Future Work

The primary deficiency of the unified theory of physics is the lack of proof that the neutrino structure envisioned here is stable. The stability question hinges mostly upon the behavior of the brutinos at the central core of the neutrinos. There is no question that the brutinos can move toward the center approaching a sphere with a diameter at which the flow speed equals the critical speed for a converging nozzle. Also, there is no question that the flow can have the required angular momentum. Finally, there is no question that the assemblage can translate at the required velocity IF (and that's a big if) the structure inside the critical speed sphere is as envisioned in this theory and produces the anticipated thrust.

To our knowledge the behavior of this type flow inside the critical speed sphere (of a converging nozzle with a half angle of 180º) has not been reported in the literature. What we are considering here is the flow into a sink where critical speed (i.e., sonic speed) is reached at a distance approximately equal to the mean free path. The mean free path for the gas considered here is extremely large (compared to the diameter). The mean free path to diameter ratio is 10^{14} (or so) times the mean free path to diameter ratio for air at standard conditions.

The flow we envision inside the critical-speed sphere requires that the gas particles coming into the sphere become aligned with each other (i.e., the thermal, or fluctuation, velocity must be completely eliminated) so that the gas particles can all touch each other to effectively form a compactly packed group of particles. We call this a complete condensation of the gas.

We believe the complete condensation involves a thermal separation process which commonly occurs, but which has not been identified in the technical literature on gas behavior. The basic mechanism of this thermal separation process occurs when a flowing gas takes a curved path. The curved path flow may result from such things as solid surfaces guiding the flows as in vortex tubes or may be from the chance fluctuations in a gas essentially at rest.

When any gas experiences a curved path flow the higher speed particles (where speed for the individual particle is the flow speed combined with the fluctuation, or thermal, speed) are more difficult to turn than the slower speed particles. As a result there is a tendency for the higher speed particles to move radially outward from the center of curvature and for the lower speed particles to move inward toward the center of curvature. As such a separation is occurring the curvature is accentuated since the higher total speed particles may have a higher flow speed than the lower total speed particles. This phenomenon is believed to be a fundamental part of the following commonly observed situations:

1. Vortex tubes
2. Tornadoes and "dust devils"
3. Hurricanes
4. Turbulence in general

In the neutrino before the flow reaches the critical speed sphere the flow producing the angular momentum may result in some thermal separation and possibly assist in condensing the gas. However, the primary condensation mechanism occurs inside the critical speed sphere whose radius is on the order of the gas mean free path. When (and if) the complete condensation occurs the gas particles all, of necessity, must be aligned to flow in the same direction and, by necessity, they are accelerated. The flow velocity which is the background mean speed increases by almost 10 percent of the background rms speed. This linearly accelerated flow gives further impetus to the alignment of the particles inside the mean free path diameter sphere.

With all this foregoing qualitative description, how can we go about this problem in a rigorous manner? This is no trivial question. We're asking how can we prove that an inhomogeneous state of a gas can be stable for eons (10^{10} years) where the gas consists only of perfectly elastic particles which interact only by a repulsive force when they collide. The existence of such a state is a counter example of the second law of thermodynamics – the state is a "violation of the second law." The second law problem has been worked ad-infinitum for over a century – without success. Scientists generally feel that everything has been tried – without success. We have identified two new concepts which, to our knowledge, have not been investigated. Do high speed particles migrate outward from the center of curvature and do low speed particles migrate inward toward the center of curvature when gas flows in a curved path? And further, what is the global effect on the gas if, and when, this occurs. The second concept which also, to our knowledge, has not been investigated is what is the behavior of a mean-free-path diameter spherical "kernel" into which a gas flows as into a "spherical sink" and out of which the same amount of gas flows through an extremely small area. We now propose an experiment and discuss the analyses we have used and those which might be used to examine this question.

The "defining" experiment which we propose is now described. Take a large thin-walled sphere with a diameter of 1 to 5 meters. Drill a number of small radial holes through the surface at equally spaced intervals across the area. Twenty equally spaced centers are easy to located since they can be located at the center of the triangles of an enveloping dodecahedron. Plug these holes with valves. Begin with the sphere immersed in air at standard conditions. At this condition the mean free path of the air is $6\times10^{-8}\,m$.

What we need now is a flow rate which can be selectively controlled for all the inlet holes to simulate motion of the neutrino through the gas and which will form a solid core whose output can be measured. The following paragraphs present the "sizing" analysis for this proposed experiment. The principal parameter for determining the sizing is the ambient pressure (and thus density).

