c**.

Figure 2 clearly shows the motion of aether as it relates to the surface mass. But what about the motion of the chunk of mass itself? … This is shown in the right-hand column of the figure. In parts (a) and (b) there is a tangential velocity with respect to background space. Important to the discussion is that there be no doubt as to the meaning of "background space"; it means space in the sense of *an empty nothingness container*. The thing to note is that the aether's tangential velocity $\boldsymbol{\upsilon}_{aT}$ and the mass's tangential velocity $\boldsymbol{\upsilon}_{\text{background}}$ are equal in magnitude (and oppositely directed). The two are shown as such here, but this is not always the case, as will be seen in a moment.

The rotational motion of the mass element may also be expressed as having a certain value *through* aether, as well as a certain value with respect to background space. The velocity vector of the motion through aether is just

the negative of the vector $\mathbf{\upsilon}_{aT}$. For the examples in **Figure 2**, the rotational velocity through aether is equal to the velocity with respect to background space (both are directed leftward). The significance of this dual description is revealed in the next diagrammed set of examples.

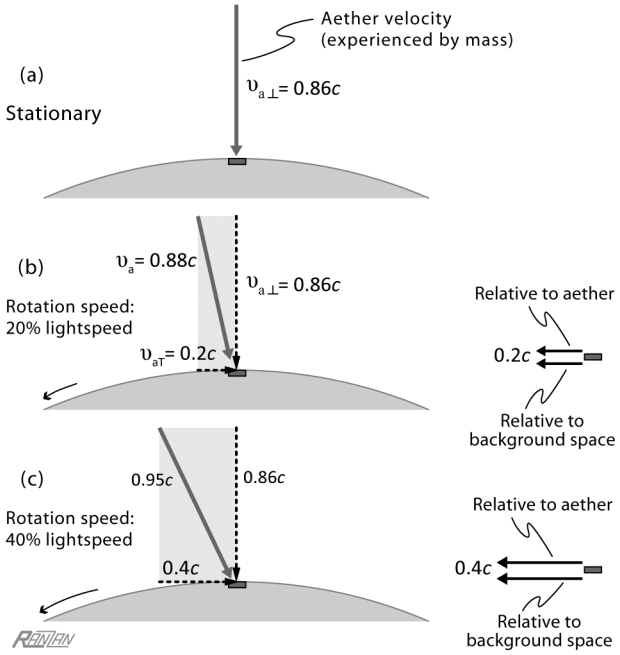

Figure 2. An equatorial chunk of mass embedded in a neutron star "experiences" aether inflow depending on the star's state of motion (as indicated), total mass (2.5 Suns), and radius (10 kilometers). The aether-flow vectors are relative to the mass's reference frame (*left-hand column*, which gives sectional views through the equatorial plane). When the structure is stationary, the flow is perpendicular (part a). When the structure is rotating, the mass experiences the same vertical inflow as well as a tangential flow due to the through-aether motion (parts b & c). The right-hand column compares two distinct velocities of the embedded mass (viewed from the perspective of background space): the velocity with respect to aether and the velocity with respect to background space.

Still using the 2.5-solar-mass-10-kilometer-radius neutron star, when the rotation speed clocks at 51.2 percent of lightspeed, the chunk of equatorial mass finally encounters the special relativity limit. At this rate of rotation, the mass experiences the ultimate aethereal headwind. See **Figure 3a**.

From the perspective of the equatorial surface mass, it is moving through the space medium at the nominal speed of light. It simply cannot travel faster (see the vector rectangles in **Figure 3a**, left-hand column). Mass, of course, cannot propagate at lightspeed. What actually happens as the ultimate speed is approached is that the affected mass (a thin surface layer) converts to pure energy; the process is described in Part 3 of this series, "*Noninteraction Mass-to-Energy Conversion*." The assertion is that the surface really does attain lightspeed with respect to the aether medium (as illustrated).

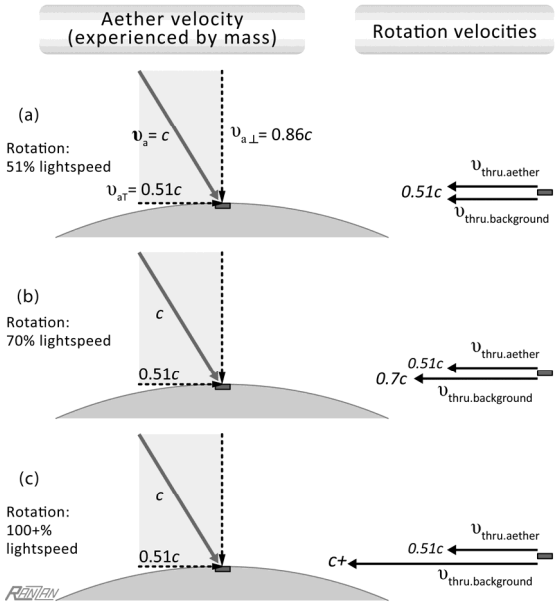

Figure 3. Equatorial mass of the same neutron star (having rotation as indicated) "experiences" maximal aether headwind. Part (a) shows the threshold situation —when mass confronts the special relativity limit. This is when the rotation rate pits mass against the uncompromising speed-through-aether restriction. Mass experiences a strict limit, which means *the rotational speed with respect to aether* simply cannot be increased. However, the rotational speed with respect to background space is NOT subject to such restriction (Part b). It could, theoretically, exceed the speed of light (Part c)!

It may be said that every sufficiently massive and compact star has a rotational velocity limit, its own identifiable characteristic. For the neutron star example of **Figures 2** and **3**, this limit is 0.51 lightspeed. Here are important points to keep in mind:

● The rotational velocity limit (e.g., 0.51*c*) is one of the two components that determines the special relativity restriction of rotating mass.

● Its value represents a strict limit on the rotation speed —specifically its rotation speed with respect to aether.

● Its value is independent of the rotation speed of the structure with respect to background space.

● Its value is determined by the total mass and radius of the gravitating structure.

● Mathematically, it is determined from the Pythagorean relationship $\upsilon_{\text{limit}}^2 = c^2 - \upsilon_{\text{aether}\perp\text{inflow}}^2$, in which, in accordance with aether gravity theory, $\upsilon_{\perp\text{inflow}} = \sqrt{2GM/R}$ (Ranzan, 2016). The expression then becomes

$$\upsilon_{\text{limit}}^2 = c^2 - 2GM/R \quad . \tag{3}$$

● Most importantly, the *rotational velocity limit* does not in any way restrict the rate of rotation. It only affects the centrifugal effect —which it strictly limits.

Now comparing the two frames of reference: A graph of the two rotational speeds for the 2.5-solar-mass neutron star is presented in **Figure 4**. Plotted is the aether-referenced speed *versus* the background-space-referenced speed. The graph is essentially the speed of rotation that specifically determines the centrifugal effect. Along the horizontal portion of the curve, the centrifugal effect undergoes strict attenuation.

