

The Metaphysical and Ontological Symbolism of Total Gravitational Collapse (... in the Grand Unification Framework of GUT embracing STR, GTR and the Quantum Principle ...)

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ABSTRACT

Having laid a firm foundation in SPACETIME for a detailed analysis of total gravitational collapse, by linking Einstein's Special Theory of Relativity (STR) to the General Theory (GTR) in the context of the Quantum Principle and within the all-embracing framework of GUT (the Grande Unification Theory), we proceed with an investigation of the total gravitational collapse of the Universe all the way into the Central Singularity. We propose that with the crushing of all matter in the Universe into a central singularity of zero volume and infinite density, in fact, "a yet unknown theoretical entity", this theoretical entity is indeed nothing else but 'spirit/consciousness', with all its possible ramifications thereof, ontological and transcendental ...

Key Words: Relativity (STR & GTR) - Quantum principle - GUT - SPACETIME - Total gravitational collapse - Central singularity - Spirit/ Consciousness

1. INTRODUCTION

Before we begin to grapple with questions involving the whole of the Universe, as it were, we must first indeed understand something of the behaviour of stars. We may thus conceive Gravitation itself as having to do with the birth of stars, because it is in fact through *gravitational attraction* that hydrogen atoms come together in space, eventually to such densities and pressures that great heat is generated, thermonuclear burning begins and a star "turns on", as it were, and we say, "*a star is born*"! Thus hydrogen is converted into helium, helium into carbon, carbon into heavier elements by a roundabout process. In fact, all the atoms in our bodies have come through such stellar furnaces, now long banked; the mysterious process called life had indeed merely rearranged the atoms into molecules, cells, fibres, proteins and so forth (Wheeler 1972; Haubold 1998).

Gravitation also has to do with the death of stars, because its relentless contractive force indeed continues even long after the thermonuclear flares of the fusion process in stars have died down. Thus, "White Dwarf", "Neutron Star", "Pulsar" ..., are all names for dead or dying stars, in the language of the Astrophysicist or Astronomer alike. A "Black Hole" thus indeed refers to *the ultimate annihilation: total gravitational collapse to oblivion*. How may we then characterize a Black Hole; for indeed of all the conceptions of the human mind throughout the ages of scientific inquiry, Black Holes are possibly indeed one of the most fantastic and bizarre! We may thus characterize Black Holes in a preliminary way, as being neither bodies of matter as such, nor are they radiation. Put in simple

language, we may refer to Black Holes as "clots of gravity" (Novikov 1998). And how do we come about such extravagantly dense clots of gravity? In answering this important question, let us indeed go back to the picture which various notable Astrophysicists and Cosmologists, Martin J. Rees, Chandrasekhar, Philip Morrison, Virginia Trimble and P.N. Okeke, amongst others, have given us through time, as follows.

Introducing the Schwarzschild Black Hole or Metric

A Black Hole will indeed form when a given quantity of matter is squeezed inside what is now known as its Schwarzschild radius, giving us what is known as "a Schwarzschild Metric or Black Hole", whose equation is given by:

$$dr^2 = \left(1 - \frac{2GM}{c^2 r}\right) dt^2 - \frac{dr^2}{\left(1 - \frac{2GM}{c^2 r}\right)} + r^2 d\mu^2 + \sin^2 \mu d\Lambda^2$$

Thus for a mass equal to the solar mass for example, the Schwarzschild radius, R_s has the value $R_s = 2.5$ km, where the symbols have their usual meanings ...

Thus, one way in which a Schwarzschild Black Hole may form is when, for example, a massive star, at the end of its life, collapses, as it were, under its own gravitational attraction. It is thus important to note that if when such a collapse begins, the final mass of the star, (known as the *core remnant*), exceeds THREE solar masses, (the limit may in fact be less than this; [Iyer 1982], then, so far as we know at this point in time, there is indeed *no known force* in nature that can bring to a halt the indefinite and inexorable collapse of the material

of that star. In other words such a gravitational collapse will continue until *all* of the star's material is compressed into a mathematically abstract point known as a "singularity".

And what are the rather unusual properties of such a mathematically abstract point? Simply bizarre - *infinite mass and zero volume*, as postulated by Einstein's theory of General Relativity. In such a singularity therefore matter is *infinitely compressed to infinite density by infinitely powerful gravitational forces*. Put differently, we find that *the SPACE-TIME Curvature is infinitely great at the singularity*. Thus, to put it rather mildly, We note in passing however that infinite forces and densities are not phenomena that present-day physics can cope with comfortably, if at all; the laws of nature as we understand them in present-day physics *simply break down*, apparently, at a singularity, which leads us briefly into the labyrinths of scientific and philosophical ruminations, as we shall see shortly hereafter, with a view to pointing in the direction of a possible escape route, if not actually finding a way out of the scientific and philosophical impasse or dilemma...

