THE OBSERVATIONAL IMPETUS FOR LE SAGE GRAVITY

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For many years I never questioned the obvious fact that masses attracted each other (inversely as the square of their separation - to complete the mantra). The "attraction" was so blatant that it required no thought. But then observations of galaxies and quasars forced me to accept the fact that extragalactic redshifts were primarily intrinsic and not the result of recessional velocity in an expanding universe.

How did this lead to my abandoning pulling gravity and investigating pushing gravity? It is interesting how the crumbling of one fundamental assumption can have reverberations throughout the whole underpinning of science. In this case it was the necessity to find a mechanism which would explain intrinsic redshifts that eventually turned out to shake other fundamental assumptions. The search was motivated by a desire to have the discordant observations believed. (Unfortunately, when I asked Feynman about the Hoyle-Narlikar variable mass theory, he told me, "We do not need a new theory because our present one explains everything".) Nevertheless the ball had started rolling down hill so to speak and in 1991, with Narlikar's help, I outlined in Apeiron the way in which particle masses growing with time would account for the array of accumulated extragalactic paradoxes. Later Narlikar and Arp (1993) published in the Astrophysical Journal Narlikar's original, 1977 solution of the basic dynamical equations along with the Apeiron applications to the quasar/galaxy observations.

We hoped, of course, to gain validation of the new theory by showing that it was a legitimate product of the accepted, one might even say worshipped, general relativistic field equations. All we gained in fact was an audience which totally ignored this new, more rigorous solution. Nevertheless, seeing it in print started the wheels slowly turning in my head.

The first insight came when I realized that the Friedmann solution of 1922 was based on the assumption that the masses of elementary particles were always and forever constant, m = const. He had made an approximation in a differential equation and then solved it. This is an error in mathematical procedure. What Narlikar had done was solve the equations for m= f(x,t). This a more general solution, what Tom Phipps calls a covering theory. Then if it is decided from observations that m can be set constant (e.g. locally) the solution can be used for this special case. What the Friedmann, and following Big Bang evangelists did, was succumb to the typical conceit of humans that the whole of the universe was just like themselves.

But Narlikar had overwhelmed me with the beauty of the variable mass solution by showing how the local dynamics could be recovered by the simple conformal transformation from t time (universal) to what we called τ time (our galaxy) time. The advertisement here was that our solution inherited all the physics triumphs much heralded in general relativity but also accounted for the non-local phenomena like quasar and extragalactic redshifts. Of course, to date, that still has made no impression on academic science.

In addition, I eventually realized that an important part of the variable mass solution

was that it took place in perfectly flat, Euclidean space. This pointed directly at the revelation that the Riemannian, geometric terms on the left hand side of the famous

$$G_{\mu\nu} = T_{\mu\nu}$$

equation were zero. If $G_{\mu\nu} = 0$ then the curved space-time had nothing to do with real cosmic physics.

Two thoughts then presented themselves:

1) The $G_{\mu\nu}$ terms in the conventional solution usually represent forbiddingly complicated terms. But their existence appears to be required only for the purpose of compensating for the variable m in the $T_{\mu\nu}$ side of the equation which was assumed constant in the Big Bang solution. These geometric terms as is well known are used to adjust parameters such as H_0, q_0, etc. when the redshift - apparent magnitude relation is interpreted in an expanding universe. (In the variable mass solution H_0 equals only the inverse age of our galaxy and is equal to around 50 km/sec/Mpc, with no adjustable parameters.)

2) If there are no geometric space curvature terms in the variable mass solution, and this is a more valid solution, is there ever a legitimate use for these terms? For some time I entertained the idea that near high mass concentrations one might need them. But now I see work by Montanus and Gill which indicates physics with proper time and local time can reproduce classical relativity tests in flat, Euclidean space. It raises the question is space-time curvature valid? At this point the elementary question that should have been asked long ago by scientists and non-scientists alike is: *With any reasonable definition of space, how can one "curve" it?* (If you have trouble visualizing curved space, try curved time!) Curved space-time appears to be, and always to have been, as Tom Phipps casually remarked, an oxymoron!

In Table 1 appended here is a summary of how conventional relativity fails and how the flat space time, local and cosmic time treatments gives common sense results in its place.

Gravity

After this long preamble we finally come to the point: If space is not curved by the presence of mass (as per Einstein) - then what causes gravity? We are forced by the solution which explains the redshift dependence on age of matter to look for another cause of gravity. If masses do not move on prefixed tracks in space then there is no hope of having the "instantaneously" acting component of gravity by guiding them with the exchange of some electromagmetic wave travelling with c.

Since the time of the 18th century Genevan physicist, Le Sage, many people have considered what is apparently the only alternative to "pulling" gravity, i.e. "pushing gravity". My attention, however, was belatedly called to it by articles in Tom Van Flandern 's Meta Research bulletin. The key point for me was that its force behaved "inversely as the square of the separation" a point which I had not bothered to work out. The force (be with you) is transmitted by a surrounding sea of much faster than light gravitons. Van Flandern (1998) calculates $> 2x10^{10}c$. So we can have as "nearly instantaneous" action as we wish and yet not abandon the concept of causality.