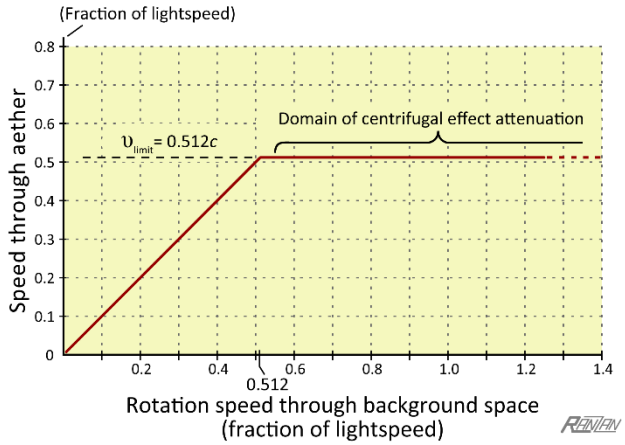

Figure 4. Graphic implications of conforming to the special relativity restriction. Two pieces of information are contained within this graph. First, it gives the limit of the equatorial speed through aether —as indicated by the horizontal line at 0.512 *c*. Second, the height of the curve gives the velocity magnitude for determining the centrifugal effect. (Again, the rotating structure to which these values apply is a 2.5-solar-mass neutron star of radius 10 kilometers.)

A good question to ask at this point: *How is it possible to keep the speed through aether constant (as when it attains the aforementioned limit) yet still allow for higher rates of rotation of the structure*? … The answer lies with the process of aether drag —conventionally called frame dragging by eschewers of the aether concept. Aether is dragged along with the rotating structure. It is drawn vortex-like around and around while flowing into the neutron star. Aether drag may be quantified; it is the difference between the velocity through aether and the velocity with respect to background space (or synonymously, with respect to the surrounding distant universe). Frame dragging will be revisited later in association with total centrifugal negation.

3. Centrifugal Effect versus Spin Rate

Now for a more direct examination of the centrifugal effect and the *attenuation principle*. In order to construct a suitable graph, start with the textbook expression for the centrifugal "force."

(Centrifugal force) = Mass × (Centrifugal acceleration);

$$F_C = m_{\text{test}}\left(\frac{\upsilon_{\text{equator}}^2}{R}\right); \tag{4}$$

and impose the special relativity restriction, $\upsilon_{\text{equator}} \leq \upsilon_{\text{limit}}$, as discussed earlier.

Next express this in terms of the spin rate by noting that $\text{Spin} = \dfrac{\upsilon_{\text{equator}}}{(\text{circum.})} = \dfrac{\upsilon_{\text{equator}}}{2\pi R}$ revolutions per second, and consequently $\upsilon_{\text{equator}} = (\text{Spin}) \times (2\pi R)$. This latter is substituted so that the original centrifugal expression becomes

$$F_C = m_{\text{test}}\left((\text{Spin})2\pi R\right)^2 \tfrac{1}{R}. \tag{5}$$

When this is applied to a 1 kilogram mass at the equator of a 10-kilometer-radius sphere the result is

$$F_{\mathrm{C}} = 1kg\left((\mathrm{Spin})2\pi\right)^2 10^4 meter\ . \tag{6}$$

And the special relativity restriction, now expressed in terms of the rate of spin *with respect to aether*, is

$$\mathrm{Spin}_{\mathrm{lim}\,it} = \frac{\upsilon_{\mathrm{limit}}}{(\mathrm{circum.})} = \frac{\sqrt{c^2 - {}^{2GM}\!/_{R}}}{2\pi R}\ . \tag{7}$$

Then, when the known values for the 2.5M⊙ neutron star are inserted, the spin limit **relative to aether** must be 2450 revolutions per second (corresponding to a tangential speed of 1.54×10^8 m/s); which in turn gives the limit of the centrifugal force as 2.37×10^{12} newton on each unit of mass.

The graph of the relationship between Centrifugal effect and Spin rate is shown, in two parts, in **Figure 5**.

■ $F_{\mathrm{C}} = 1kg\left((\mathrm{Spin})2\pi\right)^2 10^4 m$, $0 \le \mathrm{Spin} \le 2450$ rps.

■ $F_{\mathrm{C}} = 2.37\times10^{12}$ newton, $\mathrm{Spin} \ge 2450$ rps, *with respect to background space*.

So, when the spin rate reaches 2450 revolutions per second, the attenuation kicks in. The centrifugal effect cannot increase further regardless of the spin rate (as shown by the linear portion of the graph in **Figure 5**).

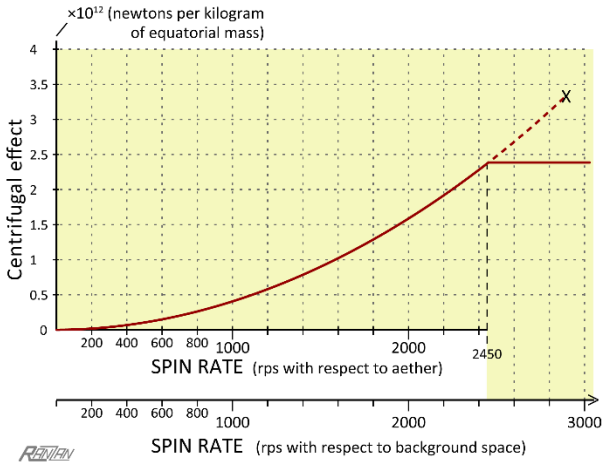

Figure 5. Centrifugal "force" is plotted as a function of the spin rate, thereby giving a graphic demonstration of the *centrifugal effect attenuation* principle. When the 2.5-solar-mass neutron star discussed in the text finds itself spinning at 2450 revolutions per second, the centrifugal effect reaches a limit — 2.37×10^{12} newton for each kilogram of equatorial mass. This "force" limit remains constant regardless of any further increase in the spin rate. The dashed portion of the curve is an unrealistic extrapolation according to which special relativity is violated and the structure flies apart at 2900 rps indicated by the “X” mark.

Comments: With the traditional approach, according to which the space medium is ignored, this structure would fly apart at 2900 revolutions per second. The point on the extrapolated portion of the graph where this supposedly occurs is marked with an X.

Up to this point, the discussion has focused on a rotating structure of 2.5-solar-mass and a radius of 10 kilometers. The next section examines what happens when the mass varies while the radius continues to be held constant at 10 kilometers.

4. Centrifugal Effect versus Mass

4.1. Graphic Demonstration of Centrifugal Effect Attenuation

The following study examines the centrifugal effect as plotted for a domain of gravitating masses. This is done for various pre-selected spin rates —namely, 1600, 1400, 1200, 1000, and 500 rps. As before, the study deals with neutron-density mass packed into a 10-kilometer-radius sphere.

