Force Strengths in our Universe, Material Densities and Bernoulli's Equation

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We note in our Universe vastly different strength forces, ranging from the strong nuclear forces to the weak gravitational. We theorize that in each case the material density involved determines the limiting steady force. Thus, nuclear forces are stronger than gravitational by a factor (38 powers of 10) because nuclear densities are roughly (38 powers of 10) times denser than the 'thin' aether in space! We assume that a great gas-like ethereal pressure exists to hold the spinning proton together, and we calculate it, [(*i.e.*, about 33 powers of 10 (n/m²)]. We postulate a 'spinning aether ball' with a circumference equal to the Bohr hydrogen atom, and with a spin angular momentum roughly equal to the proton's spin. From all that, we calculate aether's very low density, [about –20 powers of 10 (kg/m³)]. That is roughly equal to the vacuum in space between planets. That is, indeed, about (-38 powers of 10) less dense than a proton's nuclear density. We speculate that elementary particles wiggle at roughly the velocity of light. And that causes a moving Bernoulli equation-related 'aether-space constriction'; and suction to arise between them, (*i.e.*, Gravity)!

Preface

Somewhat 'conventionally accepted' values for the 'observable' Universe are: Total Mass $= 10^{52}$ kg; 'Universe' Radius $= 10^{26}$ m; Gravitation Constant $G = 6.67 \times 10^{-11}$ (mks); 'nuclear density' $= 2.3 \times 10^{17}$ kg/m². The total gravitational potential energy in the 'observable' Universe is vastly greater than the total calculable 'mc^2' in the 'observable' Universe, but not infinite as in many silly models of black holes. So, I urge anyone, who is skeptical of an aether, to consider the above, and thus what even 'conventional physics' implies: Consider the total 'gravitational potential energy' in our 'observable' Universe divided by total volume in our 'observable' Universe. (Let us even disregard the orbital kinetic energies and high temperatures of much of the mass that might otherwise prevent 'gravity' from bringing all of the masses together.) Let us even discard the speculative 'black holes' (as Einstein did); and simply estimate the gravitational potential energy that would be manifested if all the 'observable' mass of the Universe were brought together into one large 'neutron star'. (Or even into one extremely large star having the density of our Sun.) 'Modern physics' implies that there is an 'E/c^2' '**MASS** equivalence associated with that 'total **Gravitational Energy'. That total gravitational energy's equivalent MASS divided by the Universe's VOLUME** implies an average aether density, and it corresponds roughly to the aether density advocated in my paper. Or even considerably denser than in my paper! But even those densities would constitute a more rarefied vacuum than is producible in our laboratories on Earth!

Incidentally, the above mental exercise is a 'gravitational version' slightly similar to the electrostatic energy method of calculating the so-called 'classical radius of an electron', (or Bohr-electron orbit energies for the hydrogen atom), except that, for the case of total 'potential gravitational energy', more particles and a greater final concentration are involved.

1. Introduction

The pressure differences in simple, level, fluid flow in pipes can often be treated using the simplified Bernoulli's equation given in elementary textbooks [1]:

$$\begin{gathered} P_1 + 0.5\rho(v_1)^2 = P_2 + 0.5\rho(v_2)^2 \\ \text{or} \quad (P_1 - P_2) = 0.5\rho\left[(v_2)^2 - (v_1)^2\right] \end{gathered} \tag{1}$$

That motivates the following inquiry. Might there be, in our Universe, a class of related events that arises under the following conditions: The velocity v_2 is the highest possible, except limited by approximately the speed of light, $c = v_2$; and the velocity v_1 is nearly zero; for the maximum effect for each related case. (Thus, we consider a maximum speed, approximately 'c', to be imposed on vibrational and other motions of all elementary particles.) Let us assume that there exists an 'aether' in space, and that it generally exerts a maximum ultra high steady pressure, P_1. We initially imagine that P_1 results from the ultra high-speed motions of aether particles, and we will calculate P_1 later.

Under the above conditions, a 'reduced pressure region' might develop, with a 'suction pressure' equal to $P_1 - P_2$. That suction would then depend on (and be proportional to) only the density, _, of the substance in which the suction pressure develops. That suction would be generally less than P_1. A very strong nuclear 'suction' force could develop in nuclear matter of very high density, and so on, down to the very weak gravitational suction force developing in the ethereal matter, because of aether's very low density. We regard that aether density as existing in all non-trivial sized volumes of space, for example between separated elementary particles in space.

