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Discussion of Apeiron Books

Arp's New Book: A Catalyst For Change

Over the past ten years, a large number of books and papers have been published, concerning possible errors in the interpretation of data from modern astronomy. Three of these have been written by professionals in the field (1-3), while literally hundreds have been written by amateurs: for example students, artists, scientists from other fields, military men, lawyers and doctors (4).

Arp's new book (5) is a "must-buy" for all of these open-minded people, although it may not find much favor in academia. There will be particular weeping and gnashing of teeth in exclusive academic institutions such as Cambridge, Oxford, Harvard and Caltech, where professional astronomers may well have to justify their past 20 years' existence to other professional scientists at the same institutions: for example to experimental physicists, chemists and genetic engineers.

Thus, this new book *Seeing Red* presents a vast cornucopia of detailed experimental knowledge about extragalactic astronomy, little of which has yet been explained in terms of theory. Other professional scientists who do not work in cosmology, will be able to read this book easily, and see right away that so many new and detailed observations cannot be ignored. There lies the danger for Big Bang cosmology, as well as a possible catalyst for change.

Chapter 1 describes how compact x-ray sources are often found in pairs, which seem to be centered across the minor axis of certain Seyfert galaxies, following their presumed ejection from the center. In many cases, such x-ray sources turn out later to be quasars of high redshift. Chapter 2 expands on this same theme, and shows how Seyfert galaxies may actually be "quasar factories".

Chapters 3 and 4 describe a wealth of experimental data on anomalous redshifts within groups of galaxies, or even for the brightest stars. Chapter 5 then gives an overview of the Virgo Supercluster, and how certain quasars may be an integral part of it. This Chapter concludes by mentioning a conversation between the author and science-fiction writer Arthur C. Clarke in Colombo: Arp realizes suddenly, that Clarke may be far more perceptive than most of his colleagues in astronomy.

Chapter 6 considers how certain clusters of galaxies may contain quasars or BL Lac objects; while Chapter 7 discusses the problems of a gravitational-lens interpretation for quasar-galaxy associations. To make a long story short, "It isn't a lens."

Chapter 8 summarizes an abundance of data on preferred redshifts for quasars as well as galaxies. It then presents certain empirical relations, concerning the quasar redshift periodicity of 1.23 and other physical constants. Next, it introduces the concept that "mass" may be some kind of internal particle frequency, which could in principle vary over broad scales of space or time. This Chapter finally discusses a possible relation between the quasar periodicity 1.23 and masses of planets in the Solar System.

Chapter 9 then presents a general theory, which could explain all of the anomalous data which Arp and others have collected. The author and his colleagues Hoyle, Burbidge and Narlikar seem to favor a scheme, where the mass-energy of particles may vary over long historical intervals of time. That would then explain the Hubble redshift in terms of an altered frequency of light on emission from the source, rather than by receding velocity.

Furthermore, they favor a model where active, mature galaxies are the sources of "continual creation" in a very old, largely stationary universe. Such active galaxies (often of a Seyfert kind) may then emit new matter in the form of jets, dwarf galaxies or quasars. Furthermore, such newly-created matter seems to be emitted initially with low intrinsic mass. As it comes into contact with ordinary matter in the space that surrounds it, that new matter will slowly gain mass, and thereby "age" until it reaches an equilibrium with its environment.

Chapter 10 discusses many important problems of a sociological kind in modern academia. Arp is quite realistic in his expectations here: "It is clear that no matter how ill we think of the present, ponderous cultural establishment, we are not going to move it precipitously."

Next there is an Epilogue which describes a "scintillating quasar," that was discovered recently by a student in Sydney. Arp shows that it lies close to an active Seyfert galaxy. I recall when this important discovery was announced, the newspapers here wrote a story entitled, "Student Overturns Astronomy Theory". No one could believe that any quasar might vary so much in intensity over just a few minutes, given its expected diameter of light-hours or even light-days, for an assumed cosmological distance from Earth.

At the very end, there are 20 attractive color plates which should please the casual reader. The book is lavishly illustrated throughout with line drawings plus black-and-white pictures.

I was planning to cite here additional data in favor of Arp's interpretations. See for example the accompanying Figure, which shows failure of a Hubble redshift-brightness-size relation for dwarf galaxies in the Fornax cluster (6). Yet these anomalous data are perhaps so numerous that, as John Locke once wrote, "I need not pile up examples: every man's reading shall furnish an abundance for him."

In summary, Arp's new book *Seeing Red* will be a very valuable acquistion for professional scientists in fields other than astronomy, who want to keep an eye on what their cosmological colleagues are doing; as well as for the huge numbers of amateur astronomers, who are tired of being told by the Big Bang cosmologists what is real and what is not, and how the whole Universe began from nothing 15 billion years ago. Beyond any reasonable doubt, this new book shows: (a) how the Hubble redshift-distance relation is true only approximately, because it fails in certain cases; and (b) how most of the redshift data from extragalactic astronomy may be interpreted in terms of altered mass at a some distant source, rather than in terms of receding velocity from Earth.