When the spin rate is 1600 rps (corresponding to an equatorial speed of 1.005×10^8 m/s), the centrifugal "force" is found, using equation (4), to be 1.010×10^{12} newton. In order to meet the *relativity* restriction imposed by **Figure 1**, the minimum mass required is 0.76 $M_\odot$. As more massive bodies are examined, as one follows along the curve to the right, one eventually reaches a cusp —the point at which centrifugal attenuation kicks in. This point of commencement of centrifugal reduction is found by determining the quantity of gravitating mass for which the equatorial velocity through the aether EQUALS the velocity limit (the limit imposed by special relativity). In other words, one must find the mass for which 1.005×10^8 m/s (corresponding to 1600 rps) is that limit.

This can be done very easily.

Simply write equation (3): $v_{\text{limit}}^2 = c^2 - {}^{2GM}\!/_{R}$.

And rearrange the terms so that

$$M = \frac{R}{2G}\left(c^2 - v_{\text{limit}}^2\right) \quad . \tag{8}$$

When solved, this equation gives the quantity of mass at the cusp of the 1600-rps graph in **Figure 6**. The answer is 3.01 solar masses.

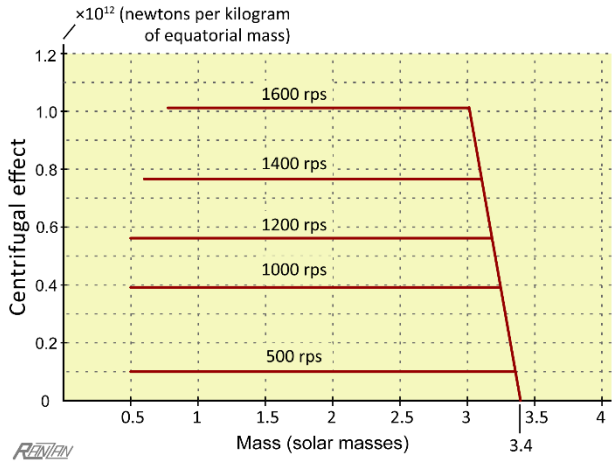

Figure 6. Centrifugal "force" is plotted as a function of the mass for several spin rates. The sloping line traces the centrifugal effect attenuation. Notice that if the mass corresponds to 3.4, then it will manifest no centrifugal effect whatsoever —regardless of spin rate. (Sphericity and constant radius of 10,000 meters is assumed.)

Similarly, when the spin rate is 1400 rps (corresponding to an equatorial speed of 0.880×10^8 m/s), the centrifugal "force" is found to be 0.775×10^{12} newton. The minimum mass required is 0.583 $M_\odot$; while the mass required for onset of centrifugal attenuation is 3.10 $M_\odot$.

Values for the other selected spin rates are included in the summary chart, **Table 1**.

Table 1: Calculated values for Figure-6 graphs.

Spin rate	Equatorial speed	Centrifugal effect	Mass (min. required)	Mass (required for attenuation)
1600 rps	1.005×10^8 m/s	1.010×10^{12} N	0.76 $M_\odot$	3.01 $M_\odot$
1400	0.880×10^8	0.775×10^{12}	0.583	3.10
1200	0.754×10^8	0.569×10^{12}	0.5 approx.	3.175
1000	0.628×10^8	0.396×10^{12}	< 0.5	3.24
500	0.314×10^8	0.098×10^{12}	< 0.5	3.35

Details for the sloping portion of the graph are presented in the Appendix.

4.2. Principle of Centrifugal Attenuation

The physics rule that the forgoing sections have illustrated may now be stated.

Principle of centrifugal effect attenuation: In astrophysics, if and when a gravitating structure's speed of rotation attains its *aether-referenced speed limit* —a limit imposed by special relativity— it becomes subject to centrifugal effect attenuation. The Principle only applies if the structure is sufficiently massive and compact.

As a general rule, the centrifugal effect is determined by the *tangential* velocity THROUGH the space medium (aether).

5. Total Cancellation of Centrifugal Effect

The explanation leading to the complete negation of the centrifugal tendency requires an understanding of the fundamental difference between absolute rotation and just mere relative rotation. This means gaining an appreciation of the fact that absolute circular motion leads necessarily to centrifugal effects but purely relative motion does not. Final understanding then comes from the answer to the question: *Granted the presence of absolute rotation, but relative to what?*

5.1. Absolute versus Relative Rotation

In a remarkably simple demonstration, Isaac Newton (1642-1727) convincingly showed that the centrifugal force is the result of absolute motion, and not just relative motion. His famous bucket experiment is performed as follows: A bucket of water is tied to the end of a length of rope which is secured to an overhead support. The hanging bucket is turned round and round many times, causing the rope to become tightly twisted. While the bucket is patiently held in place, the disturbed water is allowed to come to rest. The experiment begins when the bucket is released and allowed to freely rotate as the rope unwinds. Initially, the contained water remains stationary while the bucket rotates around it; the water displays no centrifugal effects (**Figure 7a**). As the rotation speed quickly increases, the water develops a concaved surface, thereby revealing the presence of a centrifugal effect (**Figure 7b**). With the rope now markedly untwisted, the turning bucket is forcefully brought to a halt. But the contents is still rotating, still manifesting the centrifugal effect of surface concaveness (**Figure 7c**). Notice, when the water is rotating relative to the bucket in Part (a) there was no centrifugal effect. Yet when

rotating relative to the immediate surroundings, as in Parts (b) and (c), the Effect was obviously present. The centrifugal effect signals a special kind of rotation.

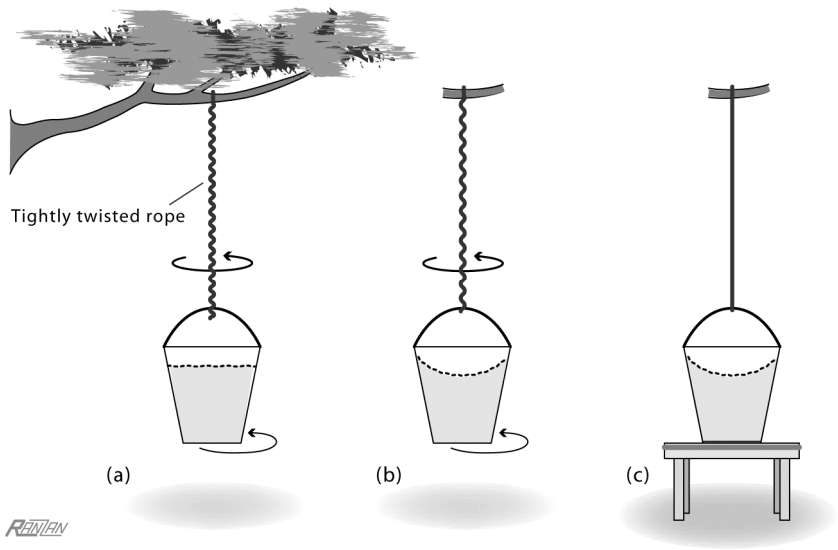

Figure 7. Newton's water-bucket experiment. Part (a) shows the situation just a brief moment after the bucket is released and allowed to spin in response to the torque present in the rope. At this stage, the water remains stationary while the bucket rotates around it; the water displays no centrifugal effects. In (b), the water displays a centrifugal effect (while rotating relative to the surrounding world), indicating the presence of absolute rotating motion. The surface of the water becomes concave, as it rises up the side of the bucket. In (c), the bucket is brought to a sudden stop. But the contents is still rotating, still manifesting the centrifugal effect of surface concaveness. Newton concluded that the centrifugal force is the result of absolute motion, not relative motion.