Thus, as for the original matter which made up the star to start with, it appears that it is apparently crushed completely, *simply vanishing into nothingness*, as it were, and thus giving greater boost to the philosophical thoughts and ruminations mentioned earlier...

2.0 The Metaphysical and Ontological Properties of SPACETIME Revisited

(... with relativistic perspectives from STR and GTR, and the linking of both theories in an all embracing Grand Unification Theory (GUT))

Since Black Holes are indeed the result of total gravitational collapse in space and time according to the classical notions of Laplace, who first conceived of them indeed in terms of the classical gravitational laws of Newton, it is indeed necessary to review what metaphysical and ontological changes have taken place in our fundamental notions of time and space since that period, especially in the last century... Thus it is important to note that classical physics is founded on certain fundamental principles, namely, *the absoluteness of the spatio-temporal localizations and universal determinism*. The picture that classical physics thus gives is that of "an objective world", which can in fact be described *in its completeness* and defined independently of the observer. Thus difficulties and problems left in suspense as it were, by this science did not in any way shake the trust in its principles, which were considered capable of *overcoming all difficulties, and solving all problems*.

Thus, the most important innovations in our concept of space and time are linked with the name of Albert Einstein,

who with the introduction of the time-factor to complete the classical three dimensional notion or picture of space, the outmoded classical (3-D) concept of space is thus superseded by *the new four-dimensional SPACE-TIME of Relativity Theory*, both special and General. In fact, this introduction of time has indeed modified the classical concept of *space as a "place" having objective properties*; the geometry of space has become in fact, a geometry of time, or, to put it differently, space has been *closely bound up with time*, just as, reciprocally, *time has indeed become intricately bound up with space*. Thus, according to the Theory of Relativity, SPACE-TIME are indeed not absolute, *but relative to the reference system*, and they change with the changing of the *velocity in the world of the observer*. Thus, in other words, the measurements and laws judged by us as *absolute* are *valid* for our world *because of its motion*, but indeed are not so for other worlds whose motion (speed and direction) differs from ours; thus they have *no absoluteness whatever*. In short, the phenomenon being observed cannot be regarded *independently* of the observer; that is, the phenomenon cannot in fact be determined in an *absolute sense, but only by way of hypothesis*...

What is more, the classical principle of Relativity held the spatio-temporal intervals to be *constant*; Relativity, instead, holds *simultaneity, distance, velocity and time to be relative*. When the reference systems are different, the measurement of spatial distances, and of temporal intervals *within a reference system*, does not, in fact, *coincide* with the measurement *in other reference frames*. Thus, for example, the space measured by an observer *at rest* differs from that measured by an observer *in motion*. Similarly, two events being *simultaneous* for one observer are, in fact, *successive* for another; hence arises the IMPOSSIBILITY of an absolute spatio-temporal determination of a reference point that is unique and absolute. In other words, TIME and SPACE are indeed not independent of each other, but are *conditioned* reciprocally, that is inextricably and intimately bound up with each other in a new 4-dimensional, *spatio-temporal continuum* in which any phenomenon is hereafter to be determined relativistically, as mentioned above.

2.1 THE LINKING OF THE GENERAL THEORY OF RELATIVITY (GTR) WITH THE SPECIAL THEORY OF RELATIVITY (STR) (by the Equivalence of INERTIAL AND GRAVITATIONAL MASS...)

The ground for the General Theory of Relativity, as for the Special Theory, was indeed prepared by preceding research. It was in fact a logical development of the Special Theory of Relativity, in which the work of Minkowski played an important role ... Thus, General relativity arose through the extension of *the Principle of Relativity* to the GRAVITATIONAL FIELD. What is more, the development of the General Theory of

Relativity, was thus a consequence of the generalization of experimental facts already known, such as *the equivalence of inertial and gravitational mass*. This important equivalence had in fact been discovered quite a long time before, during the study of the properties of gravitation, in connection with which Einstein stressed that

in contrast to electric and magnetic fields, the gravitational field exhibits a most remarkable property, which is of *fundamental importance* for what follows. Bodies which are moving under the *sole influence* of a gravitational field receive an acceleration, which does not in the least, depend either on the material or the physical state of the body ... (Einstein 1947)

Thus, the theoretical generalization of these observations led Einstein to establish *the principle of equivalence*. It is thus important to note that while the Special Theory of Relativity arose from a study of the properties of the electromagnetic field, which followed from *the constancy of the velocity of the propagation of light*, creation of the General Theory was stimulated by *the discovery of the fact of the equivalence of inertial and gravitational mass*. In fact, it followed from the Special Theory that if the inertial mass of a body increased in proportion to the increase in its velocity, its gravitational mass, consequently, should also increase by virtue of the equivalence of inertial and gravitational mass. But this last conclusion could not indeed be explained within the framework of the special theory. A way of escape out of the limitations of the Special Theory was required; in other words, *a new and broader theory was needed*. As Einstein noted:

... that Special Theory of Relativity is *only the first step of a necessary* development became completely clear to me only in my efforts to represent gravitation in the framework of this (special) theory (Einstein, 1949)

Further, Einstein drew attention to *the limited character* of the Principle of Relativity developed by him in the Special Theory in connection with the description of electromagnetic processes. We recall that this Principle affirmed that there were no preferred systems among ones moving uniformly in a straight line, and they were all equivalent as regards formulation of the laws of mechanics and electrodynamics. The Principle of Relativity of the Special Theory, Einstein concluded, thus held only in so-called inertial systems. But in actual fact, we note that other systems also existed that were, for example, in accelerated, slow-speed, circular and rotational motion.

The question thus arises naturally; was the principle valid for systems of this kind also? To cut a long story short, we note that in these so-called NON-INERTIAL SYSTEMS, we necessarily perceived phenomena of the acceleration or slowing down of the moving body ... It thus finally dawned on Einstein that these perceptions were not necessarily connected with changes in the velocity of the system; in fact, they could be the consequence of the action of gravitational forces! Einstein thus came to his momentous conclusion, that from the fact of the equality of inertial and gravitational mass, all processes occurred in a uniform gravitational field in the same way as in a space in which there was no gravitation, but which had AN EQUIVALENT FIELD OF INERTIAL FORCES, generated by UNIFORMLY ACCELERATED MOTION. The indistinguishability of the effects of INERTIA and GRAVITATION thus suggested that an inertial system with a uniform gravitational field was, in fact, PHYSICALLY EQUIVALENT TO A CERTAIN NON-INERTIAL SYSTEM. And that already gave sufficient grounds for extending the Principle of Relativity to non-inertial systems, thus firmly linking the Special Theory to the General Theory of Relativity, which was thus founded and built up from the fundamental equivalence of inertial and Gravitational mass. As Einstein clearly commented:

The fact of the equality of inert and heavy mass thus leads quite naturally to the recognition that the basic demand of the Special Theory of Relativity (the invariance of the laws under Lorentz-transformation) is (indeed) too narrow, i.e. that an invariance of the laws must be postulated also relative to NON-LINEAR TRANSFORMATION of the co-ordinates in the four-dimensional continuum (of SPACETIME) (Einstein 1949).

Thus, in summary, we note that by means of the General Principle of Relativity, according to which all frames of reference, including non-inertial ones, are EQUIVALENT as regards the description of nature, Einstein passed, in his General Theory of Relativity to yet another form of field-matter, namely "gravitation" itself. Thus, by means of some simple "gedanken experiments", Einstein was also able to investigate the phenomenon of a body moving uniformly in a straight line in Galilean space (without a field of gravitation) and relative to a Galilean body of reference K. What is the course of such a motion RELATIVE TO A BODY OF REFERENCE K', moving with ACCELERATION RELATIVE TO BODY K? Thus, as Einstein discovered in answer to this important question, the body moving uniformly in a straight line relative to K is (indeed) moving with ACCELERATION and, generally speaking, CURVILINEARLY relative to K'. What is more, the magnitudes of the acceleration and curvature quantitatively represent the influence that the gravitational field, existing relative to

the body of reference K' EXERTS ON THE MOVING BODY. It is thus important to note that the influence of the gravitational field on the motion of bodies had indeed previously been known, of course, *but THE FUNDAMENTAL NEW RESULT connected with the General Theory of Relativity was that GRAVITATION (also) ACTED ON ELECTROMAGNETIC RADIATION (!):* "... in general, rays of light are (indeed) propagated curvilinearly in gravitational fields ..." (Einstein 1949). It is thus important to note that this theoretical conclusion was of interest to Einstein in two respects: firstly, it could be *tested* experimentally. Thus by Einstein's calculations, *the bending of rays of light in the sun's gravitational field would be 1.07 seconds of arc.* This phenomenon could in fact be OBSERVED during A TOTAL ECLIPSE of the sun; it would thus seem to us that stars NEAR the sun were shifted by that amount IN RELATION TO THEIR REAL POSITION. Thus, to summarise, this effect that Einstein's *Theory of General relativity predicted was indeed confirmed by British scientists with a high degree of accuracy during the eclipse of the sun in 1919. That very date was indeed the beginning of the triumph of the Theory of relativity, both General and Special...*

Secondly, it is thus important to note the fact of the bending of the trajectory of a ray of light in a gravitational field was indeed evidence that the law of the CONSTANCY of the velocity of light IN VACUO, which was one of the main and fundamental principles of the Special Theory of Relativity, *had a RELATIVE CHARACTER.* It, in fact, *compels us to ponder over the limits of the application of the Special Theory.* Thus, we conclude, for now that the sphere of its operation, like that of the operation of classical mechanics (and all other physical theories), was *indeed limited to a certain framework.* As Einstein himself wrote:

we can only conclude that the Special Theory of Relativity cannot (indeed) claim an unlimited domain of validity; its results hold only so long as we are able to disregard the influences of gravitational fields on the phenomena (of the propagation of light) ... (Einstein 1949)