Could most of today's astronomers really have mistaken a whole host of small, nearby quasars for novel, ultramassive black holes, which supposedly lie at the very end of the universe? I recall a similar error of my own while hunting as a boy in rural Florida. You see, while looking off into the distance through a clear blue sky, I thought for a moment that a nearby mosquito was really a distant duck.

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Quasar Redshifts: Is Aging of Matter Necessary?

In his new book *Seeing Red*, Arp (1998) attempts to strengthen his hypothesis linking the redshifts of quasars to the aging of matter. According to this hypothesis, a quasar is ejected as a low mass, high redshift object from the centre of an active galaxy. As the quasar moves outward from the parent galaxy, its matter ages and simultaneously increases in mass. The quasar is consequently transformed to a lower redshift object, since the light emitted from more massive atoms is more energetic.

To account for the increase in quasar mass, Arp invokes the hypothesis by Narlikar that the mass of a particle increases according to the relationship $m = at^2$ (where t is time and a is a constant). This arises, it is suggested, because of a Machian interaction with the other matter in the universe. The newly formed quasar matter has only had time to 'exchange signals' with the matter in a small volume of space; its mass is therefore small. As the light sphere of its interaction increases, so does its mass.

Problems with Aging of Matter

What are the difficulties with this hypothesis? To begin with, we must consider the overall conservation of energy as a quasar increases in mass. This depends on what form the new matter in quasars takes. If it appears as new baryons (or as the 'Planck particles' suggested by Arp), then all the known energy sources in the universe would appear to be insufficient to furnish the atoms of fully evolved quasars with their ordinary store of rest mass energy. Arp concedes that the energy to build up the new matter must be drawn from some kind of 'negative energy field', for which nothing more can be said with any certainty at all. In the end, we have replaced the dismal picture of runaway galaxies in the Big Bang, in which conservation of energy is violated once at $t = 0$, with a cosmology in which conservation of energy is violated repeatedly on an ongoing basis.

Another difficulty concerns Olbers' paradox, or why the night sky is not bright. Darkness at night *is* explained in 'tired light' models, since the integral of the light energy received from the remote depths of space becomes finite due to the redshift effect (Jaakkola 1993). In addition, if gravitation is assumed to be electromagnetic in nature, an analogous solution is provided for the related Seeliger-Neumann paradox. Arp rules out tired light mechanisms, but offers no explanation at all for the disappearance of starlight or gravitational energy in space. Indeed, as all galaxies

increase in mass and luminosity in his model, these problems are only exacerbated.

While Arp makes a possible case for a localized aging of matter in quasars, he then weakens it by extending the concept to the universe as a whole. In this endeavour, he unfortunately invokes evidence normally used by proponents of the Big Bang to support their theory. For example, one of the main tests of the Big Bang model is the Tolman surface-brightness test. According to the Big Bang model, the surface brightness of a galaxy moving with a velocity redshift z relative to an observer should be fainter by a factor of $(1+z)^4$, as opposed to a factor of only $(1+z)$ for a stationary one. Sandage and Perelmuter (1991) had earlier reported evidence for a $(1+z)^4$ relationship, which had been considered decisive by some authors. Arp apparently also accepts this evidence in saying that such a relationship should also apply for distant galaxies created at younger epochs in his model (p. 234). But recently Sandage (1997) has backtracked on this point, stating that their earlier finding had been based on data of other researchers which may have been biased. In addition, Jaakkola (1993) had previously considered the evidence on this point to be favouring the static model. Arp also accepts uncritically evidence given for time dilation in a distant supernova (p. 233) as well as the establishment view of the Hubble Deep Field.

A Modified "Machion" Hypothesis

Supposing that we choose not to follow Arp in his aging of matter concept, how then can one explain the excess redshifts of quasars? Here I will briefly mention three alternative possibilities which tie quasar redshifts to quasar masses *without aging of matter*. The groundwork for the first of these is laid out by Arp himself in *Seeing Red*. We begin with Arp's "machion" hypothesis, which he uses to explain the 35 km/sec quantization of redshifts in galaxies extending in all directions away from us. Arp argues reasonably that this quantization cannot be the result of a clumping of matter in uniform concentric shells around the Earth. Rather, he makes the interesting conjecture that matter acquires mass through the exchange of "machions," wave-like particles analogous to the gravitons of gravity. The machion waves are of ultra-low frequency, on the order of 10^{-14} sec^{-1}, such that between us and the Virgo Cluster there are only about 23 wave maxima. When the machion emissions of two bodies are 180 degrees out of phase with each other, Arp supposes that the bodies will be unaware of the existence of each other. For this reason, we see only those galaxies which are positioned in wave maxima relative to us.

