New Developments: The Big Bang - in Controversy

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Theory Behind the Big Bang

Einstein published his Theory of General Relativity (GR) in 1916. Soon after, Georges Lemaitre, Wilhelm de Sitter, and Alexsandr Friedmann investigated different theoretical models for the evolution of the universe. One class of potential solutions to Einstein's equations allowed for the possibility that the universe was expanding (or contracting). Einstein dismissed this possibility (as had all other scientists before him) because there was no evidence that the universe was in motion; the universe was, at that time, believed to be static.

The flavor of some of these ideas has been summarized from a website on a *fractal* theory of the universe. It begins, “10 March 2007 - From New Scientist Magazine by Amanda Gefter: “This idea that matter is spread more or less ***evenly*** throughout the universe is embodied in Einstein's Cosmological Principle. Einstein formulated it after publishing his general theory of relativity, which describes how the distribution of mass bends space-time and creates gravity. It allows cosmologists to use the equations of general relativity to describe the geometry of the whole universe. As a result it has led to a picture of a universe expanding *uniformly* in a *center-less* manner from the Big Bang, and in which cosmological measurements have defined meanings.”

“Recall that Einstein's fiendishly complex equations of gravity *can be solved exactly* only if we assume that the Universe on the large-scale is ***homogeneous*** - that is, it looks the same from every place. This assumption, enshrined in the Cosmological Principle, leads to the Friedman-Robertson-Walker solutions: the Big Bang models. Abandon that assumption and everything we thought we knew about the Universe gets ***jettisoned***, as New Scientist has pointed out (21 August 1999, p 22).”

Experimental Evidence on Galaxy Distributions

A series of measurements known as Deep Pencil Surveys has been done in the past decades by a team of astronomers generally headed by Broadhurst and Koo [1-7]. A pencil is a narrow cone ~40 arc minutes in diameter, which gives a manageable few thousand galaxies to count and measure their redshifts over a depth of about 4 billion light years. A cartoon illustrating their measurement results is shown below.

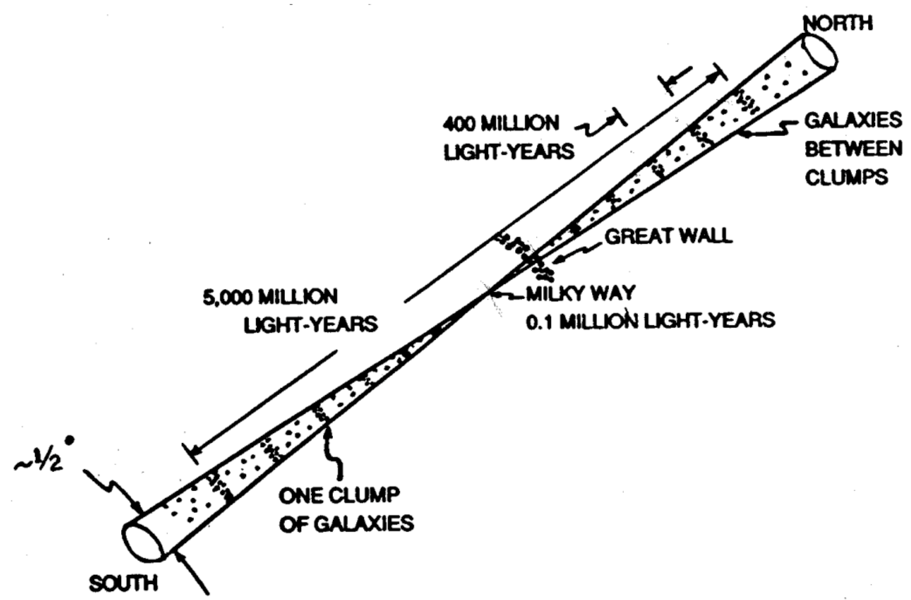


Figure 1. Cartoon of experimental setup where dots in cone represent galaxies. Note that the first clump of galaxies to the North Galactic Pole is due to the intersection of our observing cone with the Great Wall.