The relation between the mean free path d_m and the core diameter d_c is given by flow continuity. The mean speed of air molecules at standard conditions is taken as $470\,m/s$, and this is the velocity taken at the mean free path distance from the core as well as at the core. Thus, we have the relation

$$\rho_m\left(\pi d_m{}^2/4\right)470=\rho_c\left(\pi d_c{}^2/4\right)470$$

or

$$\rho_m d_m{}^2=\rho_c d_c{}^2$$

The core density is the density of frozen air which is taken as $6000\,kg/m^3$ $\left(\approx 400\,lb/ft^3\right)$. Using $d_m = 6\times10^{-8}m$ (for standard air) and $\rho_m = 1.0\;kg/m^3$ (again, for standard air) we have

$$d_c = d_m\sqrt{\rho_m/\rho_c} = 6\times10^{-8}\sqrt{1/6000} = 7.7\times10^{-10}\;m$$

This produces an extremely small solid exiting stream (a stream of approximately 50 atoms cross section). Such a small stream would not exit the sphere, and the inlet flow rate could not be controlled to the required accuracy. The flow rate is

$$\dot{m} = \rho A\mathrm{v} = 6000\left(\pi 7.7^2\times10^{-20}/4\right)470 = 1.3\times10^{-12}\;kg/s$$

As the ambient pressure is reduced the flow rate increases and, of course, the mean free path increases. With a 1.2 meter diameter sphere (which we have available) the maximum mean free path we can use is about 0.1 *m*. The basis of this limitation is that the flow through the inlet holes of the sphere must diffuse tangentially to produce a uniform inward flow as the center is approached. Using $d_m = 0.1$ and using the mean free path equation we have

$$d_m = \frac{1}{\sqrt{2}\pi d_a{}^2\eta} = \frac{1}{\sqrt{2}\pi d_a{}^2\left(\rho/m_a\right)}$$

Where η is the particle number density, d_a is the air molecule diameter $\left(\text{taken as } 10^{-10}m\right)$, ρ is the ambient density, and m_a is the air molecule mass $\left(\text{taken as } 16\times1.6\times10^{-27}kg\right)$. Solving now for ρ gives

$$\rho = \left(16\times1.6\times10^{-27}\right)/\left[\sqrt{2}\pi\times10^{-20}\times0.1\right]$$
$$= 1.8\times10^{-5}\;kg/m^3$$

This is approximately 10^{-5} atmospheres – and is easy to produce and maintain. For these conditions the flow rate is

$$\dot{m} = \rho A\mathrm{v} = 1.8\times10^{-5}\left(\pi 0.1^2/4\right)470 = 6.6\times10^{-5}kg/s$$

The core diameter is given by

$$6.6\times10^{-5} = 6000\left(\pi d_c{}^2/4\right)470$$

or

$$d_c = \left(0.3\times10^{-10}\right)^{1/2} = 0.55\times10^{-5}\,m$$

The number of particles required to fill a cross section of this stream is given by

$$\frac{\pi d_c^{\,2}}{4} = N\frac{\pi\left(10^{-10}\right)^2}{4} \text{ or } N = \left(\frac{d_c}{10^{-10}}\right)^2 = 0.3\times10^{10} \approx 10^9$$

Such a stream (with one billion molecules cross section) would be easily detected and should be maintained as it traveled to the tank surface. The stream would encounter N_e molecules where N_e is given by

$$N_e = \int \frac{\rho}{m_a}\frac{\pi d_c^{\,2}}{4}dr$$

where ρ is the local (variable) density. Since ρA is a constant

$$\rho = \rho_c\left(\frac{r_c}{r}\right)^2$$

where r_c is the core radius. Now

$$N_e = \int_{r_c}^{r_m}\frac{\rho_c r_c^{\,2}}{m_a r^2}\frac{\pi}{4}d_c^{\,2}dr = \frac{\pi}{4}\frac{\rho_c}{m_a}r_c^{\,2}d_c^{\,2}\left(\frac{1}{r_c}-\frac{1}{r_m}\right)$$

$$\approx \frac{\pi}{4}\frac{\rho_c}{m_a}\left(\frac{d_c}{2}\right)^3 = \frac{\pi}{8}\frac{6000}{16\times1.6\times10^{-27}}\left(0.55\times10^{-5}\right)^3$$

$$= 1.5\times10^{13} \text{ molecules}$$

The number of molecules, N_s, making up the stream is

$$N_s = 10^9 \times \frac{d_{sphere}/2}{d_{air}} = \frac{10^9\times(1.2/2)}{10^{-10}} = 6\times10^{18}$$

or 400,000 times as many as impinge upon the stream.