Thus in response to this question of a linkage between STR and GTR, Einstein in fact (strongly) *objected* many times to opponents who tried to present matters in such a way that the Special Theory of Relativity was refuted by the General Theory, (and that there was in fact *no connecting thread* between his (Einstein's) theory and those of preceding physics. In that connection, Einstein pointed out, for example, that *the link between* the two theories (STR and GTR) in fact came out within the limits of the action of

Earth's gravitational field. As Einstein explained:

For an infinitely small area, the co-ordinates can always be so taken that no gravitational field exists in it. The Special Theory of Relativity may then be presumed to be valid for such an infinitely small area. In that way the General Theory of Relativity will *always be linked* with the Special Theory and the results of the latter can (thus) be made applicable to the former (Einstein, A., 1947)

3.0 THE QUANTUM PRINCIPLE COMES TO THE RESCUE

With the Special Theory of relativity (STR) now properly linked with the General Theory of Relativity (GTR), it is important to note that this brings us a step closer indeed to having a *VIALE UNIFIED FIELD THEORY that will accommodate not only GTR and STR, as discussed above, but also the Micro-World of the Quantum Theory as given us and explicated by Heisenberg, Dirac and others ...*

3.1 THE TWO OVERARCHING PRINCIPLES OF MODERN PHYSICS RECONCILED?

We note, in summary, that the two overarching Principles of Modern Physics, General relativity and Quantum Theory also have to be accommodated in a viable Unified Field Theory, which as popularly espoused, is a theory which will ultimately unite *all the known fundamental forces* of the Universe - *strong electromagnetic, weak and gravitational* - in a *GRAND UNIFICATION THEORY, fondly known as GUT,* the quest for which, initiated essentially by Einstein himself, has indeed tempted and occupied physicists for most of the preceding century, and continues into the present ...

Thus GENERAL RELATIVITY, (or to use a more descriptive word, GEOMETRODYNAMICS), fitting into GUT

indeed conceives of space itself "AS A DYNAMIC ENTITY, *changing with TIME, influencing and being influenced by MASS,* in the same way that particles and electromagnetic waves are dynamic entities" (Wheeler, 1972).

And, what is more, ANY DYNAMIC SYSTEM that has been investigated *in sufficient detail,* has indeed been governed by THE QUANTUM PRINCIPLE, which says, (to put it briefly and succinctly) that *we can NEVER predict deterministically - that is, WITH COMPLETE PRECISION - how a system will change in the future,* because in order to predict deterministically *how a system will change,* we have to know two things: *WHAT THE SYSTEM IS DOING RIGHT NOW AND HOW FAST IT IS CHANGING.* But the QUANTUM PRINCIPLE says you cannot indeed KNOW BOTH SIMULTANEOUSLY; and we have no reason whatsoever to believe as Wheeler reminds us, that there is

ANY EXCEPTION for SPACE as A NEW DYNAMICAL FEATURE OF NATURE. As Wheeler so emphatically posits:

... no principle that we know of in all physics has the same *Universal power* as the quantum principle. The more we pursue it, the more it looks as if it is (indeed) *the number one principle*, and that everything else is, in some way we don't yet understand, derived from it (Wheeler, 1972).

And thus (in maintaining the HARMONY between STR and the Quantum Theory (within a GUT setting), what can be said about (the validity of) the Principle of the constancy of the speed of light, a fundamental Principle (and pillar) of the Special Theory of Relativity (STR) as mentioned earlier? What is more, what can indeed be similarly said also about "THE REST MASS" (and ENERGY) of "a stationary body", in which *both position and momentum (or time and energy) would seem to be simultaneously known*, in seeming violation of the Quantum Principle? Can these also in fact, be really accommodated in the overarching schema of the Grand Unification Theory (GUT), embracing (as we would love to have it) both STR, GTR and the Quantum Principle of the micro-world, as earlier mentioned?