Arp next points out several intriguing mathematical analogies between the observed quantized redshifts of quasars and the masses, orbital speeds and orbital radii of the Solar planets. The quasar redshifts and the orbital radii, for example, can both be explained using a modified version of Bode's law. For the quasar redshifts, this is expressed using the formula

$$(1+z_2)/(1+z_1) = 1.23,$$

where z_2 is the next higher redshift from z_1. The same factor of 1.23 can be used to derive the planetary radii, with 1.23 replacing 2 in the original Bode's law. A related observation, attributed to Nottale, is that the planetary velocities decrease in the scale of 144 km/sec divided by a series of integers. The value of 144 km/sec is also one of the observed peaks in quasar redshifts, where z is expressed as a velocity shift. Arp notes that 144 km/sec could not possibly correspond to an actual velocity redshift in quasars, as such velocities would wash out any periodicities.

For the present purpose, however, the most important analogy is between the quasar redshifts and the planetary masses. Arp shows that all the planetary masses, as well as the sun, can be expressed as integer powers of 1.23. Since the masses of quasars, and apparently even the sun and the electron, also follow this pattern, he concludes that masses on all scales in our local universe are formed as integer powers of 1.23.

Let us suppose that this notion of a universal mass scaling law is valid and also that the masses of quasars indeed occur as integral powers of 1.23. To account for the greater redshifts in the smaller quasars, we need only then suppose that particle masses scale with the total mass of the quasar in which they reside. This would be consistent with the machion hypothesis, provided that the mass scaling law were enforced 'from the top down', with a critical level being that of the galaxy. In smaller galaxies and quasars, the electrons would then have less mass and the light emitted from their atoms would therefore be more redshifted. An increase in mass of quasars as one moves outward from the parent galaxy is just what one would expect, since the most massive quasars would logically be associated with the most energetic ejection events. In addition, this hypothesis would more simply explain the fact that the dominant progenitor galaxies, such as M31 and M33, are blueshifted relative to the other galaxies in their systems. These would simply be larger galaxies, not galaxies composed of older atoms.

Interestingly, these very analogies between planets and quasars may actually cast doubt on Arp's main premise that observed quasars are moving outward

from the parent galaxy at speeds roughly equal to .07 c. After all, the Solar planets are not known to move from lower to higher orbits, or to individually increase stepwise in mass. The evidence Arp presents for the quasar ejection velocities is rather slim. He computes the ejection velocities using the differences in the redshifts of known quasar pairs, which in this instance he designates as true velocity shifts. Is it conceivable that both rapidly moving and quasi-stationary quasars could exist at a given redshift? The fast moving quasars might correspond to objects ejected as a single compact body from a galactic core. The 'slow' quasars could be bodies condensed from an earlier gas jet, nucleated at any of several positions along the jet trajectory.

Whence a Quasar's Kinetic Energy?

Another conceivable mechanism for quasar redshifts without aging of matter involves the relationship between a body's rest mass energy and its kinetic energy. One advantage of Arp's approach is that the quasars or associated jets can be expelled at extreme velocities, close to c, since the matter involved has little or no mass. The idea that an atom has zero mass lends itself nicely to the idea that it is a 'young' atom.

But let us suppose that the kinetic energy of an ejected atom is instead 'borrowed' from its rest mass energy. Consider these three notions:

- the rest energy of a particle is proportional to its rest mass, with proportionality constant c^2
- accept as a premise that the principal frequencies of light emitted by a moving atom, like those of a stationary atom, are proportional to its rest mass, with deviations arising for different observers due to the Doppler effect
- we have as an experimental fact and from relativity theory that moving atoms emit radiation with a frequency reduced by a 'time dilation' factor $(1 - v^2/c^2)^{½}$.

Points 2 and 3 would together imply that the rest mass of the moving atom is also depleted by the factor $(1 - v^2/c^2)^{½}$. We may simplify this by stating that the so-called time dilation factor is simply the result of the reduced rest mass of the moving atom. A further implication, arising from point 1, is that the rest energy of the moving atom must also be depleted by the same factor. In this case we have the consequence that the total energy of a particle at all times must be seen as having a constant value equal to its rest mass energy when actually at rest. If this constant value is written as $m_o c^2$, we then have

$$E_{rest} + E_{kin} = m_o c^2$$

Alternatively, if the rest mass of a body at redshift z is m_z , then the total energy of the body can be expressed as $m_z c^2/(1 - v^2/c^2)^{½} = m_o c^2$. We see that the extreme energies observed in particles moving at relativistic speeds are actually due to rest mass energy which has been temporarily given over to kinetic energy.

Returning to the quasar case, the quasar material at the point of ejection from the parent galaxy has negligible mass only because its rest mass has been 'photonized' to kinetic energy. It is not 'younger' mass. The quasars observed at high redshifts would then correspond to ones in which the matter is still possessing an extremely high amount of kinetic energy. The nature of this kinetic energy is mysterious; however, as these kinetic energies would appear to be quantized, they would seem to correspond somehow to the quantized orbital velocities of planets noted by Arp.