Let us return to the mass inflow rate $\left(6.6\times10^{-5}\,kg/\sec\right)$. We note that this is $6.6\times10^{-5}\times2.2 = 1.5\times10^{-4}\,lb/sec = 1.5\times10^{-4}/(0.07) = 2.1\times10^{-3}\,ft^3/sec$ of standard air. Such a flow rate probably can be metered. It would be necessary to supply the air to a manifold and let it then enter the holes in the sphere. If we used (say) 200 inlet holes then it would be necessary for the manifolding to be such that the pressure outside the sphere would be very uniform. If so, then the relative flow rates through the individual holes can be effectively controlled simply by proportioning the hole diameters (almost independent of the actual hole sizes).

We optimistically hope that this experiment would produce the stream of frozen air and thus prove the neutrino mechanism envisioned is possible. Incidentally the outlet stream , of course, would have to be at the very bottom of the sphere so that the frozen air would be pulled out by gravity.

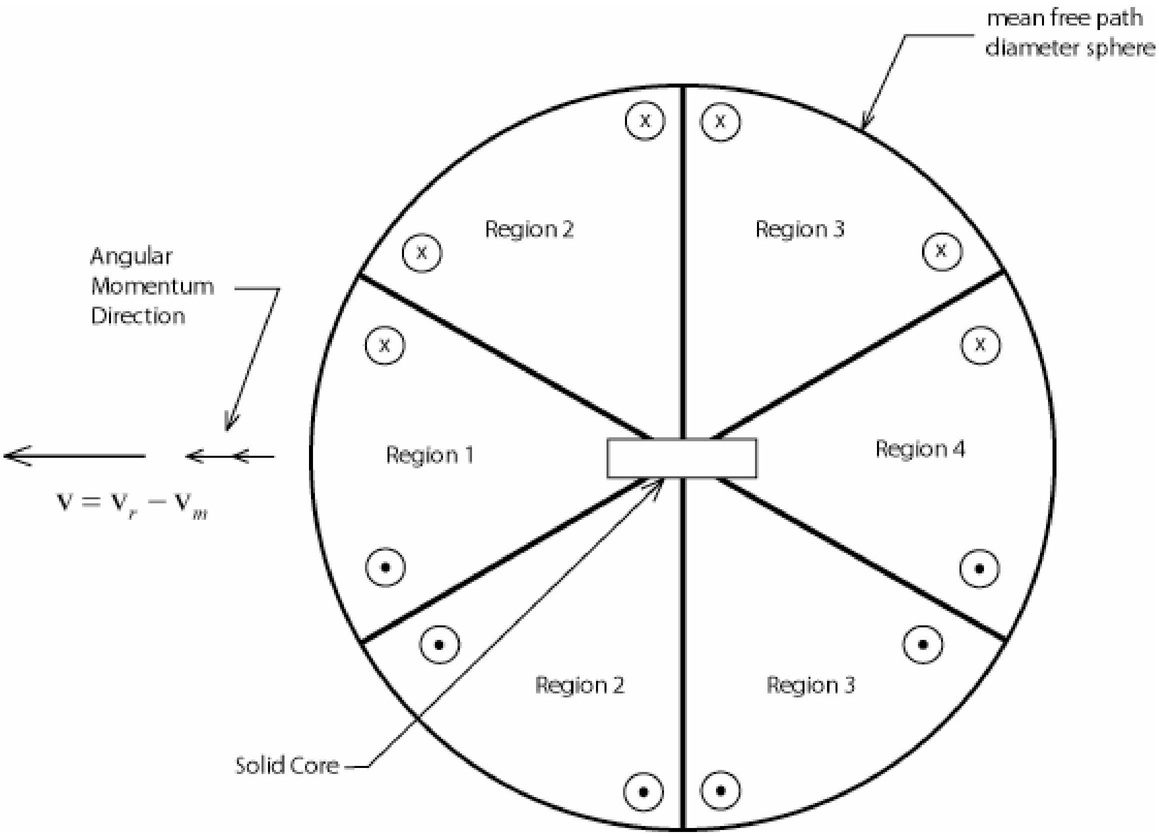
Let us now discuss analytical approaches to the problem. We begin with approximate analyses and end with the ultimate analysis.