In answer to the important questions posed above, we note that Einstein has, in fact, in his inimitable *manner*, given us clues to viable answers to the above metaphysical and ontological mysteries, as follows:

We note, in passing, that in Einstein's now famous and historic formula, $E = mc^2$, the natural connection of *mass and energy*, following from the Special Theory of Relativity is not only made explicit for the *first* time in the annals of science, but also is its *enormous importance for science and practice*, dramatically highlighted - unfortunately, from the humane viewpoint *by the catastrophic events of "Hiroshima" and "Nagasaki"* amongst other things. Further, we recall the fact that, according to STR, the *mass* of a body indeed increases with an increase in its velocity. Thus, Einstein proffers some help with the problem of a comfortable and acceptable accommodation within the overarching *Grand Unification Theory* (GUT) itself by the proposition that, *if the ACCRETION TO THE MASS OF A MOVING BODY WAS DUE TO ITS KINETIC ENERGY, THE MASS PROPER OF A STATIONARY BODY WAS (INDEED) CONNECTED WITH AN ENERGY WHICH, HOWEVER THOUGH HIDDEN FROM US, WAS "THE INTERNAL ENERGY" OF THE BODY. Thus, for a "STATIONARY BODY", its energy, far from being, like its displacement, also ZERO (in stark violation of the Quantum Principle), must indeed be determined quantum mechanically!*

As for the constancy of the speed of light in the Special Theory of Relativity (STR) Einstein indeed took pains to

remind us that *the first demand on any theory was that it should indeed not contradict* experience. Unlike Poincaré (1954) who, in his dogmatic slumber, stuck to his mistaken belief that "geometry" (including even Einstein's geometrodynamics of GTR fame) cannot indeed be said to be "true", (but) *only "advantageous"* (Gribunov, 1987); that is, *a mere convention at that*, Einstein saw no sense in a science which is *not indeed a (true) reflection of objective reality* in theory. As Einstein himself took pains to explain:

... without the belief that it is (indeed) possible to *grasp the reality with our theoretical construction*, without the belief in the *INNER HARMONY of our world*, *there could be NO SCIENCE*. This belief is, *and always will remain*, the *FUNDAMENTAL MOTIVE for all creation ...* (Einstein 1972)

Thus, to continue on the question of the constancy of the speed of light, Einstein has in fact already given us the clue to a valid answer, in his bold and innovative explication of the General Theory of Relativity, as noted earlier. To recall Einstein's own very words on this matter, the *fundamentally new result in his explication of GTR was that*: "... in general, rays of light are (indeed) propagated curvilinearly in gravitational fields .. (Einstein 1949). Thus, this fact, (gleaned from the General Theory of Relativity (GTR), as mentioned earlier) of the BENDING of the TRAJECTORY of a ray of light (i.e. photons) *in a gravitational field* had in fact led Einstein to conclude that the Special Theory of Relativity, founded as it was on the premise of the constancy of the speed of light (in vacuo) had a *LIMITED DOMAIN OF APPLICABILITY*, *its results holding only as long as we are able to DISREGARD the influences of gravitational fields on the phenomenon of the propagation of light* (Einstein 1972).

In summary therefore, we may rightly come to the understanding that Einstein's Theory of Relativity as a whole (STR and GTR) thus demonstrated not only *the inseparable connection of MATTER* (in all its *ramifications* - substance and field -) and *MOTION*, but also from a *purely physical point of view revealed the role that the discovery of field matter (in particular) and its properties* played in the development of physical science. What is more, it indeed not only *linked the two material spheres of the objective world, substance and field*, as such *physically*, but also, through that linkage, expressed previously unknown properties of SPACE and TIME, (or, to use the proper relativistic idiom), previously unknown SPACETIME properties... of matter.

Thus, as for the Special Theory of Relativity (STR) itself, Einstein considered that, from a FORMAL point of view,

it (STR) has (indeed) generally shown *the role* which the Universal constant, c (the velocity of light in

vacuo) *plays* in the laws of nature, and has demonstrated that there exists (indeed) a close CONNECTION between the form in which time on the one hand and the spatial co-ordinates on the other, enter into the laws of nature (Einstein 1954).

We now *finally turn to the very core* of Total Gravitational Collapse into "the Central Singularity" of the Black Hole, and, of great importance, to what is *revealed*, metaphysically and ontologically of the *nature* and *properties* of this previously indecipherable region of "unknown theoretical entities", where our conventional (and orthodox) scientific knowledge was (purportedly) taken to have come to an end, (a dead end, indeed) as follows.

4.0 Total Gravitational Collapse Revisited (... with a focus on the fundamental symbolism of collapse into the Central Singularity)

Wheeler indeed points the way forward, when, in commenting on the Black Hole phenomenon, (especially in the paradoxes and intrinsically contradictory perceptions (as we shall see shortly hereafter) by the various observers, *inside and outside the Black Hole*, he suggested that we look at this structure and events through "*other windows*" than Einstein's original point of entry. ... thus, to put it in Wheeler's characteristically vibrant and visionary words,

If collapse is the most *startling prediction* that physics has ever made, it is also true that General Relativity (except for the Quantum Principle) is *the strangest edifice* that physics has ever reared (!). Therefore, it is (indeed) appropriate to look into this structure from *windows* other than Einstein's original point of entry, aiming especially in the latter derivations to enlarge one's view of what collapse is and what it means... (Wheeler 1972)

It is therefore upon this process of enlarging our views that we are now embarked, as follows ...