With reference to this second possibility, I am indebted to Henry Dart and his 'Scalar Field Theory'. Dart (1996, 1998) has developed a variation of this idea and has extended it moreover to the gravitational case. Dart states that a body in the presence of a large gravitational field has its rest mass energy reduced exactly as though it were in a state of rapid motion. This can be seen quite simply as a consequence of the body's 'potential energy' being converted to kinetic energy during its fall. Dart himself argues that quasar redshifts are gravitational in origin.

The last alternative I shall mention for reduced atomic masses in quasars without aging of matter is due to Marmet (1997) and his classical formulation of relativity theory. The details of Marmet's approach are beyond the scope of this report. Inside large, dense bodies, such as large stars, Marmet finds that the masses of atoms approach zero in his theory. The ejection of these low-mass atoms in a quasar or jet would thus also require little energy in this scheme.

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Seeing Red—The End of Dogma

Think of this book as a declaration of war. At the very least it marks a new step-up in hostilities between the think-alike sheep in science and the think-different goats… that is, between science professionals (the faithful, sometimes called the Establishment) who bow to authority and are ruled by consensus, and science outcasts who lack faith and insist on thinking for themselves. The latter, the goats or pluralists, are at an eternal situational disadvantage. They make none of the rules (such as the anonymous refereeing system) and are at the mercy of an enemy who has only to divide and conquer. For many years science has been shaped by the myth that wisdom resides in consensus. But on evidence such as this book furnishes, one must infer that a likelier fruit of consensus is unending elaborations of folly: Let but one seed of folly be sown and from it logic and self-consistency raise an ever more-bountiful folly crop.

Arp is unique in pulling no punches. He correctly identifies the enemy of pluralism as academic science. That is already a giant step forward—to know one's enemy. Hitherto, the warfare has been as one-sided as it has been merciless—largely because academic villainies have been cloaked by the legend of academic impartiality and gentlemanliness.

Astronomy is a science of pure inference from observation. It wholly lacks the corrective feedback of controlled experiment. Therefore it behooves astronomers to be especially meticulous in avoiding cocksureness… to be particularly careful about preserving the conventions of gentlemanly behavior—to save at least the appearance of broad-mindedness. As Arp points out, astronomers have nothing but photons and their wavelengths to go on. In such a "science" facts are too sparse and precious to be ignored. Yet, not content with ignoring his findings, his colleagues have denied him telescope time, to ensure that he gives them nothing further to ignore. These are acts of a war that Arp can hardly be accused of starting. As for cosmology, that is the ultimate in inference. It lacks all experimental brakes on imagination. Its practitioners need to guard even more carefully against becoming know-it-alls. So, what happens? Consensus, in both astronomy and cosmology, puts its big Monty Python foot down on any deviations from orthodoxy. Arp has declared his personal war on this institutionalized villainy, with its trappings of academic credentials and its aspect of forbidding Authority. And, I say, more power to him. The war is righteous, the only righteous war I know of in our era.

Arp understands that in a science of inference the observational data must rule: They must be gathered without fear or favor and must be studied, refined, and respected. Apparently he is one of the few astronomers who feel that way. The rest allow their prior probabilities to be so dominated by foreknown theory that no amount of data can prevail. And what is the origin of this savant-blinding, fact-blighting, all-powerful theory? More incestuous academic science, layer upon layer—ever inward-looking, ever building on a fetid mixture of old physics experiments and (possibly) tiny seeds of original folly.

What is Arp's evidence? Simply that in case after case high-redshift quasars are seen to be closely associated (collocated on the celestial sphere) with low-redshift active galaxies, *e.g.*, of the Seyfert type. Conventional astronomy replies that these claimed associations are mere coincidences of background objects. That seems unlikely… too many "coincidences." But there is more to it than subjective prior probabilities of association. There is a regularity and predictability of objective features: Arp finds in dozens of cases that the quasars (a) are aligned across the central galaxy, (b) lie along the "minor axis" (spin axis) of the galaxy, and (c) show a systematic progression of redshifts from maximum nearest the galaxy to minimum farthest from it. Is all that to be explained as more and more coincidences? From these observed regularities Arp infers that quasars are not background objects but are exactly what they appear to be: ejections from the central galaxy, hence located at the comparatively close distance (within our local Supercluster of galaxies) of the parent galaxy, which has produced them through some mechanism of matter creation. In other words, the large redshift of quasars is not a proof of their high recession velocity and great distance. This strikes at the heart of current expanding-universe dogma.

Another dogma of academic astrophysics, that the creation of all matter in a single initial (Big Bang) event accounts for the observed abundance of the elements, has apparently been quietly dropped, at least by realists among the astronomers. Most of these now concede that there is also matter creation going on continuously throughout the existing universe within the active cores of galaxies. This makes the Big Bang redundant except for explaining the "expansion of the universe," read as dogma. Let us be grateful for small concessions to observation.