An even simpler pair of experiments reveals the absolute-versus-purely-relative difference. Twirl a ball on the end of a string and watch the ball defy the Earth's gravitational pull as it flies in circular orbits above the experimenter's head. A very real absolute effect is being produced. Compare this with apparent relative circular motion. Spin yourself around amidst a stand of trees; watch the trees circle round and round; no matter how fast you spin and they rotate around you (they rotate, as an aggregate, relative to your position) they do not bend away from you, not in the slightest. The ball has motion relative to the experimenter's raised hand; the forest is rotating relative to the observer. One manifests a centrifugal effect; the other does not. Evidently, one undergoes absolute motion; the other is limited to only relative motion.

Newton, in connection with the bucket experiment, concluded: "The effects which distinguish absolute from relative motion are centrifugal forces, or those forces in circular motion which produce a tendency of recession from the axis. For in a circular motion which is purely relative no such forces exist, but in a true and absolute circular motion they do exist, and are greater or less according to the quantity of the absolute motion" (Harrison, 1981).

If it is only absolute motion that produces centrifugal effects, what is it about absolute motion that makes it different? Does it have something to do with the surroundings? Look at the summary of the observations of Newton's water-bucket experiment in the following table.

Table 2. Rotating water-bucket experiment.

Figure reference	Water rotating relative to bucket	Water rotating relative to background	Centrifugal effect (indicative of absolute motion)
Part (a)	Yes	No	No
Part (b)	No	Yes	Yes
Part (c)	Yes	Yes	Yes

The centrifugal effect only manifests when there is rotation relative to the "background." Clearly, there is something special about the surrounding world that defines absolute motion and imparts centrifugal effects.

5.2. Identifying the Effect-Inducing "Background"

So, the problem boils down to identifying, specifically, the background to which *absolute rotation* has an underlying connection (or is relative, so to speak).

One influential scientist was convinced he had the answer to the "background" question —Austrian physicist and philosopher Ernst Mach (1838-1916). The centrifugal force, he believed, is produced only if the rotation is relative to the surrounding universe, in his words "relative to the fixed stars."

"For me only relative motion exists … When a body rotates relative to the fixed stars centrifugal forces are produced; when it rotates relative to some different body and not relative to the fixed stars, no centrifugal forces are produced" (Mach, 1981). In other words, for Mach, *absolute motion* is only meaningful in the sense of being relative to the universe as a whole. See **Figure 8a**.

Now, if Ernst Mach is correct (and it turns out that Mach was partially right but for the wrong reason), then the following argument must be true: Assume a body rotates; it can be a large or small body; it does not matter. If the universe were to rotate around the body, *at the same rate* about the same axis, then there would be no centrifugal effect. There would be no rotation "relative to the fixed stars"; and, therefore, there would be no tendency of recession from the rotation axis. The rotation would be quite undetectable. See **Figure 8b**.

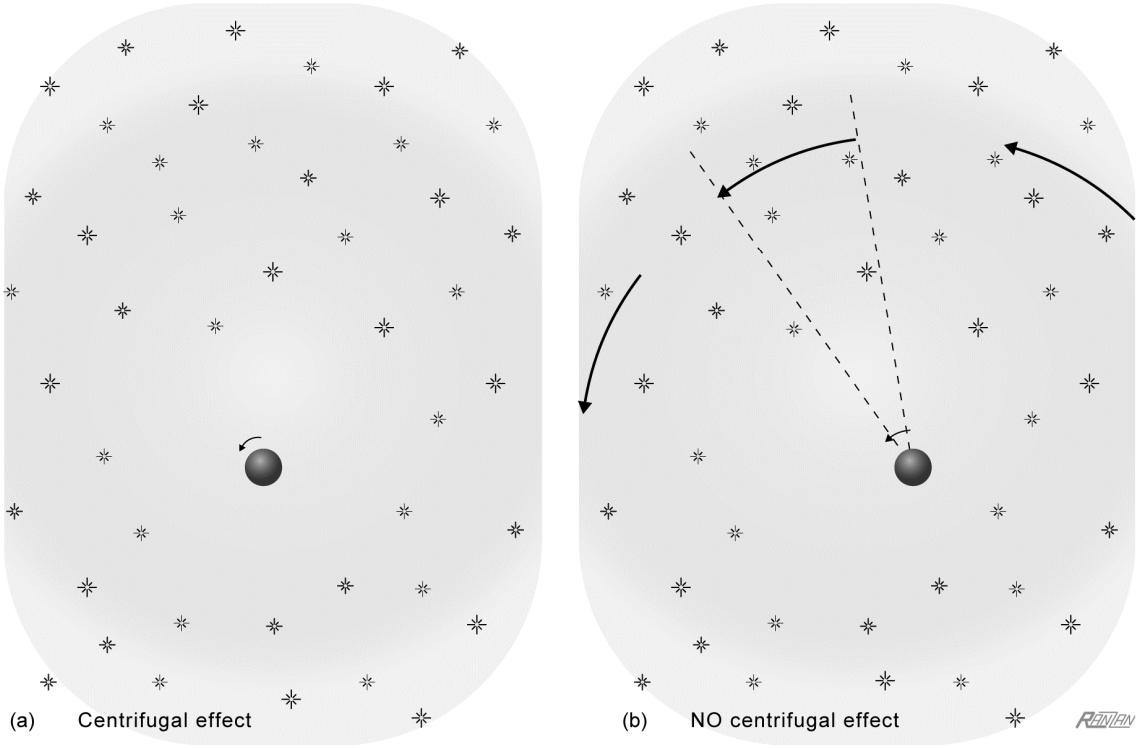

Figure 8. Mach's hypothesis. (a) Body rotates relative to the background universe, "relative to the distant stars." According to Ernst Mach, this is the cause of the inertial centrifugal effect. (b) Mach's premise logically means that if the background universe were to rotate in synch with the test body, then there would be no centrifugal effect.