4.1 Where Our Present Knowledge Ends (...i.e in a "dead end" (?) in the Central Singularity ...)

In thus taking another look at the Black Hole scenario, it is quite important to note that, once a Black Hole has formed, as described earlier, it is indeed crucially significant, for the *completion* of our knowledge, to reflect on *what really happens to the matter that went into making it, in the first instance*. We recall that Einstein's Theory of General Relativity (GTR), (indeed the best theory that we have at

the present for studying the SPACETIME of our Universe), *predicts* the fact that such matter will keep collapsing gravitationally until it is reduced, in the Central Singularity, to ZERO VOLUME and, because it still has mass, INFINITE DENSITY. (It is thus indeed that we have the scientific caption for the end-point of runaway and total gravitational collapse, that is, a Central Singularity of "Zero Volume and Infinite Density"). Thus, matter has apparently and literally squeezed itself so small that it indeed occupies *NO SPACE AT ALL*, and yet, *IT IS STILL THERE*, in *SOME yet UNKNOWN SENSE, FORM or THE OTHER*, that is, apparently *AS A YET UNKNOWN THEORETICAL ENTITY ...!*

And where paradoxes abound, we begin to perceive the fraying edges and limitations of our much-vaunted scientific knowledge! In fact, as the Astrophysicists and cosmologists *unabashedly inform us*, (and as we ourselves are prone to see for ourselves in the inexorable logic of General Relativity, *this indeed is where our present knowledge ends, in the Central Singularity of Total Gravitational Collapse!* (Rees, 1994).

Thus to see more clearly the nature of the metaphysical and ontological limitation of our knowledge as given us by even our very best theoretical tool, General Theory of Relativity (GTR) itself, we refer to the *gedanken experiment*, given us by noted astrophysicists and cosmologists, such as Wheeler, Novikov and Rees, (to mention just a few) as follows: An intrepid and adventurous astronaut *deliberately* volunteers to explore the interior of a black hole, *taking his timing equipment with him... . It is important to note, in passing, the fact that anyone falling into a Black Hole meets a fate that an outside observer cannot indeed find out about, unless of course the outside observer himself plunges in also, to experience the same fate ...!* We thus take this imaginary and innovative journey into the precincts of a Black Hole, to follow the (rather painful) adventures of our brave friend, a volunteer astronaut, *who summarily takes the crazy plunge into the Black Hole*. We then *compare* the details of the effects of this *one-way trip* to our astronaut friend with what an outside observer such as we ourselves, at our safer (and wiser) distance from the Black Hole, would perceive. Such outside observers as ourselves are said to be "theoretically at infinity", (even though our own orbit may be just a few Astronomical Units (AU) above the Black Hole proper, and outside the "event horizon" itself.

4.2 The Intrepid Astronaut, Tidal Force ..., and "the Cosmic Rack" (i.e. on passing through the "Event Horizon" itself ...)

Thus, for our intrepid Astronaut journeying *towards and into* the Black Hole, it is important to note that one rather unpleasant effect to which the infalling astronaut would be subjected, would be *tidal forces, where such tidal forces arise as a result of the difference in gravitational attraction*

exerted on different parts of an *extended* body.

Standing on the surface of the Earth, we are subject to tidal effects due to the Earth alone (that is ignoring the effects of the sun and the Moon)! If one is standing upright, one's feet are closer to the centre of the Earth than one's head, and for that reason, are subject to a stronger force of attraction. Naturally, the effects are infinitesimal, and we are neither aware of them nor even able to measure them in everyday circumstance ...

Close to the event horizon however, things are very different indeed; 10 solar masses, of material have been compressed within a radius of 30 kilometres, and as we would expect, the gravitational force rises very sharply as we approach the event horizon. Close to it, the infalling astronaut would be subject to a tidal force roughly equal to that experienced by someone hanging from a bridge with *the entire population of London, New York, Lagos or Abuja swinging from his ankles ...!*

Our adventurous astronaut would indeed be *stretched and torn apart by what may be called "a cosmic rack" of ever-increasing severity* long before he reached the event horizon. Once through it, his shattered remains would plunge into the central singularity to be *instantly* crushed out of existence! At least, the end would be *mercifully swift*; falling virtually at the speed of light, the remains of the astronaut would reach the singularity about one-ten thousandth of a second after crossing or passing through the event horizon.

4.3 The Paradox of Two Conflicting Points of View

(... as moderated by GTR itself ...)