The observed progression of redshifts of ejected quasars, and their association with nearby galaxies, suggest to Arp that these redshifts are not Doppler shifts resulting from velocities of source recession but instead evidence new physics—specifically, a hitherto unsuspected age dependence of elementary particle mass. That is, newly-created matter initially possesses zero mass and emerges from its creation

locus in the central galaxy at speed c, but acquires mass and slows down with the passage of time. Thus the earlier ejecta from a matter-creating galaxy, being "older," appear to our observation farthest from the parent galaxy and least red-shifted; whereas more recent (closer in) ejecta have less mass and show greater redshift. This is based in part on elementary quantum mechanics: The energy eigenvalues of the hydrogen atom, for instance, are proportional to the phenomenological mass of the atom. Whatever may cause a reduction of that mass will proportionately reduce spectral line separations and the $h\nu$ of radiation from the atom, hence will increase wavelength or measured redshift of that radiation. So, an atom "born" with zero mass will initially radiate at infinite wavelength or redshift. (In other words, it won't radiate at all for a while.)

This is a wild idea, that mass increases with time. To make any sense of it one must combine it with another wild idea—that of Mach regarding the origin of mass; namely, that phenomenological mass or inertia of local matter derives physically from a sort of mutual "contact" with distant matter. Combining this seemingly acausal idea with the causal notion of retarded action, one may find it plausible to picture newly-formed matter as created initially "out of contact" with distant matter, so that the local stuff has no Machian mass, but gradually acquires it with time passage, as increasing amounts of "distant" matter come progressively into "contact" by speed-c interaction. (By the same token, of course, the distant matter acquires a small increment of its own mass through interaction with the new matter. That effect is presumably too small to measure.) Hence any newly-created particle's "mass" is proportional to the amount of pre-existing matter enclosed in an expanding light sphere centered on that particle.

Arp keeps looking at the data and seeing further regularities that defy academic science. In addition to the unwelcome relationships of quasars, galaxies, and their redshifts, he and others have observed amazing "quantizations" of redshifts of various kinds. These defeat all attempts to identify redshifts with Doppler shifts, because they would mean that in velocity-space the Earth is privileged to be the center of a regular sequence of spherical shells of preferred redshifts. This takes us back to the cosmology of the Middle Ages, with the Earth in a privileged position. One might try to reconcile such observations with the Machian model by predicting plateaus of redshift due to progressive inclusions of matter increments within the expanding light sphere—first the local galaxy, then the local galaxy cluster, *etc*. But the regularity of the periodic redshift data seems to defy such crude explanations. I am forced to conclude that "there are more things in heaven and earth, Horatio …" This is a healthy thing to realize, since it induces humility—a prime requisite for scientific progress.

While vending humility, I might as well admit that finding a non-Doppler explanation for observed redshifts in a non-expanding universe is no picnic. Tired-light models do not appeal to most astronomers, including Arp; but they seem to me still definitely in the running. Even apart from "dark matter" hypotheses, it must be admitted that we cannot perceive all the matter that may be out there. A feature of the cosmic background radiation is that it is thermalized (black-body) radiation. Looking at it is like looking into a furnace at a uniform temperature … which means that all objects and particles at that temperature by definition fade into their background and become "invisible" against it. So, how do we know what interactions long-distance photon travelers may experience?

Let Pluralism be the battle cry of any *Quixotes* who want to follow Arp into battle against the Blue Meanies of the *status quo*. I, for one, am with him, and thoroughly recommend his book as a bible for this worthy crusade. If your energies are not otherwise engaged, I commend it as a good fight—perhaps the most worthwhile "mental fight" of our times. Arp has accurately identified the academies as leaders in the modern degradation of science. But the war takes place on a broader front. In 1938 the English novelist Geoffrey Household (*The Third Hour*, Little, Brown, Boston, p. 103) pointed out that the United States was "aiming at a civilization in which thought should be communal rather than individual." Even that early, one observer was not fooled by the lip service to individualism with which we in the U.S. traditionally fool ourselves. He recognized that we who reject communism as an economic doctrine embrace it as communism of the mind—the New Wave of "Democratic" Consensus (*e.g.*, today's "politically correct" thinking). To human science, that is as antithetical as religious Truth… indeed, it is a secular form of it. Authority and Consensus—these two vipers—academic science has taken into its bosom and reared as its own. Higher education has devolved into their very embodiment. In sequel the academies have delegated the guardianship of science to its most implacable enemies. The novelist perceived that it is not only science that is at stake, but civilization.

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Seeing Red—Aethereal Forces

Having finished the above and re-reading *Quasars, Redshifts and Controversies*, I am convinced of your argument for the association of high and low redshifted objects, and of the ejection of these objects from older galaxies. I am not convinced that electrons, *etc*., are "created" (formed?) with low mass, only to grow into the particles as we know them, nor that the quantization effect is stimulated by this growth.

My involvement in studying cosmology began some time ago when some writer mentioned "The Expanding Universe" once too often and I decided to find an alternative mechanism for the cosmological redshift in an essentially static Universe, and without a Big Bang. This I did, along with a mechanism for an intrinsic redshift which lends itself to quantization, somewhat along the lines of your hypothesis but without the need for an electron of increasing mass.

