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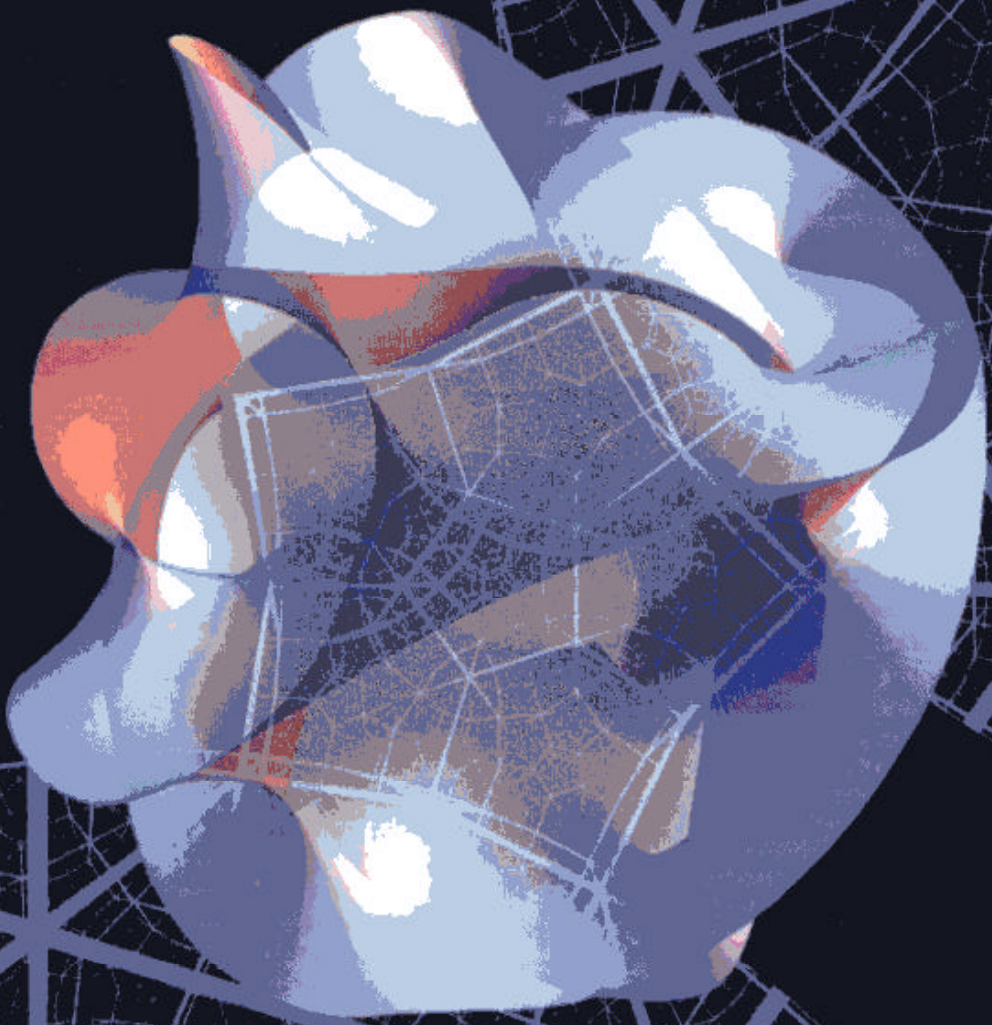

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Continuum Theory (CT): its particle-tied aether yields a continuous auto-creation, non-expanding cosmology and new light on galaxy evolution and clusters.

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Here the following **Corrigenda** applicable to the published version have been implemented, but its pagination has been retained.

1. Colour, as submitted, but lost in the published version, has been restored to Figs 5, 6 & 8, which illustrate seven example galaxy forms.

2. On pp 422-423 the two paragraphs, respectively beginning ‘In (c) NGC1672’ and ‘Non-ionized material’, were published in reversed order. This has been corrected.

3. In the reference listing, the one [23] to Barr, NL, 1953, has been supplemented by addition of the exact date, document number and no of pages of that report. This information and the release of a hard-copy of the document has now been agreed by appealing to the US Freedom Of Information Act (FOIA).

Note. It was our examination of comprehensive previous observations of sky brightness at heights of 18-35 thousand feet, and Barr’s clarifying presentation of them, which enabled us in 1959 to recognize the significant departures from accepted scattering theory, which were the original trigger for all my work reported in the present and in the previous paper.

I have presented to the Royal Astronomical Society library at Burlington House, London, a copy of the published “*The Physics of Reality:....”* volume, which contains 52 papers in all.

CONTINUUM THEORY (CT): ITS PARTICLE-TIED AETHER YIELDS A CONTINUOUS AUTO-CREATION, NON-EXPANDING COSMOLOGY AND NEW LIGHT ON GALAXY EVOLUTION AND CLUSTERS

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Our preceding paper "Implementing Maxwell's aether....." (Paper I) concluded:-

(A) Maxwell's aether, ignored in Relativity, is a massless, quasi-superfluid continuum of extremely high negative charge density; (B) Fundamental particles are not infinitesimal singularities within the aether but develop their mass by being 'made out of it' (hence the name Continuum Theory) as finite-sized vortical constructs of its motion. So reproduction ('auto-creation') of more of them requires only the addition of suitable dynamical energy, with Ampere's law providing charge-coupling in shear to get rotations.

(C) In the resulting gravitational process, generating the Newtonian force simultaneously also generates a radial electric field, the Gravity-Electric (G-E) field, whose action on astronomical plasmas could explain the flat tangential velocity profiles of spiral galaxies without resort to Cold Dark Matter (CDM) if outward disc flow is present. One of the objectives here is to provide that flow by axial infall and to examine its consequences.