The general conclusion is that all of the surveys are ***highly correlated***, have the ***same*** periodicity and hence have a ***common*** source. Furthermore, the data ***can only be*** consistent with a ***spherical*** distribution of galaxies emanating from an origin about 70 million light years from Earth in the general direction of Virgo [8]. *The universe is **not expanding** at all, but the galaxies are each moving in space in a **radial direction** away from the **origin**!*

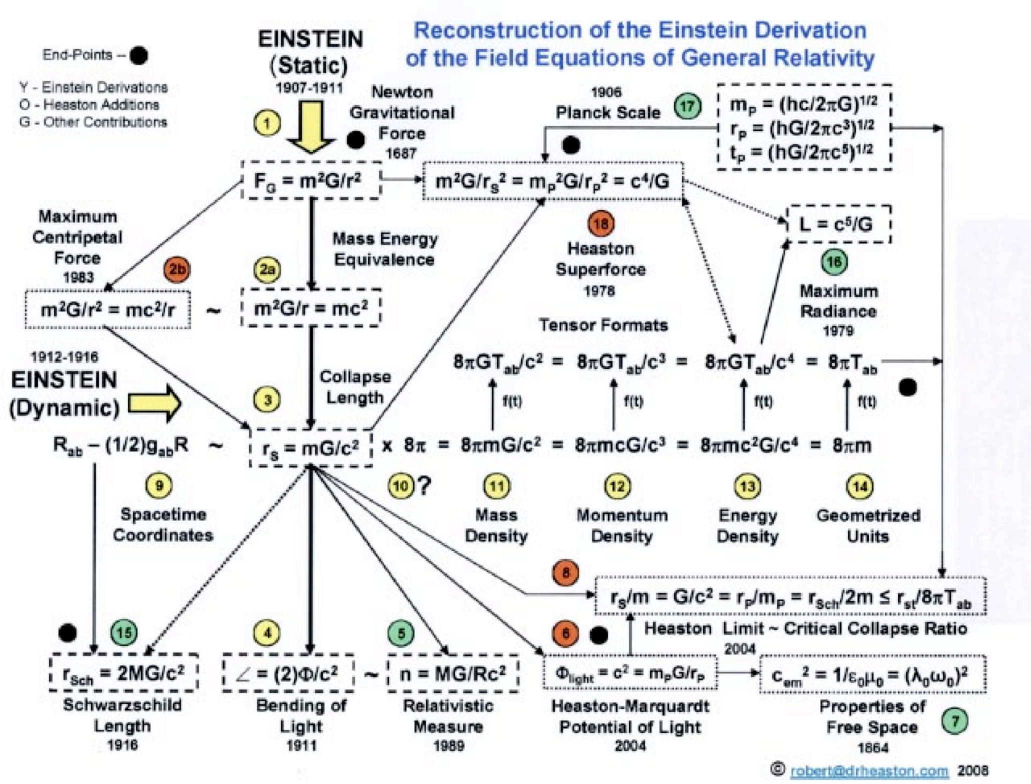
From the entire Sloan Survey [9], the actual density is decreasing as $1/r^2$. The above result ***violates*** the ***primary assumption*** of GR as applied to the Big Bang, namely that the universe is homogeneous with constant density! The observed spherical pattern of galaxies ***violates*** the conclusion that the expansion is ***uniform and center-less***, because it is ***clearly spherical*** from an ***origin*** near Virgo! And ***nowhere*** in any of the proposed alternative theories is ***periodicity*** predicted! Hence, the motion of the universe <u>***does not correspond to any of the GR solutions.***</u>

NewTheoretical Results: Heaston

Beginning in about 1975, Bob Heaston spent his spare time as a Theoretical Physicist, trying to make sense of Modern Physics as it pertained to General Relativity and the Standard Model of particles. Until his death in early 2009, he took the time to read extensively in the literature, and to try to understand what the famous theoretical physicists were doing with old and new concepts. He was especially interested in the interconnections between various constants of physics, including critical points, lengths, times and forces. He explored the various fundamental magnitudes in physics, numerical coincidences and bounds. He was especially interested in the unification of the four forces, which he defined differently from the standard definition as the Heaston Equations [10].

In a 2008 summary paper [11], which was somewhat misleadingly entitled, “A Third Alternative to the Generation of Energy by Fission and Fusion”, he described his analysis of the 10 year history of Einstein’s derivation of General Relativity (GR). In effect, Bob followed various pathways that Einstein followed, or could have followed to get to the answers Einstein was trying to derive.