Very briefly, and to establish a point of beginning, our universe is seen as just an observable portion of an infinite and eternal Existence. Ruling out Creation in any guise and all mysticism (including mathematical), there can be no spatial or temporal boundaries, *i.e.*, no place or time of non-Existence. This being so, and the simple fact of the universe which we *do* see, mandates an all encompassing cycle of things wherein the matter-to-energy transformation is followed by an energy-to-mass transformation, with an efficiency of 100%.

There can be no one-way processes at work—no entropic death, no black-holes for matter to disappear into, no endless dilution *via* expansion, *etc*. Instead, both matter and energy would seem to be drawn into mature galaxies to become new objects which are, in turn and in some manner, ejected as proto-galaxies. Old galaxies eventually become the debris which is assimilated into the new.

Coming at this from another direction, the magnetic fields of the earth and the planets are supposedly caused by molten iron circulating in their core regions. However, if we consider these fields to be electro-magnetic manifestations, and, using the observed fields and rates of rotation of the planet calculate the electrical charge necessary to produce the fields, we find that all planets must be positively charged. If we go a step further and, using these charges and the electrical capacity of the planet to space, we discover that all have electrical potentials to space which average +54 quadrillion volts! A coincidence? Hardly. Next, we run the same calculations on the Sun using an 8 hr. rate of rotation, as inferred from its oblateness. Again we get about +54 quadrillion volts! Quite enough to cause the solar flares and to drive the solar winds which charge the planets!

It would seem that the fusion furnaces in the Sun are the cause of this positive voltage as a result of its matter-to-energy conversion process. Negative charge has disappeared along with the energy! (I recall the remark of some scientist who was watching an early atomic blast, that "...there seems to have been the creation by the blast of a depletion of negative charge...".)

From this, one may conclude that the energy generated by an atomic blast carries away both mass and negative charge (or, in essence, *is* that charge?). *I.e*., it now has two characteristics, neither of which are consistent with those of electro-magnetic radiation. Instead, it should be seen as a physical entity (the "material vacuum", or the "aether"?) which behaves as such, through which the e.m. wave travels, and which provides the substance that determines the permittivity and permeability of "space", and a substance which *can* revert to matter.

Additionally, being gravitationally responsive, it is drawn into the galaxy (or any material mass, such as the sun, or the earth, or even an atom) and compressed, but only until its negative self-repulsive force equals the force of gravity. Thus, we have an aethereal atmosphere of varying density, much like the air surrounding the earth, only, in this instance, surrounding all mass concentrations, blending together in inter-galactic, inter-stellar, and inter-atomic space, as well as intra-atomic space.

From this one may conclude several things:

1) that black holes are prevented from forming by these conflicting forces;
2) that these galactic, or stellar, atmospheres should refract light;
3) that the energy density in an atom on the sun will be greater than that in a similar atom on earth;
4) that, therefore, electron orbital changes will be slowed by the denser dielectric medium;
5) that a cosmological redshift (if it exists?) could be caused by a gradual and constant increase in the density of the aethereal medium [according to the formula: $F_O = F_S(1-R)^t$, with the F's being the observed and source frequencies, R being the rate of change per second of the aethereal medium and t being the time of travel of the observed wave.

One could calculate R by comparing the energy leaving a galaxy to the energy within and around that galaxy, or by choosing a value for t and solving for R. The ratio of F's is the preferred red-shift symbol, in that wavelength is a velocity of light derivative, and given the variation in the density of the aether, the

velocity of light is no longer a constant. And, km/s is a concession to the Expanding Universe tribe.]

A slower atomic electron inter-orbit transition would, of course, result in less energetic e.m. radiation, hence the intrinsic red-shift. The greater the mass of the source, the greater the intrinsic red-shift.

As the aethereal medium (actually the negative energy) is compressed ever more within the galaxy, one may assume that a point is reached where it is re-transformed into matter, and that because the aether was negative the matter thus formed will be negative. As the aether was spinning with the galaxy the newly formed matter will continue to spin the same way, of course, but being negative, will generate an electromagnetic field exactly opposite to that of the parent galaxy. Being massive objects they cannot simply flip ends (as two magnets in the lab.) so will repel, with the smaller being ejected along the axis of the larger, perhaps splitting in two in the process, if the action takes place in the center of the galaxy.

These ejected objects are from the core of the parent galaxy and so are greatly compressed. As they move into the regions beyond the galaxy the compressive forces are gradually relieved and, consequently, the objects expand. As they expand the intra-atomic aethereal medium becomes less dense, the orbital jumps become easier and faster, and the redshift decreases. So, we get a lessening of the redshift, as you do, but from a cause other than increasing electron size.

The quantization is presumably as you describe, an inherent delay in the change of an orbital jump until the force for change reaches certain levels.