But first, if particles are 'made out of aether' the associated random aether-charge motion will generate radiation (the CMB) and impose four distance-cumulative, wavelength-independent transmission effects upon electromagnetic waves. One of these – a redshift – we see here as the cosmic redshift, plus intrinsic redshifts in stellar and galaxy 'atmospheres'. Such a redshift appears to have been reliably observed with caesium clocks over long ground-level paths in 1968 but, lacking an appreciation of its mechanism, its wide significance was doubted. In fact, our extrapolation to intergalactic conditions dispenses with the BigBang. The other 3 transmission effects are:- spectral line broadening, scattering and attenuation, each of which has significant astronomical/cosmological expression.

If the cosmic redshift is not a velocity, the reason for Dark Energy vanishes. In the resulting no-expansion cosmology the Universe was originally equipped with randomly moving aether, from whose motion and energy content the entire mass content of the Universe has grown over time by auto-creation, the local rate of which experiences positive feedback and acceleration as gravitational accumulations drive energy levels higher. Hence the clumpiness of galaxy distributions.

The infall of cosmogonically young material from the auto-creation auras of clusters has 3 major implications.

(1) It completely inverts the BigBang perspective that low-metallicity material, widespread in galaxy haloes, is very ancient.

(2) Quasi-axial infall of such broadly neutral material (mostly H) onto a Spiral will spread out in the galactic plane, driven radially from the ionizing bulge by the G-E field, maintaining constant tangential velocity; all without CDM. This pattern means that the arms, although trailing, are actually being blown outward (unwrapping). See Paper I for detail. For such ongoing disruption of Spirals to prevail so widely means that originally each must have started life as an a.m.-conserving, tightly-wound spiral of mostly neutral, cosmogonically young material (mainly H), in which G-E field action was minimal until star formation and ionization had set in.

(3) In cluster interiors, other cluster members may deflect the two infall streams as they converge onto a Spiral, introducing a dynamical rotational couple near the centre, with an axis roughly in the galactic plane, to produce a Barred Spiral. Cessation of infall then results in endwise collapse of that bar, yielding a fattened Elliptical. Those are indeed typically concentrated in the centres of clusters and show a dearth of active star formation, consistent with being deprived of young infall.

We present images and diagrams in support and elaboration of (2) and (3).

The CT model for quasars provides large intrinsic redshift by the CT analogue of Transverse Doppler Effect and offers light-element synthesis by the evolutionary precipitation of a runaway rotational shrinkage, with mass annihilation and emission of a GRB.

Of special interest, relative to the arm's-length nature of BigBang cosmology, is that continuous auto-creation (CAC) cosmology is in principle available near-by for direct study and the development of strong observational constraints. In the context of (1), the very low metallicity (Pop II) of globular (star) clusters abundantly present in the haloes of galaxies points to them being (infallen?) local concentrations of quite young auto-creation. In that case the 'blue straggler' stars more recently formed in their core regions may be our youngest examples of ongoing auto-creation.

In summary, CT offers a much more directly observable Universe, with no BigBang, CDM, or Dark Energy, and a CMB that records the true temperature of intergalactic space along the path taken by the radiation. Its closely cavity-radiation character arises from the random aether's transmission-related opacity (Olbers' Paradox) of the infinite CT Universe. Fundamentally, the aether's random motion constitutes all-penetrating random electromagnetic excitation at the atomic scale that may offer the accommodation between classical physics and stochastic quantum electrodynamics so long obstructed by Relativity Theory.

Keywords: cosmology; auto-creation; metallicity; particle-tied aether; dark energy; redshift, cosmic; redshift, intrinsic; galaxies; QSO; inertia; Olber's paradox.; photoelectric effect.

1. Introduction

As set out in the preceding paper [1] ('Paper I'), CT is built upon two findings.

A. Maxwell's aether, far from being a negligible aspect of the Universe, is actually seen to be a massless and ubiquitous quasi-superfluid continuum of extremely high negative charge density ($>10^{30}$ C.cm^{-3}).

B. Mass-bearing fundamental particles are **not** infinitesimal singularities, but they develop their mass property by being 'made out of aether' as non-zero-sized vortical constructs of its motion (hence 'Continuum Theory').

Main Contents

If B is how the mass property is generated, the production and reproduction ('auto-creation') of more of such particles requires only the addition of suitable dynamical energy, some of which must be rotational.

Relative motions in a superfluid are by definition incapable of initiating rotation. But in this case Ampère's Law operates on the aether charge to limit the superfluidity and provide the necessary coupling in shear. This coupling, with associated magnetic energy storage, also provides the elasticity in shear to enable the aether to support the propagation of transverse electromagnetic (TEM) waves, but these are not the right kind of aether motion to have mass [1]. Conversely, by making particles out of aether electric charge, their wave-like diffraction may be explainable.

On the other hand, TEM waves do possess electromagnetic energy, as must all forms of aether motion. This is a point hitherto neglected in the former context of dubious motions of a rather negligible aether, but it is central to the auto-creation cosmological theme to be developed in this paper. As I noted in 2000 [2], the recognition of that energy in CT is essential if the Second Law of Thermodynamics is to be sustained.

Consequently, in CT the equating of energy to mass now has restricted validity. In no circumstance may the very obvious energy of TEM waves be treated as mass.

In General Relativity (GR), by contrast, Einstein's proposed universal applicability of the now-famous (although not his own, but apparently that of Poincaré (1900) [3]) mass-energy equivalence formula $\boldsymbol{E = mc^2}$ offers what is from an incisive point of view an uncritical shortcut between events and processes without due care as to how the equivalence is physically or dynamically achieved in the particular case at issue. This fixation with energy rather than with mechanism seems to have been adopted from Thomson & Tait (1867)[4].

2. Random Motion of the Aether

By making particles out of aether in vortical motion, as envisaged in Paper I, they are not to be seen as sharply delimited objects, but are "indefinitely co-extensive" – Larmor (1904) [5]. So any random motion of atoms/molecules built of such particles, as in a gas, will surely entrain the intervening aether also, endowing it with a corresponding random motion.