The modern view, however, interjects a crucial element; one that changes the way matter relates to the rest of the universe. It is not the distant stars that are important but, rather, the space medium present between the stars and between all bodies. A body's entire "sensory" connection with the surrounding universe is by way of the universal space medium —the medium that empowers gravity. Pause and think about this. The entire universe need not rotate for the argument to remain valid. Only the body's immediate local universe, the surrounding aether, needs to rotate, in order to produce the same negating effect. The rotating body will "believe" itself to be stationary. It will manifest no centrifugal effects.

What scientists of the 20th century (not to mention also those of the 19th century) failed to recognize is that the absolute motion —that special motion that Newton had deduced to be the key factor in the centrifugal effect— was none other than motion with respect to the ethereal universal medium.

The all-important *background* that defines absolute motion and that facilitates the centrifugal effect is aether.

The distant stars, the far off galaxies, the surrounding universe, all are irrelevant. Only the circular motion *with respect to aether* matters. When the relationship between the rotating body and the inflowing aether meets a simple limiting condition, the Effect entirely vanishes.

5.3. Negation of the Centrifugal Effect

The phenomenon of *Effect vanishment* is contingent upon a surprisingly simple condition, a necessary and sufficient state. The essential condition arises when a gravitationally collapsing body possesses sufficient mass to transform itself into an end-state neutron star. If a body has collapsed but lacks the total mass needed, then it

must first acquire the necessary additional mass before transforming into an end-state neutron star. This kind of star is unique. Another name for it is *Superneutron star*; named so because its density is the ultimate in all of nature. Yet another name for it is *Terminal star*; "Terminal" because it cannot be altered in any way other than its rotation. Such an object is truly in an end state of existence (Ranzan, 2016, 2017).

The Terminal star's defining feature —the feature that guarantees the negation of the centrifugal effect— is that its aether inflow at its surface is equal to the speed of light (Ranzan, 2020).

When the surface inflow is the same as the speed of light, lateral motion through aether becomes impossible (per special relativity rule). Such a body cannot rotate "through" the aether medium. It can, however, rotate with respect to background space; but in order to do this, it must drag the aether as in a vortex. In effect, the aether spirals into the mass body.

There are two ways to argue the negation phenomenon:

● The special relativity argument. Since lateral motion through aether is precluded, it follows that no centrifugal effect can manifest.

● The ultimate-drag argument. Since, in the reference frame of the Terminal star, the aether inflow over the entire surface is perpendicular and equal to the speed of light; the situation is categorically equivalent to having the surrounding universe rotating in synchronization with the Terminal star. See **Figure 9**. Again, it follows that no centrifugal effect can manifest.

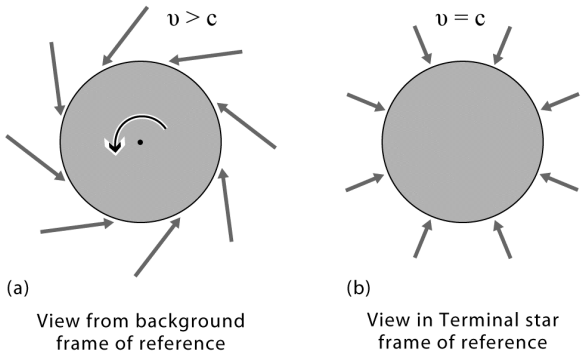

Figure 9. Rotating Terminal star from two perspectives. In (a), the view is with respect to background Euclidean space (space as an empty container) and shows significant aether dragging. The velocity magnitude of the flow must necessarily be greater than lightspeed. In (b), the view is in the frame of the spinning star; and regardless of the rotation rate, the flow speed at the surface is always the speed of light and the flow direction is always perpendicular to the surface. From the perspective of the Terminal star, the situation is equivalent to having the external world rotating in exact harmony WITH the star —essentially the star senses NO rotation whatsoever.

With respect to background space, the Terminal star may have significant circular motion (**Figure 9a**). But from the perspective of the star's own reference frame, there is no rotation (**Figure 9b**). The aether that is streaming onto its surface is streaming from a direction that is *perpendicular to the surface*. The space medium inflow is perpendicular to the surface exactly as it would be if the body were *not* rotating.

The next figure (**Figure 10**) illustrates the situation from the perspective of an imaginary observer on the surface of the spinning Terminal star. He "sees" an object, comoving with aether, falling perpendicular to the surface. The corresponding vector diagrams are instructive on two counts: One, the "perpendicular component" vector at

the surface is constant and must remain constant; while the other two vectors can vary in relationship to the rate of rotation. Two, the observer in this thought experiment has the ability to measure the motion of the aether (via the comoving object) but has no way of determining the rate of rotation. For him, the body is not rotating at all. We, as the distant observers, can "see," or deduce, the reality of the situation: With respect to the background Euclidean space, the comoving falling object has a velocity magnitude that is considerably greater than lightspeed; however, its comoving velocity with respect to the Terminal star has a magnitude of 300,000 kilometers per second and a direction perpendicular to the surface.

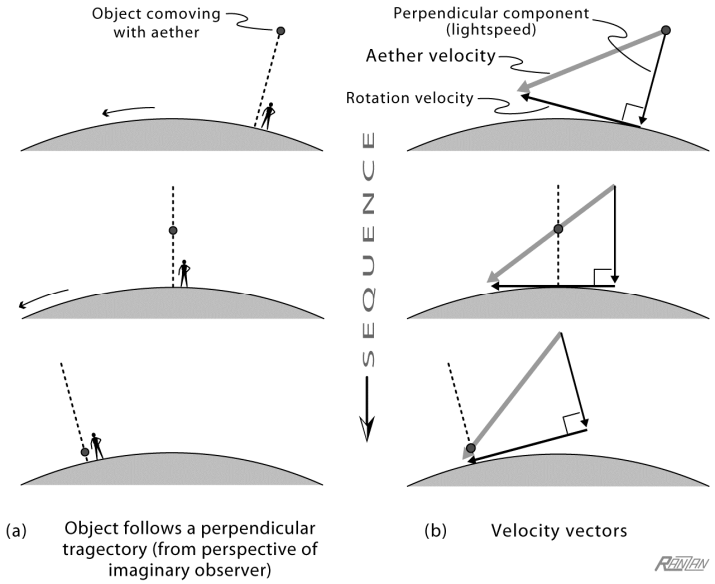

Figure 10. Imaginary observer on a spinning Terminal star "sees" an object (comoving with aether) falling perpendicular to the surface (a). Part (b) shows the corresponding vector diagrams. Three things to note: (i) The "perpendicular component" vector at the surface is, by definition, constant; the other two vectors can vary in relationship to the rate of rotation. (ii) The observer in this thought experiment has the ability to measure the motion of the aether (via the comoving object) but has no way of determining the rate of rotation. For him, the star is not rotating. (iii) Because of the phenomenon of relativistic aberration, or headlight effect, visibility is strictly limited to a perpendicular line of sight. (View is from background frame of reference.)