2. Conventional Treatment of the Proton and its Implications

A simple exercise in some introductory textbooks on nuclear physics is to calculate the density of a proton's nuclear material, given the proton's mass ($m_{\text{proton}} = 1.67 \times 10^{-27}$ kg), and its radius ($r = 1.2 \times 10^{-15}$ m), and with the tacit assumption that the proton is sphere-shaped and not hollow [2]. The 'standard' (accepted) result for its nuclear density is then:

$$(\rho_{\text{nuclear}}) = 2.3 \times 10^{17} \text{ kg/m}^3 \quad . \tag{2}$$

Such textbooks have even described the hypothesis that the electron spins about an axis "just like a top" [3]. According to experience and the 'wave mechanics' treatment for the spin of a proton, it is considered to spin with an angular momentum magnitude of $L = \sqrt{3}\,(h/4\pi)$ joule sec. Although the proton does not likely have uniform density nor well-defined surfaces, it still seems compelling, as an approximation, to calculate the angular velocity of rotation expected of such 'simplified' proton, that would give $L = (1.731)(h/4\pi)$. (For a 'solid sphere', the moment of inertia, I, is $(2/5)mR^2$. $L = I\omega$, and $v_{\text{equator}} = \omega R$, where ω is the rotational velocity in radians per sec.; R is the proton's radius, and v_{equator} is the velocity of a point on the proton's spinning 'equator'. Planck's constant is $h = 6.625 \times 10^{-34}$ joule sec.) Thus:

$$L = (1.731)h/4\pi = [I]\omega = [\tfrac{2}{5} mR^2\ ]\omega \quad .$$

And thus, approximately:

$$\omega \ = \ 0.949 \times 10^{23} \text{ radian/sec.} \quad , \tag{3A}$$

$$v_{\text{equator}} = 1.14 \times 10^{8} \text{ m/sec} \quad . \tag{3B}$$

The above leads to further compelling inquiries: Suppose the proton's interior is somewhat fluid-like. Let us calculate what centrifugal-related pressure that such proton's spin would generate against a rather narrow belt around the proton's equator. For a centrifuge, if r_o is the closest point of the spinning liquid to the centrifuge's spinning axis, and P_r is the pressure in the spinning liquid at any greater distance, r, from that axis; then $P_r = 0.5\rho\omega^2(r^2 - r_0^2)$ $P_r = 0.5$. For our case, r_o is assumed zero, and r is 1.2×10^{-15} m, so we get, approximately, the spinning proton's maximum 'centrifugal' Pressure:

$$P_{\max} = 1.50 \times 10^{33} \text{ n/m}^2 \tag{4a}$$

But suppose the spinning proton must be (and is) held together by the external pressure of an aether against it. Thus, suppose that the dogma of 'innate attractions' in material is a myth, and there are no 'attractive forces' in nature? Then the above (4A) also represents an estimate of aether's pressure in space, (and even then an estimate likely on the 'low end', somewhat). But we will use it here as an approximation, and see where it leads to. Thus the aether Pressure (in space) is:

$$P_{\text{aether}} = \ 1.50 \times 10^{33} \text{ n/m}^2 \quad . \tag{4b}$$

Let us, initially, treat the aether 'atmosphere' in space as somewhat like our own pressurized atmosphere near sea level. Let us approach it somewhat like an 'ideal gas', as described in elementary textbooks [4]. Using that and (4b), we deduce the approximation below:

$$\tfrac{1}{3}(\rho_{\text{aether}})(v_{\text{aether particle}})^2 = 1.50 \times 10^{33} \text{ n/m}^2 \quad . \tag{5}$$

3. Another Equation for Aether's Velocity, Density

Solving Eq. (5) relates ρ, v to aether pressure. Now we will develop a separate equation relating ρ, v to an angular momentum aether consideration. That will give us the two needed equations to solve for the two unknowns, ρ, v. As in the above, we keep in mind that what follows involves approximations and simplifications, and consequently are only estimates!