In fact, of course, the 'particles' can vary in two main ways — their mass and their electric charge. The particle **mass** affects its surroundings through the aether pumping mechanism of its constituent fundamental particles, whereas the particle **charge** affects the surrounding aether charge directly through the charge density gradient that it causes. The ratio of these is directly calculable as the ratio of the electrostatic force to the gravitational force between two identical particles, namely $\boldsymbol{q^2/Gm^2}$, where $\boldsymbol{q}$ and $\boldsymbol{m}$ are the charge and the mass. This gives 4×10^{42} for electrons and 10^{36} for protons (1836 x electron mass). So the r.m.s. amplitude of the aether motion, and the resulting effects, are extremely, and principally, sensitive to the degree of ionization present in the gas.

In this frame I now reinterpret the famous Michelson-Morley result as having shown that, to the limited precision then available, the aether is indeed 'particle-tied' in its motions. The result is that TEM waves reach us along astronomical paths whose aether is in random motion mainly related to the $\boldsymbol{PT}$ and ionization there. So we consider next the five consequences of that random motion, and their big implication for cosmology.

3. TEM Waves: the four Transmission Effects of Aether Random Motion

All four are wavelength-independent and path-length-cumulative. Individual increments are proportional, so overall growth is exponential w.r.t. distance. The rates of all four increase with the gas particle velocity present so, for a Maxwellian distribution of velocities, the growth rate with distance varies as the square of the gas temperature along the path. All are steeply enhanced by ionization. Having a common cause, correlated occurrences are to be expected — a powerful diagnostic.

First we note the principal character of each, and then add some discussion to set each in context.

1). Redshift

"Random transverse velocity (RTV) redshift". Each transverse local displacement of the propagating aether stretches the wave, relative to the rest of its train, along a corresponding hypotenuse. Propagation is still at ***c*** relative to that aether but (vector addition being legitimate in CT [1]) the vector resultant is >***c***, so **transmission time is not affected**. In this case (in contrast to sound waves), precisely transverse displacement does rotate the propagation vector because Ampére's Law provides aether coupling ('viscosity') in shear, as noted above. In the CT frame, sudden jumps in the aether transverse velocity encountered by the TEM wave are unlikely, so its stretching will actually be the integrated product of the resulting transverse accelerations experienced.

2). Wavelength dispersion.

"Random longitudinal velocity (RLV) line-broadening". Frequency modulation due to the longitudinal components of the propagating aether motions, a process explored mathematically by [6]. The effect emerges as a valuable substitute for 'rotational broadening' in stars or to invoking 'surprising' turbulence.

3). RTV deflection scattering.

Associated with **(1),** this has directional properties diagnostically different from Rayleigh, and is seen high in the Earth's atmosphere, see the introduction to [1].

4). Attenuation

Due to the energy scattered. It affects distance estimates based on the inverse square law.

3.1. *Significance of the Transmission Effects*

1. RTV redshift. As shown later (Sect. 6), the cosmic redshift is to be seen as one example of this redshift. Because of the extreme sensitivity of aether motion to ionization, combined with high temperature (high particle velocity), the plasmas of stellar atmospheres and galaxies are expected to impose intrinsic RTV redshifts on emergent radiation, even though the path traversed is relatively short.

Since TEM waves are not the right kind of aether motion to possess mass, this redshift now needs in CT to replace the relativistic gravitational redshift. In Section 5.1 we consider diagnostic observations of the solar redshift in this context.

RTV redshift also needs to be allowed for dynamically in any virial longevity context for stellar clusters or in assessing the relative positions and velocities of galaxies in a cluster. Some star clusters exhibit class-related differences in redshift, the O-B group apparently receding faster [7-10]. Known as the 'K-term', Allen [11] records the effect as being much less for less-bright stars of the same class and as zero for F0-K0, rising again slightly at M0, with their deep atmospheres. Weaver [12] further associated the term with an unexplained line-broadening (our RLV effect (2)?). Velocity-equivalent values for the intensely radiative W-R (Wolf-Rayet) stars (in binaries) range to >150 km/s, relative to their O or B companions [13], so the total for the W-R probably ranges to >250km/s. And much more (>1000 km/s?) for plasma-rich Spiral galaxies, relative to their plasma-poor Elliptical companions in the same cluster, e.g. [14], [15]. Data presented by Finlay-Freundlich [16] convinced ter Haar [17] of the presence of intrinsic redshifts in stellar atmospheres**.**

2. RLV line-broadening during transmission. It is the variance that grows, so the line-width increases more slowly than the RTV redshift, which may visually dominate when large, as in quasars. Classical **i**nterpretation of line-width as temperature of the emitting plasma often leads to conflicts with other constraints, the commonest being that a star's line-width temperature is much higher than its colour temperature. RLV line-broadening appears to improve upon both the escape interpretations that have been applied. These have been:-

(a) "Rotational broadening" – the doppler result of opposite sides approaching and receding – is widely applied to the line-widths of very hot early-type stars (W-R, O, B, A). But Struve [18] (p.130) noted a

"startling decline at F5 [which] is unquestionably real"; an a.m. disposal problem still unresolved. The extreme ionization-dependence of these CT transmission effects means that quite a small drop in temperature and depth of the stellar atmosphere at that evolutionary stage might suffice, casting doubt on the interpreted fast rotation of earlier-type stars.

(b) 'Surprising' or 'unexplained turbulence'. In 1958 three major UK thermonuclear fusion devices (ZETA, SCEPTRE III & IV) were dismantled for exhibiting 'unexpected turbulence' because they yielded line-width temperatures (~5 MK in one case) some 20-fold higher than was realistic on four distinct other grounds [19]. This provoked Spitzer [20] to consider the problem to be "of great interest in basic physics'. Spectral observation had been along a chord across the pinched toroid. 'Surprising turbulence' apparently remains the official reason for this disaster, and a caveat for subsequent designs. If RTV line-broadening was really the cause, it was just the temperature-monitoring that was inappropriate.