Einstein used his Equivalence Principle [12] to equate Gravitational Potential Energy to Rest Mass Energy, which is similar to the definition of the Classical Radius of the Electron. Heaston said, *“Set the Potential Energy of the Newton Gravitational Force equal to the Mass-Energy Equivalent in Step 2a.” (Einstein implied this Step at the end of his 1907 Yearbook article).* However, if Einstein had followed Newton in using the Maximum Centripetal Force for a mass circling a similar mass at the speed of light, he would have obtained the same GR template in a different way. Heaston said *“If it is assumed that the Newton Gravitational Force is a <u>Maximum</u> for the case of Centripetal Force of an object rotating at the speed of light, the Result is Step 2b.” (from Heaston’s Early Efforts, 1983).* These steps are shown in the chart below, along with the consequences of following the steps to four of the end points. Einstein’s first phase, or “static stage”, is indicated vertically as Steps 1, 2a, 3 and 4, which covered 1907 to 1911. The “dynamic stage”, as given in steps 9-14 indicated horizontally, was done from 1912 to 1916.



The End Points of the Einstein Field Equations according to Heaston are:

1. Collapse of matter into energy with **zero** space-time curvature that corresponds with a massless Minkowski space-time. (Steps 2a, 2b, 3, 5 and 8)
2. Convergence upon Newtonian conditions at low masses, low velocities, large separations and **negligible** space-time curvature. (Step 1)
3. Convergence upon the Planck scale at a superforce and the **large** space-time curvature of a trapped surface beneath the Schwarzschild event horizon of a black hole. (Steps, 13, 15, 17, and 18)
4. Convergence on a singularity with **infinite** space-time curvature based upon geometrized units of c = G = k = h/2π = 1. (Step 14)

When Einstein then switched to geometrized units by setting c = 1 and G = 1, he managed to ***introduce a singularity***into the solution of General Relativity by means of an asymptote. Heaston said [13], *"The assumption of geometrized units is why the Einstein field equations collapse to a singularity (so the usual singularity theorems apply). When c = G = 1 in step 14, the Heaston superforce is equal to unity and the field equations are rationalized and can converge to a singularity because of an asymptote".* In effect, Einstein ignored the fact that c enters into the equations with different powers, and the effect is that he set the Heaston

Superforce , c4G=1.21 x 1044 N, to unity. If that step was not taken, the GR template, which Heaston referred to as the critical collapse ratio, would have given the expression,

η= mGrc2 ≤1 , (1)

where η=1 is the Heaston Limit where mass must undergo a phase change to energy. Bob kindly acknowledged [13] that I was the one who suggested this terminology for the maximum mass that can be squeezed into a given radius before something has to happen. On this scale, a neutron star begins at η≥0.3, and a black hole begins at η≥0.5, which corresponds to the Schwartzschild length. By this terminology, the mass inside a black hole has a finite radius which lies within the event horizon where light cannot escape the black hole, but where gravity obviously does escape. This in turn implies that a black hole is composed of neutrons that have been crushed in some way to make them denser than ordinary nuclear matter, but that they have not actually entirely disappeared.

New Theoretical Results: Crothers

1) Mass Problems According to Einstein, matter is the cause of the gravitational field and causative matter is described in his theory by a mathematical object called the energy-momentum tensor, which is coupled to geometry (i.e. space-time) by his field equations, so that matter causes space-time curvature (his gravitational field). Einstein's field equations "... *couple the gravitational field (contained in the curvature of space-time) with its sources* [14]." Qualitatively his field equations are:

Space-time geometry = -κ times matter,

where matter is described by the energy-momentum tensor and κ is a constant. The space-time geometry is described by a mathematical object called Einstein's tensor, $G_{\mu\nu}$, (μ, ν = 0, 1, 2, 3) and the energy-momentum tensor is $T_{\mu\nu}$. So Einstein's full field equations are:

$$G_{\mu\nu} = -\kappa T_{\mu\nu} \quad (2)$$

Now Einstein and his followers assert that the gravitational field "outside" a mass contains no matter. In other words they assert that there is only one mass within the whole Universe with this particular problem statement. In eq. (2) they then set the energy-momentum tensor to zero. But this means that that there is no matter present by which the gravitational field can be caused! Nonetheless, it is so claimed that mass is there, and it is also claimed that the field equations then reduce to the much simpler form [15, 16],

$$Ric = R_{\mu\nu} = 0. \quad (3)$$

$Ric = R_{\mu\nu}$ is called the Ricci tensor. So this is actually a statement that space-time is devoid of matter. Since this is a space-time that *by definition* contains no matter, Einstein's 'Principle of Equivalence' and his laws of Special Relativity cannot manifest, thus violating the physical requirements of the gravitational field that Einstein himself laid down. Despite the claims made for *Ric* = 0, it therefore fails to describe Einstein's gravitational field. Consequently, one cannot get a black hole from *Ric* = 0.

Einstein's field equations cannot reduce to *Ric* = 0 when $T_{\mu\nu} = 0$. Consequently Einstein's field equations must take the form,

$$G_{\mu\nu} / \kappa + T_{\mu\nu} = 0. \quad (4)$$

This is an identity. The $G_{\mu\nu} / \kappa$ are the components of a gravitational energy tensor. Thus the total energy of Einstein's gravitational field is always zero; the $G_{\mu\nu} / \kappa$ and the $T_{\mu\nu}$ *must each vanish identically*; gravitational energy cannot be localized (i.e. there are no Einstein gravitational waves) ; and Einstein's gravitational field violates the usual conservation of energy and momentum, putting it into direct conflict with the experimental evidence.

It was early pointed out to Einstein by a number of his contemporaries that his General Theory violated conservation of energy and momentum. So Einstein, to save his General Theory, invented his pseudo-tensor, which he said "*expresses the law of conservation of momentum and of energy for the gravitational field* [17]." First, it is not a tensor, and therefore not in keeping with his theory that all equations be tensor in nature. Second, he concocted his pseudo-tensor in such a way that it behaves like a tensor in only one particular situation, that in which he could contrive gravitational waves with speed *c*. Einstein (and his followers) did not realize that this is in fact just a meaningless concoction of mathematical symbols. The technical reason is this: Einstein's pseudo-tensor implies the existence of what is called by the pure mathematicians, a 1st-order intrinsic differential invariant which depends only upon the components of the metric tensor and their 1st-derivatives. But the pure mathematicians G. Ricci-Curbastro (after whom $Ric = R_{\mu\nu}$ is named) and T. Levi-Civita [15, 18] proved in 1900 that such invariants **do not exist**!

2) Schwarzschild's Solution It is reported almost invariably in the literature that Schwarzschild's solution for $Ric = R_{\mu\nu} = 0$ (using $c = 1$, $G = 1$) is,

$$ds^2 = \left(1 - \frac{2m}{r}\right)dt^2 - \left(1 - \frac{2m}{r}\right)^{-1} dr^2 - r^2\left(d\theta^2 + \sin\theta^2 d\phi^2\right), \quad (5)$$

$$0 \le r < \infty,$$

wherein it is asserted by inspection that *r* can go down to zero in some way, producing an infinitely dense point-mass singularity there, with an event horizon at the 'Schwarzschild radius' at $r = 2m$: a black hole. Thus, there are ***two*** singularities alleged. Contrast this metric with that actually obtained by K. Schwarzschild in 1915 (published January 1916),

$$ds^2 = \left(1 - \frac{\alpha}{R}\right)dt^2 - \left(1 - \frac{\alpha}{R}\right)^{-1} dR^2 - R^2\left(d\theta^2 + \sin\theta^2 d\phi^2\right), \qquad (6)$$
$$R = R(r) = \left(r^3 + \alpha^3\right)^{1/3}, \qquad 0 < r < \infty,$$

wherein α is an undetermined constant. There is only ***one*** singularity in Schwarzschild's solution, at $r = 0$, to which his solution is constructed. Contrary to the usual claims made by the astrophysical scientists, Schwarzschild did not set $\alpha = 2m$ where m is mass; he did not allege the so-called 'Schwarzschild radius'; he did not claim that there is an 'event horizon' (by any other name); and his solution clearly forbids a singular black hole because when Schwarzschild's $r = 0$, his $R = \alpha$, and so there is no possibility for his R to be less than α, let alone take the value $R = 0$. All this can be easily verified by simply reading Schwarzschild's original paper [19], in which he constructs his solution so that the singularity occurs at the "origin" of coordinates. Thus, eq. (5) for $0 < r < 2m$ is inconsistent with Schwarzschild's true solution, eq. (6). It is also inconsistent with the intrinsic geometry of the line-element, whereas eq. (6) is geometrically consistent, as demonstrated herein. Thus, eq. (5) is meaningless for $0 \leq r < 2m$.