For the simplest approach we consider the problem in three regions: Flow ending at the mean free path sphere surrounding the core, the flow from the mean free path diameter sphere to the solid core, and the flow in the solid core.

For the flow outside the mean free path diameter sphere, we assume that the ideal gas equation of state $\left(p = (1/3)\,\rho \mathrm{v}_r^{\,2} \right)$ is valid. The flow then is modeled first as a simple sink inflow with a prescribed sink strength. We superimpose upon this a rotational flow at the surface of the mean free path sphere which is a tangential flow rate directly proportional to the radius measured from the translational axis. Upon these flows we add a translational flow of magnitude $\mathrm{v}_r - \mathrm{v}_m$, where v_r and v_m are the *rms* and mean speeds of the background gas. The concept here is that the mean free path diameter sphere translates at the speed $\mathrm{v}_r - \mathrm{v}_m$.

Next, we model the core as we have done on pages 6 and 7 of Brown [1]. Basically this consists of an input of brutinos all aligned and moving in the same sense but not touching each other and thus having a small spread of velocities. This assemblage is then squeezed together and thrusted along its side (to conserve linear momentum) while conserving mass and energy. This model results in the core being accelerated from a velocity of v_m to the *rms* value.

The final stage of this approximate analysis is for the region between the mean free path diameter sphere and the core. We will still assume that the ideal equation of state is maintained but that the temperature varies (possibly linearly with radius) from the outer sphere at the critical temperature to zero at the core. We will divide the region into four subregions that are volumes formed by revolving areas about the translational axes as shown below, see the figure.



The input to the four regions are as dictated from the outer region boundary, and the output is dictated by the inflow to the core (and the equation of state is as suggested above). For example at the upper left corner of region 1 there is a radial flow and a tangential flow. This flow must circle around and turn forward to be parallel, and in the same sense, of "v" as it travels inward. Significant deficiencies of this analysis will be the lack of balancing shears at the common region boundaries and the assumed equation of state.

One improvement to the three-region analysis (outside the critical speed sphere, inside the sphere and outside the core, and the core itself are the three regions) can be made by assuming that centrifugal forces act individually on the brutinos flowing in a curved path and produces a thermal velocity which varies linearly with the flow radius of curvature. We have accomplished this type of analysis for certain types of flow. This type of improvement could be made in the flow outside the mean free path diameter sphere as well as for the intermediate region.

The ultimate suggested analysis of this problem considers individual brutinos so that an equation of state is not utilized. In this analysis we would take our very best guess at the densities, flow velocities, and thermal velocities then produce a set of initial velocities and locations of particles to match this initial guess. We then would follow the behavior of this assemblage as new brutinos came in from the background and exited from the region of solid flow. Hopefully this flow would migrate to a stable inhomogeneous configuration corresponding to a neutrino – and not to the homogeneous state. Such an analysis would require near the maximum computer power available in the

United States – if not exceed the available power. Nonetheless, we feel that obtaining a solution to this problem would warrant significant effort.

There are a number of other problems of great importance requiring solution in the area of this physical theory. The one of utmost practical impact is to model the strong nuclear force. The basic ingredients are all available in Brown [1]. Accurate modeling would give theoretical computations of the currently measured energies of interactions. Further, an accurate model would show whether or not cold fusion were possible and, if possible, would show how to accomplish it. There are a number of problems of lesser importance which needed to be solved. For example, the actual mechanism of charge polarity needs to be elucidated.

Let us now direct our attention to the "language" area of this unified science theory. We have shown, in principle, what to start with and how to build language. We also have shown the foundations of mathematics and physics. What needs to be done with "language foundations" is to identify more precisely the starting words for language and then develop the definitions more carefully for all the words used in the complete encyclopedia of science. Also, an improved set of books making up the encyclopedia should be written which would more efficiently and precisely lead to the last book *The Grand Unified Theory of Physics*.

We need language and mathematical philosophers to study and improve these "rough" foundations. We would like for research to be done and teaching material proposed on language to see if this approach will aid learning foreign languages as well as aid a child learning the native language.

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Reference

1. *The Grand Unified Theory of Physics* by Joseph M. Brown. ISBN 097129446-1 Basic Research Press, Starkville, MS, 2004.