3. RTV deflection scattering. As noted [1], it was my recognition of this phenomenon during astro-navigation development work in 1959 that put me onto the CT trail in the first place. The unpredicted brightness gradient feature which concerned us particularly for star search purposes was that at high flight altitudes, and more markedly with increasing height, the observations [21 - 23], probably done with just this purpose in mind, showed that as the solar altitude in the sky goes below 40^0 a hump of brightening begins to appear in the opposite direction, centred on the antisolar point. We were able to show with mathematical rigour that what we here call 'RTV deflection scattering' by a randomly moving aether would explain this and other details very well. The treatment runs like this.

The scattered brightening at any point on the sky is the quotient of two functions. One (i) is a scattering probability function that decreases radially in all directions away from the source direction (Sun). The other (ii), in the denominator, is the angular area of the elementary annulus from which that light reaches the observer. This area increases up to the angle $\pi/2$ from the source, but decreases to zero at the anti-source point, thus concentrating all the probabilities and providing a brightening rate which, at some point, inescapably surpasses the rate of decrease associated with the probability function. The scattering function along horizon-ward radii from the Sun would be very different from along zenithward ones, so the patch of brightening is not circular. Diagnostic of the wavelength-independent RTV mechanism, the colour of the added light appears to be that of the Sun.

The *gegenschein* [24] is a similar, but far dimmer, phenomenon in the night sky from the ground, also observed by Pioneer 10 at 1.86 AU [25] but is sometimes thought to be associated with the dust-caused zodiacal light. It now appears to have an RTV scattering origin. In this case, the low intensity of the scattered light would be because solar illumination is then confined to the cooler and tenuous gas in interplanetary space.

4. Attenuation due to RTV scattering. Neglecting this attenuation, in addition to the inverse square law with distance, means that we currently over-estimate distances, by large amounts at big redshifts. I see this attenuation/opacity as the probable explanation of Olbers' Paradox and as providing the solar sub-tachocline extra opacity needed [26] for matching the Standard Solar Model to helioseismology.

1 & 4. Although both redshift and attenuation grow exponentially with path-length, the cosmic redshift-distance law appears linear, possibly because it is obtained by comparing these, the exponents of which are constrained by the same parameters.

4. Aether Random Motion; the Fifth Effect: the CMB Radiation

Random aether motion implies corresponding accelerations of electric charge. These will generate synchrotron radiation at frequencies that correspond to the gas/plasma temperature of the extended region through which it arrives. So the ~2.725 K black-body temperature of the CMB radiation may indeed be that of intergalactic space, slightly enhanced where the path passes a galaxy cluster (e.g. Coma), or groups of them. It was to explain the observation of just such correlations that the Sunyaev–Zel'dovich effect was proposed and has widely been applied since 1983, even to the stage of using it to predict unseen groups of galaxies. But the S-Z effect invokes quantum energy exchanges not applicable in CT.

The CMB's precisely black-body character is attributable to the effective optical depth implied by the scattering over cosmic distances, just as stars also exhibit nearly black-body spectral continua indicating the temperature at the atmospheric (photosphere) level where substantial opacity occurs. The CT explanation, offered above, is very simple and potentially very

informative. Limitations of the present paper prevent further discussion here.

5. RTV Redshift in the Solar Environment

5.1. The Solar Redshift

This redshift is customarily cited, uncritically, as being consistent with the relativistic prediction of gravitational redshift (velocity-equivalent 0.636 km.s^{-1}). This is incorrect. Early measurements [27, 28] had already shown that along radial traverses in many directions on the solar disc the redshift is well below the prediction at the centre, rising sharply to well above it as the limb is approached. This was amply and in diagnostic detail confirmed by M.G.Adam and her colleagues at the Oxford Solar Observatory, using a sophisticated form of the Fabry-Pérot interferometer [29].

We note two features here. (i) At the disc centre, absorption lines of the same element but at different wavelengths showed very different redshifts. (ii) Absorption line profiles show distortion from the tip/core to the wings, the wings (being the first-formed part at the reversing level deep in the photosphere) being redshifted less, relative to the core (formed at shallow level as the radiation emerges). Both these features show a gradient of redshift with depth that is far steeper than the $1/\boldsymbol{R}^2$ of the relativistic prediction. At the limb, the rise looks like a zenith-angle (path-length) dependence for the emergent radiation.

Evidently the solar redshift is completely inconsistent with the relativistic interpretation but is qualitatively in accord with RTV redshift within the photosphere and the atmosphere above.

5.2. Transmission Redshifting by the Solar Corona

This appears to have been observed on two occasions.

(a) Late in 1968, as Pioneer 6 passed behind the Sun, the received frequency of its 2.292 GHz telemetry carrier wave showed a progressive fall as the sightline moved from 9 to 3 solar radii distance from the centre; a fall which was recovered on emerging the other side (Fig. 1). The fall amounts to a doppler-equivalent redshift increase of 9 m.s^{-1} between these positions.

Simultaneously, “spectral bandwidths increased slowly at first, then very rapidly at 1 degree from the sun. In addition, six solar "events" produced marked increases of bandwidth lasting for several hours” [30]. This is nice correlation of RTV-RLV action.

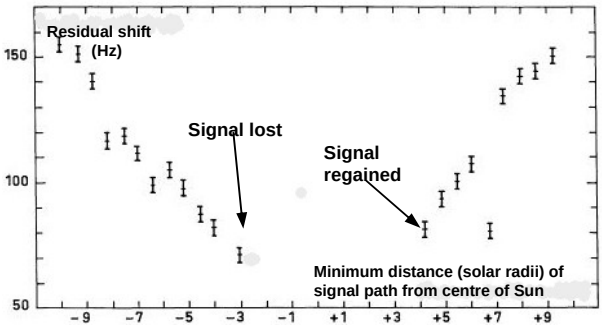

Figure 1. Changes of carrier-wave frequency received from Pioneer 6. ‘Residual shift’ is after removal of steady transmitter drift and orbital doppler correction. Modified from Fig. 1 of [31]. Reproduced with permission © ESO.