The old Bohr treatment for the hydrogen atom addresses the orbiting electron, including for the atom's lowest energy state. It implies that that electron's orbital angular momentum is $h/2\pi$. But, as previous mentioned, the proton and electron each will be treated as if they have a spin angular momentum magnitude of $1.731h/4\pi$, not $1h/2\pi$ or other value. Perhaps 'space', itself, helps to imbue spinning elementary particles with that value, $1.731h/4\pi$. But it seems puzzling as to how Planck's constant (h), in units of "angular momentum", arises at all!. And how nature keeps track of the very long orbital path of the electron, which is many magnitudes larger than the proton's size, and most electrons' size or small locality.

So let us stretch our imaginations. The following may explain how that 'h' (with angular momentum) arises, and how aether might maintain a 'perpetual gauge' on the electron's long orbital path and its angular momentum: Consider the spherical region of the hydrogen atom, slightly beyond the proton's nucleus and nearly up to orbiting electron. Perhaps that spherical region is filled with a 'ball of aether', which also spins around the proton with a magnitude of angular momentum equal of about $1.731h/4\pi$. Then we can write an equation for that, as follows:

$$\begin{aligned} L = [I]\omega = \left[\frac{2}{5}\{m\}\,R^2\right]\omega = \\ \left[\frac{2}{5}\{\rho_{\text{aether}}\,\frac{4}{3}\pi R^3\}\,R^2\right]\omega = 1.731\ h/4\pi \end{aligned} \quad . \tag{6}$$

This time, however, $R = R_{\text{atom}} = 0.53 \times 10^{-10}$ m, because that is approximately the region of our imagined spinning spherical aether ball, and we will disregard a supposed small error due to the proton's and electron's material displacement. Solving Eq. (6), we obtain:

$$\rho_{aether}\omega = 1.30\times 10^{17}\ (\mathrm{kg/m^3})(\mathrm{rad./s}) \qquad (7)$$

There are regions inside that spinning aether ball which may spin at different velocities, and perhaps not even expressible by a simple formula. However, let us focus here on the velocity, v, at the equator, at $R = 0.53\times 10^{-10}$ m, and estimate that that velocity is approximately given by: $v = \omega R$. We identify that v also with the v in (5) above. In effect, we assume that the velocities inside the spinning aether ball do not generally exceed that given in (5) above. ((We note that even in rare, exceptionally strong tornadoes (*i.e.*, also spinning events); no whirling air current seems to much exceed 500 mph {5]. That is about half the roughly 1160 mph velocity of typical molecules that make up our nearby atmosphere, and is also less than the typical 760 mph speed of sound, near sea level.)) Let us substitute for ω in (7) above; $\omega = v / R$, where $R = 0.53\times 10^{-10}$ m. Then Eq. (7) becomes:

$$\rho_{aether}v_{aether} = \ 6.89\times 10^{6}\ \mathrm{kg/m^2\ sec} \qquad (8)$$

Now, we can finally divide earlier Eq. (5) by the equation (8); and solve for the velocity of the aether particles, and then solve for aether density. The results are:

$$v_{aether} = 6.53\times 10^{26}\ \mathrm{m/sec} \quad . \qquad (9)$$

Then, by substituting Eq. (9) into Eq. (8), and solving for the aether density, we obtain:

$$(\rho_{aether}) = 1.06\times 10^{-20}\ \mathrm{kgm/m^3} \quad . \qquad (10)$$

4. Interesting Density Comparisons

To give the reader a feeling for our calculated aether density (1.06x10 $^{-20}$ kgm/cu. m.), let us compare that to standard estimates for the low material densities in space due to scattered molecular debris [6]:

Density in typical interplanetary space: 10^{-20} kgm/m³

Density in typical interstellar space: 10^{-21} kgm/m³

Density in typical intergalactic space: 10^{-28} kgm/m³

All those values, as well as our calculated aether density (1.06×10^{-20} kg/m³), are much better vacuums than are producible on our congested earth. (Regarding the intergalactic density listed above, there might be some inaccuracy if it is based on information and distances that would represent reality a billion years ago or so, instead of recently.)