As we survey this adventurous journey, from the infalling astronaut's point of view, we note that the *intervals between transmitted impulses from the timing equipment (that as we recall, he carries with him) remain precisely constant*. To us, the situation appears rather different, for as the astronaut approaches the event horizon, *discrepancies become increasingly more obvious*: the intervals between successive pulses, by his time scale, *become progressively longer and longer ...* Thus, from our point of view, the astronaut's clock is *slowing down* due to the effects of Gravitational Time Dilation; thus the *deeper* he penetrates into the gravitational field of the Black Hole, the more obvious the effect becomes until, *when he reaches the horizon, we conclude that his clock has stopped altogether!* By our own reckoning however, the astronaut takes an *infinite time to cross the event horizon*, and we may well imagine that, with a sufficiently powerful telescope, we should be able to see "*a frozen image" of the shredded volunteer, however on the brink of the Black Hole for the rest of eternity ...!*

The astronaut who ventures into the Black Hole,

however, *sees things differently*. According to his clock (and every other means of local time measurement, e.g. atomic clocks, biological clocks or whatever ...), *time is flowing in the usual way, at a uniform rate ...* He crosses the event horizon and plunges into the central singularity *in a tiny fraction of a second; and that is indeed a very REAL, painful and final event for him*. Yet, we conclude that he *has never indeed crossed the event horizon at all! ...*

Is Einstein's Theory of General Relativity of any avail? Such bizarre paradoxes as we have described above immediately prompts us to ask the question, as to *which of the two viewpoints depicted above, is correct*, the astronaut's, or the distant observer's? We answer, *(and only tentatively and hypothetically at that)*, by saying: *maybe both, or neither in accordance with your point of view!* Thus, from the point of view of Einstein's Theory of General Relativity, we can affirm that we are indeed "correct", (that is, faithful in our interpretation of General Relativity) in the *observations made in our frame of reference in our Keplerian orbit*, a few AU above the event horizon. Even so, our friend, the infalling astronaut, is indeed *also correct* in the deductions made in *his own frame of reference!* (Beiser, 1973). There is thus indeed, according to Relativity, *NO ABSOLUTE STANDARD OF TIME IN THE UNIVERSE!* In other words, *the two observers inside and outside the Black Hole, are fully entitled - with equal validity - to their points of view!* (thus giving free rein to philosophical (ontological) and metaphysical thoughts that flow from such rather disquieting scientific paradoxes and weird events, as we shall see shortly hereafter.

4.4 On What Actually Happens ... (the Collapsing Star Scenario)

It is thus important to note, as we reflect on these paradoxical and perplexing points of view, that surely, *the same line of argument could indeed be applied to the "real world" situation of the "collapsing star"*, which went to form the Black Hole in the first instance! Thus, if we were to watch a star collapse gravitationally, we should in fact, see the collapse *slow down and HALT just at the Schwarzschild radius, and a frozen image of the star should indeed remain in view forever*, in what may be described as "*a nearly Black Hole*", as it were! Thus, in *practice*, our innate feelings, (and the physics and astrophysics of it all) inform us that *this 'freezing on the brink of eternity' would indeed not be so. Rather, Black Holes will indeed form, collapsing stars will vanish from sight, and infalling astronauts, (no matter how intrepid and adventurous), will disappear into the Central Singularity!*

4.5 Is General Relativity (GTR) Valid All the Way into the Central Singularity?

We are, at this crucial point, naturally led into asking the

million-dollar question as to how to resolve this amazing conflict between theory and practice, that is, between what Einstein's theory of General Relativity predicts, and what *actually* happens in practice, (especially as we approach regions in the Central Singularity of the order of the Planck length)?

Thus, as we survey and contemplate the paradoxes and rather bizarre events and effects that are revealed in the precincts of our Black Hole, in our "gedanken" journey with our volunteer astronaut through the event horizon and towards the central singularity, the following concluding thoughts, and metaphysical and ontological reflections, come to mind. We shall thus contribute, for lack of space and time, (as in the Central Singularity of a Black Hole - only three major scientific and philosophical, (metaphysical and ontological) reflections on the symbolism of total gravitational collapse, and the way forward, both in physics and philosophy, as well as for *human knowledge* as a whole, as follows:

4.6 The Breaking Down of GTR?

In the first place, we note that the theoretical properties and characteristics of the SPACETIME (configuration) around and inside our Black Hole, up to the Central Singularity, are *revealed* to the degree that our *best scientific theory*, General Relativity, can *grapple* with the situation, and reveal what is possible within its own rather limited and circumscribed powers!

Thus, from the very fact that our two observers experience indeed two radically different perceptions of "the same event" as it were, a way has to be found, maybe through "a higher theory", i.e. a theory higher than GTR, to reconcile the two different observations ...

4.7 The Call for Other Views and Orientation, and an Enlargement of Perspectives and Method

In the second place, as we hinted earlier in our introduction to this section of the work, Wheeler of Princeton University fame, in general support of the ideas posited above, strongly emphasizes the fact that General Relativity *could not possibly hold its own (fully, if at all) in regions of very great density, as in the Central Singularity and in the very limited dimensions of the Planck length*. Thus, as Wheeler appropriately recommended, as pointed out earlier,

... it is (indeed) appropriate to look into this structure (of Total Gravitational Collapse into a central Singularity) from *windows* other than *Einstein's original point of entry*, aiming especially in the later derivations to *enlarge one's view* of what collapse *is* and what *it* means ...