(b) The other occasion was by Sadeh et al 1968 [32]. They, for several years, had used caesium clocks to monitor the 21 cm hydrogen line absorption (1420 MHz) by Taurus A, near its occultation by the Sun. A reasonable view of their Figure 1 is that, relative to sight-lines several degrees away from the Sun, the observed frequency had dropped by ~80 Hz at the two closest-to-Sun paths, although the distances were not stated. This frequency drop is a doppler-equivalent redshift ($\boldsymbol{c.df/f}$) of ~17 m.s^{-1}. Since this observation encompassed the redshifting difference by much more of the corona (and chromosphere?) than that recorded in (a) above, these values are in close mutual agreement as to the magnitude of the RTV redshifting by the solar atmosphere in those circumstances.

Both these results were dismissed as spurious in 1971 [33] when reporting radar pulse-delays and path-length-increase observations aimed at measuring the relativistic gravitational TEM wave deflection by the Sun. Redshift was assumed, relativistically, to imply a slowing of wave transmission, in which case the observed redshifts implied a slowing some two orders greater than the observed pulse delays. In fact, as emphasized above, RTV redshifting **does not affect** transmission time. So CT can make sense of the disparity but Relativity fails, further justifying its rejection.

6. Ground-wave Observation of RTV Redshift, with Extrapolation as the Cosmic Redshift

Reported in the same paper as (b) in Section 5 by members of the US Naval Research Laboratory [32], RTV redshift appears to have been observed in a persuasively careful manner during the summer of 1968 as a real phenomenon, over ground-level paths up to 1500 km from a base at Cape Fear on the East coast.

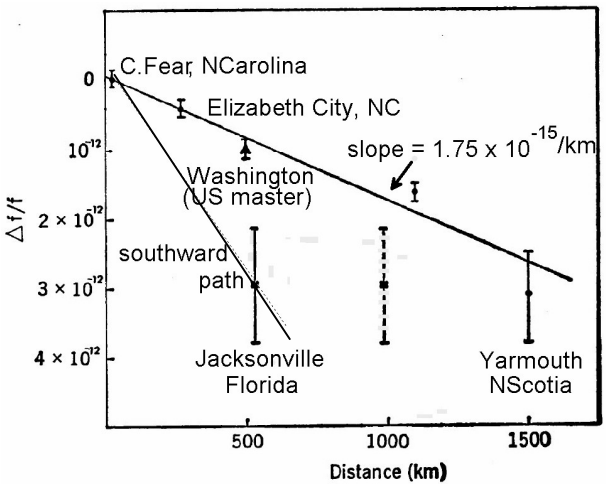

Figure 2. Plot of the redshift observations, modified from [32]. The slope indicated is for the line drawn by the authors. The Washington point was a check for overall stability of the set-up. The Jacksonville point has been replotted at the correct distance from C. Fear. (The published position is shown broken.) The much steeper slope and bigger observational scatter for that path supports our RTV expectation of the effects of temperature and/or ionization.

Each data-point (Figure 2) was for an inter-compared set of 3 caesium clocks, stationary for a week, so any doppler contribution was ruled out. Only the ground wave was used.

In 1969, taking the indicated slope as for 1 bar, 290K (temperature not reported) and air molecular weight 29, extrapolating to neutral H at 2.75K and density 10^{-25} kg.m^{-3}, I got $\boldsymbol{H_0}$ = 59.5 km.s^{-1}.Mpc^{-1}; well within the range considered, even now. Encouraging?

But that density was the only offering then available, being a mean (inappropriately) for a relativistic expanding Universe (also inappropriately). It seems far too high for real intergalactic paths. But I conclude that allowance (Sect. 2) for even a quite low degree of ionization would allow the density to be at least 8 orders lower and still yield acceptable $\boldsymbol{H_O}$.

So we now proceed on the basis that the cosmic redshift is not a velocity.

Here at last, though many have tried before, seems to be an observationally well-supported escape from the 80-year bondage to which cosmology physics has hitherto been confined by its adherence to the doppler origin of redshifts.

6.1. Effective Aether Random Motion, a very Smoothed Result of Particle Motion

To develop the foregoing observational result it is instructive to get some measure of the degree to which the particle motions are reflected in the r.m.s. aether velocity from which the observed redshift arises. Let us consider, for this purpose, the redshift that would arise if the aether velocity were to change by the most probable particle velocity of the gas every distance along the light ray path equal to the mean gas particle separation. This represents an ideal standard.

It turns out [34] that the observed rate is **5 x 10^{13} times smaller** than that which would be associated with our ideal standard. This, although very imprecise, gives us some guidance as to the high degree to which particles made out of aether involve aether motions which are actually "indefinitely co-extensive" [5]. It also shows how extremely small were the individual TEM wave transverse deflections, even under ground-level Earth-atmosphere conditions. How much tinier they must be, therefore, in building up the cosmic redshift in intergalactic space at 2.7 K. So the conclusion is that this is why this process produces no currently detectable blurring of astronomical imagery. But it does predict an ultimate limitation on resolution. The possiblity of hitting it might need to be considered before planning VLBI using an Earth-Mars baseline!

7. QSO Intrinsic Redshifts, Aberration, the Lyman a Forest and Velocity-Dependent Inertia (VDI)

7.1. Stellar Aberration and Redshifts

The RTV redshift discussed above uses a velocity triangle related to aether motions, but is otherwise essentially the same as the classical one of Bradley, for aberration, which relates to objects (ourselves and a star). We have already shown that in CT the hypotenuse can >**c** but propagation never exceeds ***c*** relative to the local aether medium. So if there is a sufficient gradient of transverse velocity in the intervening space between objects the **effective overall resultant can build to >c without limit**, providing what we here call aberration-related (A-R) redshift.