Of course it interesting to comment on some of the doctrinal problems of the imminently deceased relativity theory. Is inertial and gravitational mass the same? Since the atoms of a feather and of a lead ball are made of the same electrons, protons and neutrons, we will have, to some orders anyway, the same force applied by the absorption from the surrounding sea of gravitons. So the equivalence principle holds. But only if the absorption of gravitons, and subsequent impetus, is proportional to inertial mass.

My own working hypothesis for gravity is now that gravitons are very low mass particles with a huge De Broglie wavelength compared to photons. Since their wavelength is so long they have much less interaction with the intergalactic medium. So they far exceed the normal velocity of light in "vacuum" (i.e. the vacuum that light in our locality of the universe sees). In other words the photon is transmitted through the average cosmic false vacuum, material vacuum or zero point energy field - to use just a few names given to the old fashioned concept of "aether". But the graviton interacts with much less of this molasses and hence moves much faster. One might speculate that there is a vast amount of matter in the universe which radiates at very long wavelengths.

Perhaps it is time to wander back to the observations with our new hypothesis in hand. Since the particles of matter in the universe grow as they age and communicate with ever more distant parts of the universe they have to receive information. In the variable mass theory this electromagnetic communication is at the speed of light, c. The gravitons travelling much faster than the speed of light, however, must also carry information. (No one could argue that knowledge of the direction of an adjoining mass is not information). So the old relativistic shibboleth "information cannot be transmitted faster than the speed of light" falls by the wayside. Recent experiments with entangled quantum states may also be indicating this.

As the inertial mass of particulate matter grows with time, in order to conserve momentum it must slow its velocity with respect to the primary reference frame. This is an important contribution of the new physics because the observations show that newly created, high redshift quasars are initially ejected as a near zero mass plasma with very high velocities and then grow in mass, drop in redshift and slow in velocity until they eventually form groups of slightly younger companions to the parent galaxy. This is observationally established and can only be explained by the variable mass theory.

The condensation of low mass plasma into a coherent body in the new theory forms an interesting contrast to condensation of galaxies in the 78 year old Big Bang theory. Bernard Bligh (2000) has shown thermodynamically that the hot Big Bang can not cool and condense into galaxies because its expansion is not constrained. As experience would dictate, a hot gas just diffuses. The situation with the near zero mass plasma is different however in that the growing mass of its constituent particles slows their velocities thereby cooling their temperature. In addition the growing mass increases the pressure toward condensing into a gravitationally bound body.

Now that we reference the primary reference frame we are reminded that this is yet another strike against the hallowed relativity theory which is supposed to have no primary reference frame. But the existence of the microwave background certainly reminds us that an average over the detectable universe certainly represents an obvious, primary reference frame. Moreover laboratory experiments like the Sagnac effect by Selleri and others reveals

the presence of such a frame.

The objection by Feynman to pushing gravity which was brought to my attention by John Kierein was that objects in orbital motion such as the earth would experience resistance from increased graviton flux in the direction of their motion. The answer, without computation, seems to be that this effect would only come into action at very high orbital speeds because of the very high speed of the gravitons. But in general it should be noted that my observational experience sheds doubt on any extragalactic velocities greater than about 300 km/sec. (rotational velocities in galaxies). This would imply that older objects must come very close to rest with respect to - what else but a primary, or universal reference frame.

Quantization

An unexpected property of astronomical objects (and therefore an ignored and suppressed subject) is that their properties are quantized. This first appeared when William Tifft, showed that the redshifts of galaxies ocurred in certain preferred values, e.g 72, 144, 216, etc km/sec. Later William Napier demonstrated a periodicity of 37.5 km/sec with great accuracy. The outstandingly important, empirical implication to draw from these, by now exceedingly well established observations, is that the individual velocities of galaxies must be less than about 20 km/sec otherwise the sharp quantizations would be blurred. In turn this implied very little motion in a primary reference frame.

For the quasars, Geoffrey Burbidge noticed soon after the first redshifts began to accumulate that there was a preferred value about redshift z = 1.95. As more redshifts accumulated it became clear that that the whole range of extragalactic redshifts was significantly periodic. K.G. Karlsson showed that they fit the formula

$$(1 + z_n) = (1 + z_0)x1.23^n$$

.

This was interpreted by Arp in terms of variable mass theory by hypothesizing that as the electron masses grew with time that they increased through permitted mass states which stepped by a factor of 1.23.

The most astonishing result was then pointed to by Jess Artem, that the same quantization ratio that appeared in quasar redshifts appeared in the orbital parameters of the planets in the solar system. This first manifested itself in the ratio of planetary semi-major axes occurring in some high power of n in 1.23^n. This also appeared to be true of the ratio of planetary and lunar masses and even solar and electron masses.