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Open Questions in Relativistic Physics—A Pluralist Viewpoint

This volume is a collection of papers presented at an international conference in Athens in June, 1997, and the publisher, Apeiron, has produced to a high professional standard a softback conference volume. The volume is well produced and well edited by the eminent Franco Selleri. The papers are collected into sections: "velocity of light," "history and philosophy"; "structures in space and time"; "cosmology and astrophysics"; and "quantum theory and relativity". There is no indication of the price on the volume but it is probably far less than other contemporary publishers in science. Therefore Apeiron does a great service to pluralist theoreticians open minded and bright enough to understand the contents. In more conservative circles we would have to wait up to two years for the volume to appear with an astronomical price tag, and the subject matter would be less pluralistic and less interesting.

The standard of presentation is mixed, some papers are inevitably more thoroughly prepared than others. However, the conference organisers have had the liberality of outlook to invite papers from "non-professionals," and the volume is none the less important for that. There is a commensurate variety of hypothesis, underlying the basic tenet of natural philosophy, that any hypothesis being the product of imagination and therefore subjective, is always provisional, and can partially describe nature at best. A plurality of thought, clearly and professionally presented in one well produced volume such as this partially eliminates the dogma that has ossified late twentieth century physics fundamentals in conservative (mainly academic) circles and turned it too often into a dull, ill informed, rejection of good ideas. However, dogma is also to be found in radical thought, and must similarly be rejected as completely as possible.

The opening paper, by Fleming, is an interesting example of the open minded, or Boltzmannian pluralist, approach to the Sagnac effect, of which there are many explanations. Fleming suggests a neat, well presented, explanation based on finite photon mass and the concomitant existence of *both* wave and particle, the Einstein/Bohm/Vigier theory. It is argued that the photon behaves as does the electron or neutron in the Sagnac effect, and therefore carries mass if particulate. Unfortunately he does not mention the explanation (published in 1995) of the same effect by Barrett, using non-Abelian electrodynamics, which leads, if applied *in vacuo*, to the $\mathbf{B}^{(3)}$ field, $O(3)$ electrodynamics and the possibility of photon mass. This would have strengthened his own argument. In this context an excellent index allows one to cross refer to page 227, where Hofer derives the Maxwell equations without accepting them as "axiomatic". This is a misuse of the term "axiom" by physicists. In Logic, an axiom has two definitions: it is either an undemonstrated proposition concerning an undefined set of elements, properties, functions, and relationships, or it is a self evident or accepted principle. Nothing in natural philosophy is self evident, least of all special relativity, as the many different interpretations in this volume show. An axiom in natural philosophy must lead to a statement about nature, and therefore cannot be self evident or permanently acceptable. The Maxwell equations as found in textbooks should be interpreted only in the first sense of an axiom in Logic, as undemonstrated propositions in the sense that they can only partially describe nature, and by no means without internal inconsis-

tency and paradox. The "Maxwell equations" were in fact derived by Heaviside. The originals were twenty equations in quaternions of effectively $SU(2)$ symmetry, not vectors in $U(1)$ gauge symmetry. Only by continuously rejecting the "self evident" will any subject evolve, as demonstrated by Hofer. It is now known beyond reasonable doubt (but not of course beyond conservative or radical dogma) that the $U(1)$ electrodynamics based on the Maxwell equations are paradoxical, and that electrodynamics may be written more self consistently and less paradoxically in a higher, non-Abelian symmetry, such as $SU(2)$, $O(3)$ or even $SU(3)$. This leads back to the Barrett explanation of the Sagnac effect and the possibility of photon mass as discussed by Fleming. If the Maxwell equations are axiomatic in the sense of being self-evident, any development from $U(1)$ violates the axiom, and no progress will ever be made.

Similarly we find dogma being dismissed in two papers by Arp and Roscoe, based on data and extensive scholarly experience in cosmology. These data lead to the rejection of the Big Bang theory in what appears to this reviewer to be the high ground of natural philosophy, empirical data, reduced by logic and without prejudice. The conclusion by Arp is that flat spacetime can and should be used in cosmology. This is the result of a lifetime of scholarship but is rejected almost completely by the adherents of general relativity in cosmology. Rejection takes place despite the data, and so strays outside the bounds of natural philosophy if the data are accurate and properly interpreted and reduced, as seems to be the case with both Arp and Roscoe.

However, "the rejection of the self evident" *without* scholarship can only replace dogma by dogma, and we can see this process occurring in some of the poorer papers of this volume. This process leads to outright intellectual destruction rather than the evolution of thought, for example rejection occurs without anything being put in its place, as in the dark ages in Europe. The great synthesis of thought that went into special relativity and quantum mechanics is well reviewed by the better historical and philosophical papers in this volume and it would be a pity if this synthesis were to be destroyed by radical dogma, i.e. ill-conceived criticism. In order to reject a theory one must first learn all about it. Ill-conceived dogma results in the flooding of the e mail system with warnings about the eclipse of special relativity and the end of spacetime, in physics without equations and so on. Fortunately we are spared this to a very large extent in this volume because it is a pluralists' volume. At its worst, radical dogma can degenerate into solipsism, the reinstatement of absolute space and absolute time at all costs by fishing out obscure bits of data in favour of the hypothesis, however riddled with flaws. There are one or two papers like this in the volume, others which make a better argument for galilean principles applied to special relativity, self-contradictory as that may seem at first. One can only try to fish out the reasonable ideas if one is a pluralist oneself.