Let us clarify the nature of this A-R redshift. The classical velocity triangle treatment of Bradley leads to an aberration angle $\boldsymbol{tan^{-1}v/c}$, and the SR formulation is $\boldsymbol{sin^{-1}v/c}$ (to prevent vectors exceeding $\boldsymbol{c}$), where $\boldsymbol{v}$ is the transverse velocity of the observer relative to the source. At the small angle (20.6 arcsec) produced by the Earth's 30 km/s orbital velocity, it is not practical to distinguish between these formulations (10^{-7} arcsec difference). However, the simple relativistic treatment also predicts, since it is only concerned with the relative velocity of source and observer, an appropriate aberration for, say, a stellar spectroscopic binary component moving transverse to the line of sight. This is not observed; if it were, such binaries would appear to scoot to and fro across the sky, a behaviour which would long ago have been used to detect them without a spectrograph.

Although there have been roundabout attempts to explain this in relativistic terms, appeal in CT to a transmitting medium (the aether) resolves this at once. In the case of the Earth's orbital velocity the gradient of transverse velocity, between transmitting medium and receiver, is clearly concentrated relatively near the receiver, and a classical triangle of velocities yields the aberration angle.

For a binary star component (Figure 3), on the other hand, the gradient of transverse velocity, relating to the orbital velocity of the source, is somewhere near the far end of the path, and the aberration angle produced there mainly results in the observer receiving rays from the star that were not those originally emitted directly towards him so, as the treatment given below shows, little or no visible aberration is to be expected.

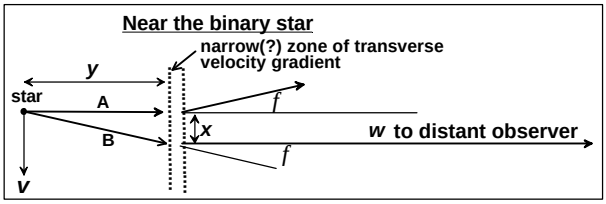

Figure 3. Aberration diagram for a distant orbiting binary star in the presence of a transmitting medium (aether)**.**

Analysis of Fig. 3.

Distance y may be of the same order as the binary orbit radius. The aberration angle is:-

$$f = tan^{-1} v/c \;\; and \;\; x/y \approx tan\, f$$

The observer sees light ray B instead of A.

The observable angular displacement is thus:-

$$a_{obs} = tan^{-1} x/w \approx (y/w)\, tan^{-1} v/c$$

which will commonly be too small to detect. In very favourable circumstances it might just be possible to do so using VLBI techniques.

It is easily shown that, contrary to simple intuition, the total aberration does *not* depend upon whether the gradient of transverse velocity is steep and confined to a small part of the sight line, or is rather widely distributed. What *does* change with position of the gradient along the sight line is the amount perceived by the observer.

Note that the associated Continuum Theory redshift ("aberration-related (or A-R) redshift"), equivalent to the "transverse Doppler effect" of Relativity Theory, depends only upon the actual aberration, wherever it occurs, not upon its perceived amount.

Quasars are complex objects and have much to tell us. We will now show that for quasars, in combination with the extreme velocities of circulation around an object which may develop during its shrinkage under the action of velocity-dependent inertia (see Paper I, Sect. 16**) much, or even most** of their redshift may be instrinsic and of the A-R variety. VDI was also favoured by Ghosh [35]**,** but for different reasons.

7.2. QSOs (quasars)

The main features of quasars are as follows.

Diminutive, star-like image size and small physical size, evident in luminosity changes on short timescales. Ultra-high radiation energy output if all the redshift relates to distance on the cosmic redshift scale.

Very broad Lyman a hydrogen emission line (normally at 1216 Å), redshifted ($\boldsymbol{z} = dl/l$) in the range <0.2–7.1 [36] (the 2011 maximum known).

Numerous (up to >100) Ly α absorption lines, the so-called "Lyman alpha forest", extending along the shortward flank of the main hydrogen Ly α emission, starting very close to its peak. Related mostly to the latter there are also metal-ion absorptions (and sometimes emissions) for CIV, NV, SiIV, MgII and FeII. In some QSOs, the so-called 'BAL QSOs', these metal absorption lines are very broad [37]. The forest lines nearest to the main emission get further apart as the latter's redshift increases [38]. The number of forest lines increases much more than proportionately with $\boldsymbol{z}$ for $\boldsymbol{z} > 2$ [39].

Historically, it has been envisaged that all these absorptions, at progressively lower redshifts, must be due to clouds or galaxy fringes in intergalactic space along the sight-line. But where the sightline traverses one of the great voids in intergalactic space, corresponding gaps are not seen in the forest [40].

Also, MJ Rees (in discussion in [37], [41]) stressed the containment problem posed by the column depths and the implied cloud temperatures of at least several

thousand Kelvin if these are at the edges of systems like galaxies. (Note that such temperatures would conflict directly with our 2.7K interpretation of the CMB (Sect. 4)). Nevertheless, a conviction reached by 1995 that the absorptions are completely extraneous to the quasar itself [42] seems to have distracted all subsequent studies from their possible relevance to the quasar itself. We will seek to remedy that here.

Particularly important is that the luminosity of $z > 1$ quasars is uncorrelated with z, contrary to expectation if z were a measure of distance [43]. Moreover, in 1995 the highest-z quasar observed had stood at 4.89, their apparent space density dropping beyond $z = 3.0$ [44]. Since then higher-z quasars have become increasingly difficult to find. The highest z has crept slowly from 6.28 (2001) [45] to 7.1 (2011) [36]. Associated with a >2 orders drop in the forest flux, this has been interpreted (assuming all the redshift is cosmic and relates to distance) as showing that at z >6 we reach the post-BigBang 'Gunn-Peterson trough' in which absorption by neutral H was predicted to have been very high [46].