Let us also ask: What would be the resulting 'spacial density' of our Sun's material, if it 'vaporized' and was uniformly scattered into a cubic box, extending from our solar system to its nearest star? (*i.e.*, "Alpha Centauri C", 4.3 light-years from our Sun.) Our Sun's mass is about 2×10^{30} kg and there are about 9.46×10^{15} meters in a light-year, so the resulting density would be:

$$\rho_{\text{spaced-out Sun}} = 3.0\times 10^{-20}\ \mathrm{kg/m^3} \quad .$$

Perhaps matter in the form of ethereal space is in a sort of equilibrium with matter in the form of elementary and other particles. That is a relevant thought; although not new nor originated by the present author.

5. Analysis and Comment

We note from (2) above, that the density of nuclear material is approximately 2.3×10^{17} kg/m³, and from (10) above, that our calculated density for ethereal density is 1.06×10^{-20} kg/m³. **The ratio of the nuclear density to our calculated ethereal density is about 2.17×10^{37}. That is within one magnitude, but on the low side, of the empirical ratio (10^{38}) as appears in conventional physics textbooks for 'nuclear force to gravitational force'** [7]. (This article might be predicting a slightly higher gravity than is manifested, perhaps because there is some geometric-related inefficiently in the gravitational mechanism, preventing the full 'Bernoulli-related' optimum result. Or, perhaps, because of some imprecise estimations and assumptions we made. Some might have affected our calculation either way.)

Let us anticipate and discuss just one of several questions that this article may raise. One notes from (9) above, that our calculated velocity of an aether particle is about 10^{18} times faster than the speed of light, c. So how can we treat aether as "supporting gravitational events within the class of events where velocities are supposed to limited by $v = c$?" The likely answer is that the net (resultant) velocity of vast numbers of aether particles is nearly zero. (Similarly, a nearly zero resultant occurs from the canceling motions of many molecules in our own atmosphere.) However, Einstein's famous equation, $E = mc^2$, seems to imply that elementary particles and other significant entities are likely vibrating, shaking, or wiggling with a velocity of an order of magnitude c; which may give them their mc^2 worth of energy. If, say, two elementary particles are so vibrating or wiggling, with respect to each other, that may cause there to develop a dynamic 'Bernoulli-related' space constriction. (An airplane wing may receive lift either if air is blown across its wing or if the wing moves through the air, i.e., in either case.) Therefore, a reduced pressure region may develop between significant particles, such as elementary particles, in the aether, and thus a relative 'attraction' occur.

'Electrostatics' likely involves a compression wave or radial motion, and at velocities far exceeding 'the speed of light'. Therefore, its description and understanding is not within the paradigm of this paper, which is "transverse flow not exceeding light's velocity and Bernoulli's equation' applications." Pardon my use of the pronoun, ' I ', as **I** now refer any interested reader to the section, **"Optional Comments:** Electrodynamics" at the end of my paper. I put it there, because my 'electrodynamics' comments are very speculative, and perhaps not of general interest.

6. Conclusions

The forces in our Universe are also subtle, complex, and not rigorously analyzed solely by simple strength comparison under a few circumstances. The simple 'model', as outlined above, does not derive all the many details and complexities of the varied forces in our Universe. It does, however, suggest some major considerations that may combine synergistically, and may contribute fundamentally to understanding some important aspects of different forces in our Universe. Those considerations include: An ultra high aether pressure, a low aether density, the different density materials in our Universe, Bernoulli's equation or a somewhat similar action, and approximately the speed of light as a limitation on the motions of elementary particles.

Perhaps just as important, this article has presented considerations and calculations, (2 through 10), which are very naturalistically compelling to contemplate, but too often avoided. They would have very likely been widely presented much earlier, had the leading 19th Century aether advocates been fortunate enough to live into the 20th Century to about 1921, to note "Stern-Gerlach's experimental results", regarding spin [8]. (Or perhaps even earlier—up to about 1913, by which time Einstein, Rutherford, and Bohr had made their contributions relevant to this article.) The concept of a 'ball of aether', as used in this article, may seem a little unusual; but it is not the first time that the use of abstract spheres has led to interesting ratios [9]. Also, I continues to actually believe that the Universe is infinite; and that there is aether of great pressure, great energy, and low density, in all regions of space (i.e., in all volumes that are larger than 'trivial' in size). And that even though that aether is of very low density, it still has some 'mass per volume' [10].