In fact, everything, radiation or particulate matter, whether comoving or not, impacting the surface, will "appear" to the imaginary surface observer to have a perpendicular trajectory. More specifically, *only what is arriving from directly overhead would be visible*. The phenomenon is known as relativistic aberration, a focusing of radiation in the direction of motion (Hodge, 1984), that is, the direction of the motion of the observer relative to the aether flow (which is necessarily perpendicular).

Under less extreme circumstances, it would be possible to observe radiation coming from all directions; it would just be most intense in the direction of motion (that of either the observer or the source). However, when applied to the ultimate situation of the Terminal star, *relativistic aberration* means that the surface observer would see only what aligns with his direction of motion (motion with respect to aether, motion equal to lightspeed). And this direction is perpendicular to the surface as shown in **Figures 9** and **10**. Everything else is invisible.

Relativistic aberration is also known as the headlight effect. For a pictorial explanation, see the Scientific American issue of May 1982 (Blandford et al., 1982; Hodge, 1984); for the mathematical proof see the 1966 book by John Archibald Wheeler, Spacetime Physics (Taylor & Wheeler, 1966).

Summing up then, the Terminal star manifests the most extreme situation. As for the negation effect, the aspect of physics that 20th-century scientists overlooked, it may be stated as follows.

Principle of centrifugal effect negation: As a consequence of special relativity considerations, any critical-state structure (a gravitating structure for which the surface inflow of the space medium, popularly called aether, equals the speed of light) is categorically precluded from manifesting a centrifugal effect and, therefore, has no theoretical limit to its rate of rotation.

The Principle applies to all critical-state stars, notably end-state neutron stars. The latter are the only *stable* contiguous structures, existing in the universe, that have the requisite surface inflow.

5.4. No Rotation Limit

As discussed earlier, the lateral velocity component (through aether) restricts the rate of rotation. Too much spin and the system flies apart. However, the Superneutron star overcomes this restriction by simply not having a lateral velocity. The structure is perfectly free to spin with respect to background space (space as an empty vessel), but not with respect to the universal space medium.

It accomplishes this seemingly magical motion by dragging the aether medium.

Now note: There is no law of physics that limits the speed of aether's motion —after all, it is not moving through any*thing*, rather, it is merely moving through *nothingness* background space. It follows that there is no limit to the speed with which aether can be dragged. It further follows that there is no theoretical limit to the rate of spin that a Terminal star may possess or acquire.

Thus, a spinning Superneutron star can wrap itself with "dragged" aether to any degree or any speed whatsoever (whatever is compatible with the angular momentum the star possesses). There need be no violation of Einstein's relativity restriction. To see how this works, in terms of the velocity vectors, see **Figure 11**. (And keep in mind, the cause of the spin is of no concern here.)

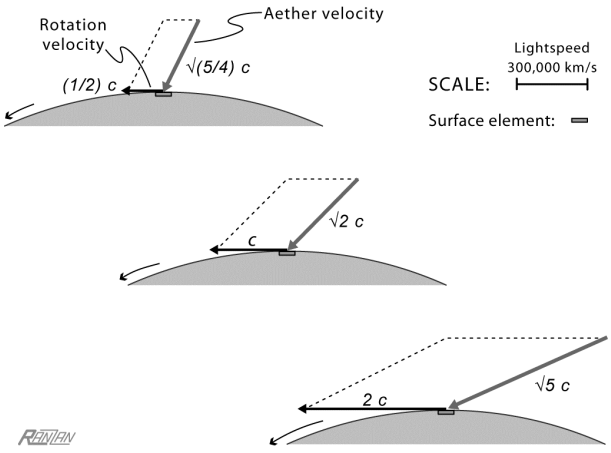

Figure 11. Terminal stars have no rotation speed limit. It is because, as explained in the text, there is no centrifugal force, no speed limit of aether with respect to background space, and no limit to aether-frame drag. The aether flow and rotation velocities (shown in these three extreme examples) are with respect to the background Euclidean, or nothingness, space. Note, the aether-drag velocity is the same as the rotation vector. The height of the vector parallelograms remains *c* (lightspeed).

In the broader context, once a star becomes enveloped by a critical-state boundary, its rotation can have no theoretical limit.

6. Summary Discussion

6.1. Quick Summary

The centrifugal phenomenon/effect associated with rotating bodies requires motion *through* aether —tangentially, or laterally. The importance of this lateral motion is summarized in **Figure 12**. The focus is on what a test block of mass "experiences" while resting on the surface of a rotating solid body whose axis of rotation is perpendicular to the page. (Except for its rotation, the gravitating structure is at rest with respect to the surrounding space medium.)

Because of the rotation, the test mass/block experiences the inflowing aether passing through itself at an angle. This aether vector (thick solid arrow), as viewed in the frame of the rotating body, has two components. One is perpendicular to the surface, the other is lateral to the surface.

There are two factors that affect the magnitude and/or orientation of these velocity vectors. The left-hand column of the figure pictorializes what happens as the rotation increases, step by step —*while the mass of the planet remains constant*. The right-hand column shows what happens as the mass of the structure increases, step by step —*while the rotation rate remains constant*. Think of the increase in the gravitating mass as a transformation from planet to dwarf star and then to neutron star. Or even simpler, just think of an increase in the intensity of gravity.

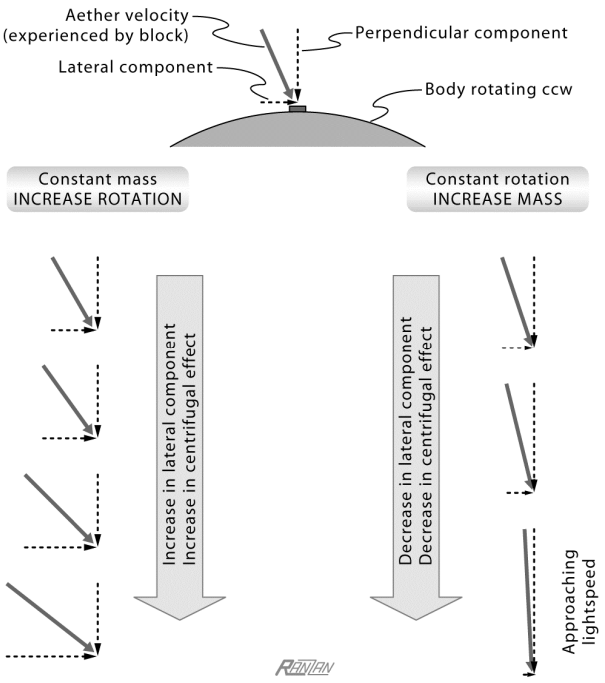

Figure 12. Key element in the cause of centrifugation is the presence of a lateral-motion component vector. Left column: With an increase in rotation, there is a corresponding increase in the lateral component; and, clearly, the centrifugal force must increase. Right column: However, with an increase in mass (of the gravitating body), there is a *decrease* in the lateral component; for logical consistency, the centrifugal effect must decrease. Note, the view (and the vector analysis) is within the frame of the rotating body. Rotation is counterclockwise.