Apart from those cited above, Arp [47] has been a stalwart advocate of the presence of intrinsic redhifts in quasars, based on many examples of their apparent companionship with galaxies of lower redshift. The contention [48] that they have been ejected from galaxies does seem problematical, but a vigorously rotational environment near a galaxy might be the key.

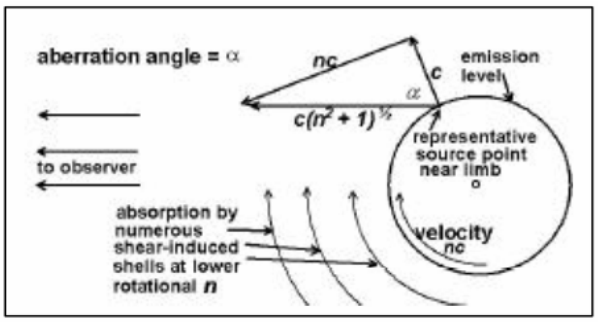

Figure 4. The new model for quasars. Each of the shear-induced shells is seen as responsible for the individual forest line absorptions at successively lower transverse velocity and A-R redshift, evident to the observer. When this was drawn in 1995, $z = 4.89$ was the highest that had been observed, and it sought to show the extreme possibility that all of it could be intrinsic. It demonstrates the geometrical limitation on escaping flux which arises when the intrinsic (A-R) component of z becomes large. In fact we do not at present envisage that the redshift of any quasar actually includes an intrinsic component which is that big. Superluminal factor – n.

Features of the new QSO model (Fig. 4) are:-

1. Velocity-dependent inertia (VDI), the result of recognizing that gravitational communication at velocity c drastically reduces centrifugal/inertial (but not central gravitational) force when orbital velocity approaches and surpasses c. This is because the effective volume of the "rest of the Universe" responsible, under Mach's Principle, for provision of inertia, becomes drastically reduced by retarded-field action.

So *superluminal* shear-surface velocities, due to gravitational shrinkage of high-angular momentum shells, become possible. Note that in CT (Paper 1) such velocities do not result in a relativistic mass increase of the material, no matter how that velocity is achieved.

2. Much of the redshift can be intrinsic to the body, being of aberration-related (A-R) type, and amounts to $z = \sqrt{(n^2 + 1)} - 1$. Neglecting any cosmic contribution, $z = 4.89$ requires $n = 5.8$ and a = 80.2°. So the highest-z quasar could, in 1995, actually have been 'on our doorstep'. But the radiation received would have been very weak, due to limitation of its escape in our direction to so far round to the side. This geometrical effect is seen here as the real reason for the drop in quasar intensity at high redshift that has been attributed to the Gunn-Peterson effect.

3. The bigger the redshift (higher n), the bigger the number of shells (= forest lines), with a fiercer shear velocity gradient towards the centre, and a bigger redshift interval between shells, as observed.

4. Excess central-emission-line breadth is primarily due to rotational, not RLV, broadening (n varies with latitude on the emission surface). Temperatures may be high, due to the rapidity of contraction (see (8) below), so is the source of its intense radiation.

5. The Lyman?α forest and the high-ionization metal lines are redshifted absorption as the radiation passes outward through shells, with the metals and the higher temperature being from closer-in shells, where conditions may verge between emission and absorption. The gravitation of the central body resolves the confinement problem. They are **not** due to clouds in intergalactic space, whose temperature can thus be the 2.75K indicated by the CMB (Sect. 4).

6. Perspective effects, such as RLV line-broadening if a shell is traversed obliquely, may be responsible for the line-breadths in BAL QSOs. Other perspective effects will need to be considered.

7. Quasars are **not** at cosmological distances. It may not be difficult to separate the cosmic and intrinsic components of their redshift (see (12) below). Their spatial association with (or in?) galaxies is entirely

reasonable. The need for a high angular momentum source cloud makes their occurrence in isolation less likely but would be consistent with occurrence as AGN.

8. As ***n*** rises towards and past unity during contraction, centrifugal constraint upon shrinkage decreases. This situation is the opposite of the Keplerian one; the higher the velocity the smaller is the central mass needed to keep it there, possibly precipitating an uncontrolled shrinkage. The consequent rapid gravitational compression will yield superhigh ***PT*** in the interior, and perhaps light element (D, He, Li?) nucleosynthesis, thus replacing the Big Bang in this regard, as is required by our recognizing the cosmic redshift as a transmission effect (Sect. 6). The rapid shrinkage may expel these materials as an axial jet, assisted by the G-E field, with associated synchrotron (radio-loud quasars?; galaxy M87?) and other emission, dispersing them into the cosmos.

9. In more massive quasars the process may go further. Under CT a particle only possesses mass if there is room to accommodate the required aether dynamical configuration. Further compression will annihilate the mass, with enormous energy release (GRB?), so the gravity exerted by that mass disappears too, contrary to current black hole models. Such quasars (and those in (8) too) may decay/expire on quite short time-scales, but the end product is for speculation.

10. The observation of a very high orbital velocity of an object around an unseen centre, e.g. that of the star S2 around the Sgr A* feature at the centre of the Galaxy [49], has been regarded as diagnostic of the presence of a black hole. In such cases the mass has been assessed by applying Kepler's Laws plus, perhaps, a velocity-related relativistic mass increase of the orbiting object. Not only is the latter inapplicable in CT but we have reasoned (Fig. 4 and (1) above) that in the presence of VDI the assumption of a Keplerian orbital velocity structure becomes increasingly invalid as the velocity approaches and surpasses ***c***. Thus the inferrable mass of the central object (quasar) may be quite small and bring the problem of mass-containment without mass-annihilation within reach of solution.