5.0 The Cosmic Symbolism - Metaphysical and Ontological - of Total gravitational Collapse

As a third and final contribution, within the limited confines of this research work, we turn to the region of the Black Hole and its Central Singularity itself. We note, in passing, that ever since philosophers and scientists alike had resorted to the "deus ex machina" syndrome in the earlier ages to "explain away" every problem or challenge confronting them, whether scientific or philosophical, physics had perhaps appropriately *shield* away from anything to do with Spirit and the transcendental. But alas, for too long indeed! For indeed, the pendulum of knowledge, progress and (true) method, at the deepest level, swings to and fro, at the fundamentally *ontological* level of being, life and consciousness itself! Thus, physics, *for too long enamoured by sheer matter* cannot forever bury its head, *like the proverbial ostrich in the sands and quagmire of mere materiality*! For what has Black Hole astrophysics revealed to us, *to the human mind and intuition*, but that *there is more to life, being and consciousness* (and indeed the Universe as a whole) *than mere matter and materiality*. As Wheeler so rightly and vibrantly points out in his dynamic allegory and symbolism of "other windows", there are indeed other no-less-scientific and philosophical orientations for *science in a broader sense*, that may lead to even *deeper presuppositional beginnings* than what we have now for orthodox science in its presently constituted (orthodox and narrow) mode. For purposes of simplicity and clarity, we recall Dalton's reductionist method of discovering the atom, as *the smallest "indivisible" unit of matter* ... In our own present astrophysical situation, we are faced with a Universe (initially) made up of "Spirit and Matter", and subjected to Total Gravitational Collapse in which matter itself is *completely crushed out of existence* in the Central Singularity of the Black Hole. *What is left of the original content of our Universe, but "SPIRIT" itself, the essence of all essences, the fundamental substratum of all substrata for which philosophers have sought throughout the ages?* Yes, SPIRIT itself, the *essence of all essences*, freed from the confines of all materiality, not subject to the laws of gravitational collapse, Quanta and Relativity, ready to come fully into its own proper realm of beauty, being and power. And what could such a world be but *a transcendental and fundamental vista* apparently *more real and substantial* indeed than the world of matter, a Universe certainly *more enduring* than the world and Universe of materiality, and yet *totally unknown to the World of Physics*, precisely because Physics (and Science as a whole), like the proverbial ostrich, *refuses to consider even the possibility of the existence of spirit* and its Transcendental Vista (or realm of Being). Yet, this Vista had indeed continued to stare it in the face, as it were, all along What is worse, the possibility of the existence of such a "spiritual vista" is not even included in the

FUNDAMENTAL PRESUPPOSITIONS OF PHYSICS (and sCIENCE as a whole), in its presently constituted (and rather narrow) orthodox mode!

6.0 What is Recommended: Physics (and Philosophy) Wake Up from Dogmatic Slumber ...

That indeed as given above, is the Cosmic Symbolism (both Metaphysical and Ontological) of Total Gravitational Collapse, *that Physics Itself* (and human knowledge and mankind as a whole) *is brought face-to-face with the World of Spirit ...* . Thus, if physics indeed is to remain *relevant, viable and effectively constructive* in the World of the future, physics (and philosophy as a whole) *must indeed wake up from their dogmatic slumbers and rise to the challenges posed by this metaphysically fundamental and ontological encounter with Spirit*, which apparently transcends all space and time, yes even SPACETIME itself, as in Wheeler's innovative symbolism of *Mutability, Superspace and "other Universes"*, *cosmic variants* indeed of the "leaves of Cosmic Evolution", *and the historic (and transcendental) future of man...*

7.0: The Way Forward

Thus, for man to move forward from this seeming dead-end in the "Central Singularity" where our conventional knowledge seems to have come to "a dead end", physics must indeed *take the lead* (in its traditional role of *PRIMUS INTER PARES*), by, firstly including the World of Spirit in its fundamental *presuppositions of Knowledge* as a whole, and embarking on a serious investigation of this vista by focusing attention on the ubiquitous (and seemingly "indestructible" role of, in particular, *the electron (even in the precincts of the Central Singularity)*). And, last but not the least, physics must vigorously examine *the symbolic implications of the historic_ "Membrane Paradigm" of the Black Holes of the Universe (Chinwah 2003) where, for the first time ever, the phenomenon of teleology, consciousness and design* are indeed, *MADE EXPLICIT* in the World and Universe as a whole (a topic which, for lack of space and time, lies beyond the limits of this presentation In this way, Physics may yet really become, in this New Millennium, *the EIDETIC SCIENCE, indeed PRIMUS INTER PARES*, that , in Husserl's deeply phenomenological vision, it is meant to be (Husserl 1989).

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