In the usual interpretation of Hilbert's version, eq. (5), of Schwarzschild's solution, the quantity r therein has never been properly identified. It has been variously and vaguely called a "*distance*", "*the radius*", the "*radius of a 2-sphere*", the "*coordinate radius*", the "*radial coordinate*", the "*radial space coordinate*", the "*areal radius*", the "*reduced circumference*", and even "*a gauge choice: it defines the coordinate r*". In the particular case of $r = 2m = 2GM/c^2$, it is almost invariably referred to as the "*Schwarzschild radius*" or the "*gravitational radius*". However, none of these various and vague concepts of what r is are correct because the irrefutable geometrical fact is that r, in the spatial section of Hilbert's version of the Schwarzschild/Droste line-element, is the inverse square root of the Gaussian curvature of a spherically symmetric geodesic surface in the spatial section [20], and as such it **does not** of itself determine the geodesic radial distance from the centre of spherical symmetry located at an arbitrary point in the related pseudo-Riemannian metric manifold. It does not of itself determine any distance at all in the spherically symmetric metric manifold. It is the radius of Gaussian curvature merely by virtue of its formal geometric relationship to the Gaussian curvature. It must also be emphasized that any geometry is completely determined by the **form** of its line-element [21].

Since r in eq. (5) can be replaced by any analytic function $R_c(r)$ without disturbing spherical symmetry and without violation of the field equations, $R_{\mu\nu} = 0$ (which is very easily verified), and satisfaction of the field equations is a ***necessary but insufficient condition*** for a solution for Einstein's static vacuum 'gravitational' field. Moreover, the admissible form of $R_c(r)$ must be determined in such a way that an infinite number of equivalent metrics is generated thereby. In addition, the identification of the center of spherical symmetry, origin of coordinates and the properties of points must also be clarified in relation to the non-Euclidean geometry of Einstein's gravitational field. In relation to eq. (5) it has been routinely presumed that geometric points in the spatial section (which is non-Euclidean) must have the very same properties of points in the spatial section (Euclidean) of Minkowski space-time. However, it is easily proven that the non-Euclidean geometric points in the spatial section of Schwarzschild space-time do not possess the same characteristics as the Euclidean geometric points in the spatial section of Minkowski space-time [20, 22]. This should not be surprising, since the indefinite metric of Einstein's Theory of Relativity admits of other geometrical oddities, such as null vectors, i.e. non-zero vectors that have zero magnitude and which are orthogonal to themselves [14].

3) Geometry Problems The fundamental geometrical error in the genesis of the black hole is very simple, yet it has gone unrecognized by the physicists. Consider a circle of radius $r > 0$ in the *x-y* plane. Let the center of the circle coincide with the origin of the *x-y* coordinate system. The intrinsic geometry of the circle is independent of where it is located in the *x-y* plane. Now if we move the circle to some other place in the *x-y* plane the center of the circle goes with it. It is meaningless to suggest that although the circle has been shifted to some other place in the *x-y* plane that its center remains at the origin of the *x-y* coordinate system. One can do the same with a sphere in *x-y-z* space. If a sphere of radius $r > 0$ is initially located so that its centre is at the origin of the *x-y-z* coordinate system (i.e. at $x = 0$, $y = 0$, $z = 0$), when it is shifted to some other place in the *x-y-z* coordinate system, its center is shifted with it.