Shortly afterward O. Neto, Agnese and Festa, L. Nottale and A. and J. Rubcic independently in Brazil, Italy, France and Croatia began pointing out similarities to the Bohr atom in the orbital placement of the planets. Different variations of the

Bohr-like radius = n^2 or $n^2 + 1/2n$

fit the planetary semimajor axes extremely well with rather low "quantum" numbers n. Most recently I have learned of a modification to the Titius-Bode law by Walter Murch where the

planetary radii = $1 + 2^n + 2^{n-1}$

This latter law fits the observed planetary positions exceedingly well for n = -1 to 6 with an average deviation of only 2.4 percent.

Which of these empirical laws is correct, or whether they are all different approximations to a more fundamental law is a mystery at this moment. But it is clear that the properties of the planets are not random and that they are in some way connected to quantum mechanical parameters both of which are connected to cosmological properties.

Just to try to tie some of the above results together in what is obviously an inadequate theory, let us suppose that the planetary system started as some kind of analogue to an atom. In the variable mass theory the matter starts out from zero mass but the basic unit of charge never changes. Therefore the seed planets would be placed according to Bohr atom rules. As time goes on their inertial masses grow but in steps which are governed by communication with their cosmic environment. Very soon the charge aspect of the planet is overwhelmed by its inertial mass aspect and it is thereafter governed by the currently observed gravitational laws.

Expanding Earth

As long ago as as 1958 S. Carey reported detailed geological data which implied the earth had been expanding. K.M. Creer (1965) was one of many who showed how accurately the continents fitted together in the past and M. Kokus (1994) calculated how the observed sea floor spreading in the mid Atlantic ridge supported this interpretation. Naturally without an identifiable physical cause most scientists abandoned these empirical conclusions in favor of the theory that there was nothing of significance to explain. It is appropriate to quote Creer, however: "For an adequate explanation we may well have to await a satisfactory theory of the origin and development of the universe." The variable mass theory is a candidate to fulfill that phrophecy.

But how does Le Sage gravity enter this picture? I would suggest the following trial hypothesis: If much faster than light gravitions are pushing massive bodies toward each other, then they must be transmitting an impulse which could be described as energy. Is it possible that these gravitons are depositing energy or creating mass in the interior of the earth which is causing it to expand?

There are two attractive features of this suggestion. In the Olympia Meeting (1993) there were calculations that the mass of the earth had to be increasing. The problem was, however, that the mass had to be increasing too fast: To quote J.K. Davidson (Olympia Meeting p 299). "The current expansion rate is very rapid and gives rise to questions like, how is the extra mass being created (it seems to be occurring in the core as there is no evidence at the surface); will the earth ultimately explode and form another asteroid belt or will it become a Jupiter then a sun. . ." At that meeting I reminded the Geophysics section of the fact that the extragalactic quantization evidence showed that as matter evolved it must jump rapidly from one quantized particle mass value to the next highest. The obvious implication that this would be a natural explanation for the varying rate of expansion of the earth.

The second attractive feature of the variable mass theory is that the research of Tom Van Flandern (1993) indicates that planets explode. It has always been clear that where a giant planet should exist between Mars and Jupiter there is instead belt of rock fragments called the asteroids. But Van Flandern's careful work on the problem of Mars (which

should in all continuity be much larger rather than much smaller than the earth) shows that it has suffered a fragmenting explosion leaving visible effects on one face. So there is evidence that this happens in the solar system. In fact there is visible evidence that it happens in galaxies as well (Arp 1998;1999).

The Current State

The most intriguing problem to me now is to combine the features of the the variable mass solution with the features of the pushing gravity models. The Machian communication of the variable mass solution with matter at increasing distances offers a solution for the quantization values as reflecting discrete drops in mean density as we proceed outward in a hierarchical universe (Narlikar and Arp 2000). But that communication is electromagnetic at the velocity of light. Is it possible to transfer the periodically increasing mass with photons that resonate with the frequency of the electrons and protons in the matter under consideration? Or does this resonance frequency of the electron for example (Milo Wolff 1995) just make it possible for the much smaller, much faster than light gravitons to deposit new mass in older material.

As important as the details are, the observations overall seem now to generally require new matter to continually materialize at various points in the universe. Balance, if necessary, could be obtained from feedback mechanisms between the intergalactic aether and long wavelength radiation from present matter (I presume). The greatest part of the progress independent researchers have made in the past decades, in my opinion, is to break free of the observationally disproved dogma of curved space time, dark matter, Big Bang, no primary reference frame and no faster than light information.

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TABLE 1 CAPTION. Some of the most important concepts in modern physics and

cosmology are listed in the first column. The next three columns show whether variable mass, proper time, or relativistic physics support or violate these concepts. The last column gives the common common sense (operational definition) of the concepts. Finally at the bottom of the columns are a few of the names associated with the three analytical systems. (From ACTA SCIENTIARUM, in press).