Selleri himself presents an interesting paper on the lack of a true inertial frame in physics, (precise opposite, apparently, of the galileans), and logically works out the consequences, showing what he claims to be a "discontinuity" in relativity theory. He may be right, the logic of his argument seems to be free of flaws, and leads to a velocity of light not equal to c, as in the theory of finite photon mass. The latter can be cross referenced to red shifts as long studied by Arp and others in meticulous detail, and long ignored by the "establishment," the mysterious, unelected elite of modern physics, as ossified as Lot's wife. This is what comes from looking backwards, a danger to radical and conservative alike. The middle ground then must rely on volumes and conferences like this, which circumvent the remarkably censorious nature of modern physics publishing while rising far above the end of millenium junk on the physics internet. This is no doubt due to Selleri's careful editing. Another interesting consequence of his argument, and that of other good papers in the speed of light section, is that it may lead ultimately to an explanation of the non-null result of the Michelson Morley experiment, following a recent re-analysis of Vigier. This analysis is not without its critics, but was recently published in *Apeiron*, and elsewhere. A.G. Kelly, for example, discusses some related matters and the need for an ultra-accurate test of Michelson-Morley and related effects. The "establishment" in physics would reject (again) Vigier's argument outright, and again, despite the data.

This conference proceeding is then far ahead of the average textbook in accepting and discussing a variety of primitive concepts in relativistic physics, including Einstein's own, and their evolution. The pluralist approach has its clear merits but can lead to some violent contradictions as ideas develop in a historically transitional stage. For example Kapuscik in one paper attempts to develop generally covariant electrodynamics in arbitrary media (with a field tensor remarkably reminiscent of non-Abelian electrodynamics, but in curved spacetime), while Arp and Roscoe try to demolish general relativity in other papers, and apparently, reduce it back to special relativity (the one used in general gauge theory and non Abelian electrodynamics). Still others seem to deny special relativity and replace it with absolute space and time, while Selleri does the very opposite,

denies the existence of the inertial frame: "...no perfectly inertial frame exists in practice…" Fleming discusses the very high accuracy to which the equations of special relativity have been tested, using muons in an accelerator ring, so the interpretation of these equations is the issue in many instances, surely, rather than the equations themselves. Where it seems to me that these various examinations fall far short is their inability to construct a better general gauge theory in special relativity, one capable of predicting all the observed quarks in nature better than the Yang Mills theory in $SU(3)$ gauge symmetry. (There appears to be no mention of gauge symmetry in the whole volume, and Wesley, for example, is known to dismiss the whole lot, quarks and all, reminiscent of Erasmus' *Praise of Folly*.) Unless they do the quark thing better, they will remain quirks or tinkerers on the edges, to the vast majority of physicists. (Human nature being what it is, grossly blinkered.) This reviewer is far from being unsympathetic to the contributors in this fine volume, but if one is to criticise the most successful theory in twentieth century physics, Yang Mills gauge field theory based on special relativity, one must surely put something in its place at least as powerful. This effort does not even exist in this particular volume, despite the fact that quarks are products of special relativity, i.e. of gauge theory, and despite the fact that *every* quark in nature is now known empirically. Perhaps this is why there is also no mention of non Abelian electrodynamics, the critics themselves appear to adhere rigidly and dare one say, dogmatically, to the Maxwell equations, actually Heaviside's creation. The name "Heaviside" is missing from the index and there is no progress beyond the $U(1)$ in this volume. This is perhaps a counsel of perfection by the reviewer.

On the more philosophical level there is a particularly useful paper by Bastos Filho, who uses the Compton effect as an illustration of correspondence and commensurability, thus improving on the difficult abstractions that are the philospher's lodestone and making them comprehensible to the everyday physicist. Other papers in this section are impressive but heavy going to the uninitiated due largely to lack of illustration, i.e. giving examples, as in metaphor.

There are also interesting papers on the internal structure of the photon and electron, again ideas which would be rejected by *Physial Review Letters*, and therefore interesting ideas. I like in particular the one by Bozic on this subject, but there are several more. I believe that Malcolm MacGregor was ostracised for life for suggestions along these lines for the electron, showing again the effect of contemporary dogma. MacGregor detailed some of these happenings to me at Vigier One, and I know some effects first hand. It seems amazing that an objective profession such as physics can be so unobjective, and therefore one must finally salute the courage of the Editor, the Publisher, and all contributors, whatever their views.

This volume should be on the shelves and libraries in every leading research University worth the name and worthy of Periclean Athens at her best.

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