The error in the black hole geometry is essentially this: a sphere is unwittingly shifted by the mathematical gymnastics associated with the so-called 'Schwarzschild solution', from its initial center at the origin of a parametric coordinate system to a center somewhere else in the parametric coordinate system. Then, oblivious to this shift, it is thought that the parametric center of the sphere is **still** at the origin of the parametric coordinate system, at $r = 0$, when in fact it is not. With this misconception, the physicists think that they have to get down to $r = 0$ to locate their mass there, and so devise a complicated method to do so, creating thereby their point-mass singularity at parametric $r = 0$, and event horizon at the parametric 'Schwarzschild radius', when in fact the center of their sphere is at a point at a parametric distance from the parametric origin at $r = 0$ given by the value of their 'Schwarzschild radius'.

So their 'Schwarzschild radius' is not a radius at all, but a parametric point at the center of a sphere in a parametric coordinate system. They then think that this point denotes an event horizon, because it is some 'distance' from $r = 0$. They think their sphere is centered where their point-mass `singularity' is located. The parametric nature of their quantity '*r*' is also unrecognized. This involves what mathematicians call a 'mapping', and so in the `Schwarzschild solution' the quantity '*r*' plays a somewhat different role, strictly related to Gaussian curvature. In the parametric space, '*r*' plays a dual role - it is both a radial distance and the inverse square root of the Gaussian curvature, because the parametric space is Euclidean. But the 'Schwarzschild space' of $Ric = 0$ is non-Euclidean, and so ***Euclidean relations do not hold there***.

Conclusions

The Heaston Limit is a Major Discovery, which came out of a reconstruction of Einstein's derivation of General Relativity on the Physics side of the equations [23]. Some consequences of

the Heaston Limit are:

1. No Big Bang Singularity, and hence no Big Bang that corresponds to a General Relativity solution. Galaxy distribution data are inconsistent with the Big Bang by being spherically symmetric, periodic and decreasing in density from the origin[9];
2. No Inflation or String Theory, because there is no need to have a process that begins with a singularity and then takes it to a finite realm and creates actual particles;
3. Black Holes are Finite, and contain real mass inside the event horizon;
4. No Hawking Miniature Black Holes, because black holes are massive;

Crothers' arguments [24] are based upon the nature of the mathematics used in General Relativity and the physical principles of the theory. He demonstrates that the tensor equations of space-time alleged for a one-body problem do not actually contain mass, because of a violatoin of the nature of the energy-momentum tensor. He demonstrates that Schwarzschild derived a ***different*** equation than the equation that is attributed to him, which has a single singularity rather than two singularities. And, he demonstrates that the conditions applied to the equations that are usually used to represent the problem involve violation of the intrinsic geometry of the metric and so are invalid. Consequently, the claim that General Relativity predicts black holes and Big Bang are in fact false.

To summarize: the Sloan Survey of galaxy distributions is ***inconsistent*** with the General Relativity-based Big Bang model; Einstein made an ***error*** using geometrized variables, by setting c = 1 and G = 1, that led directly to the Big Bang singularity, which does not occur otherwise; Schwarzschild's actual solution contains a singularity at r = 0, but nowhere else; Einstein's field equations violate the usual conservation of energy and momentum and are therefore in direct conflict with the experimental evidence.

References

1) T.J. Broadhurst, R.S. Ellis and T. Shanks, Mon. Not. Roy. Astro. Soc. **235**, p827, 1988.
2) D. C. Koo, R. G. Kron, D. Nanni, D. Travese and A. Vignato, Astrophy J. **333**, p586, 1988.
3) T.J. Broadhurst, R.S. Ellis, D.C. Koo and A.S. Szalay, "Large Scale Distribution of Galaxies at the Galactic Poles", **Nature**, Vol. **343**, 22 Feb, 1990, pp 726-728.
4) T.J. Broadhurst, R.S. Ellis, D.C. Koo and A.S. Szalay, in proceedings Digital Optical Sky Surveys, 1991.
5) D.C. Koo, J.A. Munn, R.G. Kron and A.S. Szalay, Astrophys. J., 1992.
6) J.A. Munn, D.C. Koo, R.G. Kron, S.R. Majewski, M.A. Bershady and J.J. Smetanka, "The Kitt Peak Galaxy Redshift Survey (KPGRS) with Multicolor