Notice the intuitive nature of the left-hand-column sequence: As the rotation increases the lateral velocity component also increases; no one would dispute the fact that the centrifugal force will increase accordingly. The aether vector (with respect to the test mass) can never become excessive (can never approach lightspeed). A centrifugal explosion would occur should an innate limit be exceeded.

The right-hand column reveals a very different effect: As the mass increases, as gravity intensifies, the lateral velocity component diminishes. As the aether flow that the block experiences approaches the velocity of light, the lateral velocity component approaches zero. The centrifugal force progressively decreases; and in the limit, the centrifugal effect ceases to exist.

6.2. Velocity Expression for Determining Centrifugal Effect

When it comes to circular motion, it is the tangential velocity that determines the intensity of the centrifugal effect.

Although the velocities shown in **Figure 13** are referenced to the background nothingness space, the tangential velocity of importance is the one referenced to the aether.

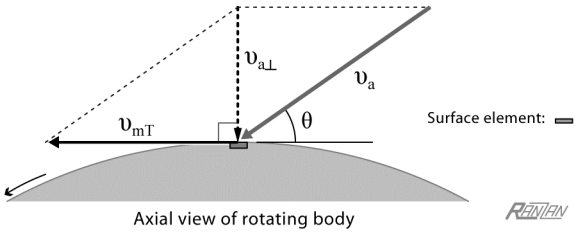

Figure 13. Three velocities are involved in determining the centrifugal effect intensity. The tangential velocity of the mass element, $\boldsymbol{\upsilon}_{mT}$. The velocity of the aether, $\boldsymbol{\upsilon}_a$. The perpendicular component of the aether flow, $\boldsymbol{\upsilon}_{a\perp}$. (All are shown with respect to the background frame of reference.) The gravitating body is rotating counterclockwise, with an axis of rotation perpendicular to the page's plane. It is assumed that the body has negligible translational motion (i.e., there is no additional aether flow component to contend with). The key constraint in this vector diagram is that $\boldsymbol{\upsilon}_{a\perp}$ must be less than or equal to c.

Specifically, it is the tangential speed *with respect to aether* that determines the intensity of the centrifugal effect. There are three criteria involved here.

First criterion: This applies to conventional situations.

$$\text{(Tangential speed of mass through aether)} = \boldsymbol{\upsilon}_a \cos\theta; \tag{9}$$

provided $(\boldsymbol{\upsilon}_a \sin\theta) < c$ AND $\left(\upsilon_a \cos\theta\right) \le \sqrt{c^2 - \upsilon_{a\perp}^2}$.

Second criterion: This applies to attenuation and negation situations.

$$\text{(Tangential speed of mass through aether)} = \upsilon_a = \sqrt{c^2 - \upsilon_{a\perp}^2} = \sqrt{c^2 - {}^{2GM}\!/_{R}}; \tag{10}$$

when $\left(\upsilon_a \cos\theta\right) > \sqrt{c^2 - \upsilon_{a\perp}^2} > 0$ OR when $(\boldsymbol{\upsilon}_a \sin\theta) = c$.

The attenuation situation arises when $\left(\upsilon_{\mathrm{a}} \cos\theta\right) > \sqrt{c^2 - \upsilon_{\mathrm{a}\perp}^2} > 0$.

The negation situation arises when ($\boldsymbol{\upsilon}_{\mathrm{a}} \sin\theta$) = c.

Note, the aether inflow's perpendicular component is related to the structure (mass M, radius R) by the expression $\upsilon_{\mathrm{a}\perp}^2 = {}^{2GM}\!/_{R}$.

Third criterion:

The structure, and its rotation, must conform to the condition described by **Figure 1**. Also, there is the assumption of an absence of other background aether flow (i.e., the rotating body is assumed to be otherwise at rest within the space medium, or to have negligible translational motion).

Once the rotational velocity has been calculated, with equation (9) or (10), it can then be used to determine centrifugal effects.

6.3. Terminal Star Defined

Terminal star: A star that is in the "Terminal" state —an ontological state that cannot be altered in any way other than changes of rotation. Such an object is truly in an end state of existence. It is both a destroyer of energy (specifically, mass energy) and a generator of energy (specifically, it amplifies the energy of photons and neutrinos) (Ranzan, 2018, 2021). **The defining feature:** It is enveloped by an energy surface/layer onto which the space medium (aether) flows at the speed of light. Moreover, this energy layer encloses a fixed quantity of mass existing as nature's ultimate density state (Ranzan, 2021). **Rotation feature:** When rotating, it is truly unique. It manifests no centrifugal effect. If the rotation axis is aligned with the emission beams, it has virtually no theoretical spin limit.

Synonymous terms: *Superneutron star, end-state neutron star*.

6.4. Overlooked Principle

General Principle governing the centrifugal effect: When the speed of rotation with respect to background space (nothingness space) exceeds the speed of rotation with respect to the universal space medium (aether), the centrifugal effect can then no longer increase. The centrifugal effect is always determined by *the rotation speed with respect to aether*. There are two situations for which the effect is zero. This happens for the trivial case when there is practically no rotation; and it happens for all critical-state stars, notably end-state neutron stars, regardless of rotation.

The attenuation and negation of the centrifugal effect applies only to structures that are sufficiently massive and compact.

Negation of the centrifugal effect: Once a lightspeed boundary forms on the surface of an astronomical body, such body totally loses its ability to sense its own rotation. The reason is straightforward. In order to sense rotation, *there must be a lateral motion through aether*; but when the aether inflow attains lightspeed, lateral motion through the aether becomes impossible (**Figures 9** and **13**). In the absence of aether flow in the lateral direction, no object, no structure, can manifest any centrifugal effects.

7. Concluding Remarks

7.1. Historical Perspectives

According to Ernst Mach, the inertia of a material object —the object's resistance against being accelerated— is not an intrinsic property of matter, but a measure of its interaction with all the rest of the universe. In his view, matter only has inertia because of the presence of other matter in the universe. So when a body rotates, its inertia produces centrifugal forces, but these forces appear only because the body rotates "relative to the fixed stars," as Mach worded it. If those fixed stars were to suddenly disappear, the inertia and the centrifugal effects of the rotating body would disappear with them (Capra, 2000).