Photometry; Basic Data", **ApJSupp**, Vol. **108**, 1992.
7) D.C. Koo, N. Ellman, R.G. Kron, J.A. Munn, A.S. Szalay, T.J. Broadhurst, and R.S. Ellis, "Deep Pencil-Beam Redshift Surveys as Probes of Large Scale Structures", Astronomical Society of the Pacific, Conference Series, Vol. **51**, 1993, and S.R. Majewski, class notes, Department of Astronomy, University of Virginia, March 1996.
8) R. A. Rydin, "Cross Correlation of Deep Redshift Galactic Pencil Survey Data", Proceedings of the Natural Philosophy Alliance International Conference, June 9 - 13, 2003 at the University of Connecticut, Storrs, CT, in **Journal of New Energy**, Vol. 7, No. 3, pp. 139-143, 2003.
9) R. A. Rydin, "Experimental Evidence that the Density of the Universe is Not Constant", Proceedings of the 13th NPA International Conference, April 3 - 7, 2006, at the University of Tulsa, Tulsa, OK, Vol. 3, No 2, pp. 246-249, 2006.
10) R. J. Heaston, "Predictions of the Heaston Equations and the 21st Century Physics Paradigm", 15th Annual Conference of the NPA, 7 – 11 April, 2008, at the University of New Mexico, Albuquerque, Vol. 5, No 1, pp. 93 – 99, 2008.
11) R. J. Heaston, " A Third Alternative to the Generation of Energy by Fission and Fusion", 15th Annual Conference of the NPA, 7 – 11 April, 2008, at the University of New Mexico, Albuquerque, Vol. 5, No 1, pp. 85 – 92, 2008.
12) R. J. Heaston, "Why Did Einstein Put So Much Emphasis on the Equivalence Principle?", 15th Annual Conference of the NPA, 7 – 11 April, 2008, at the University of New Mexico, Albuquerque, Vol. 5, No 1, pp. 105 – 109, 2008.
13) R. J. Heaston, "Reconstruction of the Derivation of the Einstein Field Equations of General Relativity", 14th Annual Conference of the NPA, 21 – 25 May 2007, at the University of Connecticut at Storrs, Vol. 4, No 1, pp. 73 – 82, 2007.
14) J. Foster, J. D. Nightingale, A Short Course in General Relativity, Springer-Verlag, New York, Inc., 1995.
15) T. Levi-Civita, "Mechanics. - On the Analytical Expression that must be given to the Gravitational Tensor in Einstein's Theory." www.sjcrothers.plasmaresources.com/Levi-Civita.pdf, 1999 translation of a 1900 paper.
16) H. A. Lorentz, *Versl. gewone Vergad. Akad. Amst.*, 25, 468 and 1380, (1916).
17) A. Einstein, "The Foundation of the General Theory of Relativity", Annalen der Physik, 49, 1916, and, The Principle of Relativity (A collection of original memoirs on the special and general theory of relativity), Dover Publications Inc., New York, 1952.
18) T. Levi-Civita, The Absolute Differential Calculus, Dover Publications Inc., New York, 1977.
19) K. Schwarzschild, "On the Gravitational Field of a Mass Point According to Einstein's Theory", Sitzungsber. Preuss. Akad. Wiss., Phys. Math. Kl., 189, 1916, www.sjcrothers.plasmaresources.com/schwarzschild.pdf
20) S. J. Crothers, "On the Geometry of the General Solution for the Vacuum Field of the Point-mass", Progress in Physics, Vol. 2, pp 3–14, 2005, www.ptep-online.com/index files/2005/PP-02-01.PDF
21) R.C. Tolman, Relativity Thermodynamics and Cosmology, Dover Publications Inc., New York, 1987.
22) M. Brillouin, "The Singular Points of Einstein's Universe", Journ. Phys. Radium, v. 23, 43, 1923, www.sjcrothers.plasmaresources.com/brillouin.pdf

23) R. A. Rydin, “Some of Bob Heaston’s Influential Thoughts That Affected Modern Physics”, 16th Annual Conference of the NPA, 25 – 29 May 2009, at the University of Connecticut at Storrs, Vol. 6, to be published, 2009.
24) S. J. Crothers, “The Schwarzschild Solution and its Implications for Gravitational Waves”, 16th Annual Conference of the NPA, 25 – 29 May 2009, at the University of Connecticut at Storrs, Vol. 6, to be published, 2009.