This conception of inertia, which became known as Mach's principle, had a deep influence on Albert Einstein and is said to have been his original motivation for constructing the general relativity theory. Physicist Fritjof Capra has pointed out that due to the considerable mathematical complexity of Einstein's theory, the experts were not able to agree whether it actually incorporates Mach's principle or not. Most physicists believed, however, that it should be incorporated in one way or another, into a complete theory of gravity (Capra, 2000).

As we now know, Mach was wrong —wrong because he ignored the universal medium. What made his oversight such a serious setback for 20th-century astrophysics and cosmology was that too many theorists (including Einstein) went along with his highly-abstract speculation. The search to find the true nature of space-permeating aether was not in vogue. No, the big thing at the time was to relativize physics.

Gödel's Strange Universe

The view of another famous thinker is worth noting. Although a great mathematician, Kurt Gödel (1906-1978) was unaware that a rotating universe is NOT subject to the centrifugal effect!!

Gödel devised a rather strange model of the universe (based on general relativity) and presented it as a gift to Einstein on his 70th birthday. The universe Gödel described to his skeptical friend had unique properties. One of which is relevant to the present discussion. It rotated, which Gödel believed provided centrifugal force that would prevent gravity from crunching together all the matter in the cosmos, creating the stability Einstein demanded of any cosmic model (Folger, 2015, p. 71).

It is said that Gödel pored over catalogs of galaxies, looking for clues that his theory might be true. Astronomers, of course, have found no evidence that the universe is rotating (Folger, 2015, p. 72).

One wonders if Einstein or anyone else asked Gödel the simple question, *rotation of the universe relative to what*? In what possible framework (reference frame) is his universe performing its absolute motion?

7.2. Altering the Gravitational Signature

An important implication of centrifugal attenuation and negation has to do with the change in the potency of gravity.

Here briefly is how the overlooked Principle affects a body's gravitational signature:

- Any reduction or elimination of the centrifugal effect permits significant increases in rotation.
- This in turn intensifies the vorticular aether motion ("frame dragging").
- Which increases the stress on the aether, leading to an increase in its self-dissipation.
- And according to the aether theory of gravity, any increase in aether self-dissipation manifests as an amplification-of-gravity effect —an increase in the efficacy of basic Newtonian gravity.

The profound implication is that spinning Terminal stars are far more potent gravitationally than their actual mass content would indicate. In fact, it is not the mass itself that produces the amplification but rather the

surrounding zone of secondary gravity (conventionally called the *gravitational field*). When *that* zone is stressed, it generates additional gravity.

How this amplification/intensification of gravity comes about is explained in greater detail in the revolutionary article, *The Nature of Gravity –How one factor unifies gravity's convergent, divergent, vortex, and wave effects*, published recently in the **International Journal of Astrophysics and Space Science** (Ranzan, 2018).

7.3. Hidden Matter or Hidden Principle

Examples of 20th-century scientists who failed to recognize this fundamental law:

James Peebles and colleague Jeremiah Ostriker had sought to analyze the rotational stability of disk galaxies using computer modeling. When they ran the program, however, their simulated galaxy went haywire. "To our surprise, the disk went wildly unstable," said Ostriker. "The stars' orbits went from being nearly circular to being very eccentric." Some of the stars even became detached from the disk and flew off into space. Peebles and Ostriker, noting that such chaos does not occur in real galaxies, concluded that some invisible reservoir of mass must be present and provided the additional gravity needed to prevent the disk structure from flying apart (McManus, 1988). For these eminent astrophysicists, the puzzle was not some hidden principle but simply some invisible mass —some *mysterious dark matter*.

As if to compound the mystery, Peebles eventually received a Nobel physics prize, in large part, for this theoretical discovery —more properly, for a speculation of something lacking any real evidence, something that in fact was not needed.

Back in the 1970s and early 1980s, Vera Rubin and her colleagues at the Carnegie Institute in Washington, D.C., conducted a detailed mapping of the orbital velocities of stars in a large sample of spiral galaxies. They made a seemingly reasonable assumption. The assumption was that the stars, dust, and gas were all travelling *through* the space medium —as they were orbiting about the galactic center— in accordance with Kepler and Newton's celestial mechanics. But that's not what they found. To their surprise and bafflement, redshift measurements showed that all the 'observable' stuff was orbiting much too fast. It was as if the centrifugal effect was somehow weakened! Gravity was somehow stronger than theory predicts! Instead of considering that here was the evidence of a new fundamental law of nature, these scientists joined the consensus view and invoked the presence of massive amounts of invisible matter. More mass theoretically solves the problem; but additional mass has never been found.

The quantity is by no means trivial. According to galaxy expert Vera Rubin, "In a spiral galaxy, the ratio of dark-to-light matter is about a factor of 10" (Rubin, 1995). In order to make 20th-century gravity work for spirals, theorists required a mass-correction multiplier of about 10. It was an embarrassing disjuncture between theory and observation!

Twenty-century scientists failed to recognize how a basic premise of Newtonian gravity limits its applicability: Newton's law, in practice, assumes objects (orbiting bodies and rotating bodies) are moving *through* the space medium (vacuum, quantum foam, aether, etc.). But in spiral galaxies, stars are, in large part, moving WITH the space medium!

It was a fateful oversight —one that led directly to the false belief in "dark matter."

The unavoidable conclusion. The failure of 20th-century scientists to recognize the centrifugal mechanism at a fundamental level —the deep connection between matter in motion and the universal space medium— led to the flawed modeling of spiral galaxies with the inclusion of wholly unnecessary *dark matter*.

The distinction between motion THROUGH aether and motion WITH aether is critically important for understanding the rotation of compact stars, the rotation of large-scale structures, and. the centrifugal effect.

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Appendix: Equations for the sloping portion of the Figure-6 graph

Start with basic centrifugal equation $F_C = m_{test}\left(\frac{\upsilon^2_{equator}}{R}\right)$; where $\upsilon_{equator}$ is used as the *critical* speed of rotation at zero latitude. The critical speed is the one limited by special relativity, as demonstrated in **Figures 2** and **3**.

Substitute $\upsilon^2_{equator} = c^2 - \upsilon^2_{aether.\perp.inflow} = c^2 - {}^{2GM}\!/_{R}$; $\sim 3M_\odot \leq M \leq 3.4M_\odot$ [Same as equation (3) derived in connection with **Figures 2** and **3**.]

Then, $F_C = m_{test}\left(c^2 - {}^{2GM}\!/_{R}\right){}^{1}\!/_{R}$; where only a unit test mass is considered; gravitational constant G = 6.67×10^{-11} N·m^2/kg^2; M is the structure's mass (the x-axis variable); R is its spherical radius 10^4 meters. This serves as the linear function of the centrifugal force and mass (for sloping portion of **Figures 6**).