11. Their smaller mass and the drastic reduction of distance by our recognition of intrinsic A-R redshift may help to remove quasars from their reputed and very problematic class as the most energetic objects in the Universe.

12. Quantifying the intrinsic component. If we assume that both Ly b (1026 Å) and Ly a (1216Å) absorption are present in the same innermost shell of the quasar then, if the short end of that a forest begins to overlap the longest members of the b forest it is immediately clear that at least 18% of that quasar's redshift is intrinsic. If the Ly a forest lines can be traced further shortward among the Ly b forest, then the intrinsic proportion is correspondingly greater.

13. A-R redshift is also to be expected in the case of the transverse velocities of binary stars but this does not seem to have been sought because aberration is not observed in this case (Sect. 6.1). In the case of the star S2, mentioned in (10) above, it has been possible to trace an orbit less than 10 arcsec across, but if aberration were present the star's apparent proper motion would be about one degree. We have shown above (Fig. 3) that if the gradient of aether transverse velocity is close to the far end of the sightline the observable aberration is negligible but the associated A-R redshift should still be present. **The spectrum of S2 should be checked for this**.

8. Dark Energy?

The demand for Dark Energy to drive an apparent acceleration of expansion has arisen **solely** from treating the cosmic redshift as a velocity in a relativistic context. Applying the relativistic doppler formula has the effect of cutting down the high-end (distant) velocities, so that ***c*** is never attained at high redshift (***z***). This makes the near ones appear relatively fast.

If the cosmic redshift is not a velocity the purpose of Dark Energy vanishes.

So does that of Einstein's big lambda L.

9. A Non-expanding, Continuous Auto-Creation (CAC) Cosmology for CT

With no expansion, there is no basis for regarding the Universe as anything but truly boundless and infinite. This resolves the question of what keeps all the high-charge-density aether together against its immense self-repulsion. The simple CT answer is "more of the same". In other words, the repulsive force-balance ensures that the mean charge density of the aether is the same throughout the Universe, apart from 'local' disturbances by gravitation.

If electron-positron pairs are related to the mean density of the adjacent aether in the manner illustrated in Figure 1 of Paper I [1], this is of profound significance for the uniformity of particle creation throughout the Universe, particularly if, as we will suggest, the electron, with its specific charge, may have

been the first-persister in the creation sequence on account of its stability.

CT has found that fundamental particles are vortical constructs of aether motion. Consequently, random motions of the aether charge have in principle, (via the coupling of relative shear displacements provided by Ampère's law) the potential for auto-creating such vorticity-based particles, especially as particle-antiparticle pairs.

So our **CT cosmology is that the Universe began, in the indefinably distant past**, as an infinite extent of randomly moving aether, from whose motion energy all the mass in the Universe has progressively been created **and, importantly, is ongoing today**.

This cosmology escapes, in what we hope is a physically acceptable manner, from the Big Bang absurdity, recognized and rejected in Paper I [1], that any mass or amount of energy, let alone the entire mass-energy content of the Universe, can be present within a zero volume. Similar discomfort recognition underlay the 'steady-state' cosmologies [50 - 52] in which creation was supposed to be ongoing and causing the expansion but only balancing it out.

The CT cosmology, in contrast, is a fully evolutionary one, envisaging that mass-creation would only become extinct when, and if, aether random motion were to become too low.

Much scientific benefit should accrue if we are able to bring observational constraints to bear on mass-creation as an ongoing process, so we pursue this in the next Section in some detail. Suffice to note here that as gravitational interactions and star formation drive environmental energy levels higher, corona-fashion, so the rate of auto-creation around that place is enhanced, providing a positive feedback for the formation and growth of galaxy clusters and even apparently to the much smaller scale of globular (star) clusters.

This cosmology invalidates the application of the mass-energy equivalence ($\boldsymbol{E = mc^2}$), as currently perceived, in that mass-bearing particles are to be created from the motion energy of the massless aether.

As I stressed in my PIRT VII (2000) paper [2] and in Section 1 of this one, this aether motion energy, even in a massless form, beit as TEM waves or as random motion, needs to be recognized in all energy-balance calculations, such as those involving entropy.

This perspective has the benefit that neutrinos, as pure eddies, not vortices, can have energy content but yet be massless and wholly unaffected by gravitational fields. Nonetheless, as pure eddies of aether charge, [2] they must surely possess a magnetic field. I suggest that it is this, currently unsuspected, property that may lie behind the observations that have seemed to give credibility to the 'oscillations' idea for changes in neutrino character.

10. CT Cosmology: the Inverted Significance of Stellar Metallicity

{'Metallicity' means the abundance of all elements above H and He and is for convenience usually defined as $\log_{10}$ [Fe/H].}

Metallicity is currently used as a major tool for inferring the cosmological age of stellar assemblages, so it is important here to address the big change in its significance brought about by our continuous auto-creation (CAC) cosmology.

In Big Bang cosmology, low metallicity is taken to record very early formation of the material, before stellar nucleosynthetic activity had built up the metallicity of the Universe. So a zero-to-very-low metallicity 'Population III' have been sought, but so far unsuccessfuly, to trace the very earliest stage of that.

Nevertheless, metallicity of low-to-intermediate character ('Population II'), and supposedly only slightly younger, is typical of the globular (star) clusters which abound in the haloes of spiral galaxies, and of many dwarf and structurally undeveloped ('Irregular') galaxies. The Large and Small Magellanic Clouds, for example, have metallicities less than half that of the Galaxy. But the mystery has been how Pop II had escaped subsequent stellar recycling to higher metallicity.

In the core of our Galaxy, where the stellar density is high, a much higher metallicity (Population I) confirms the effect of such recycling over time. The gradual outward decrease of metallicity within its disc supports that these stars (including the Sun), or the material they were made from, moved outward from the core at an earlier stage of that build-up.

In continuous auto-creation (CAC) cosmology, all newly-created material is of low metallicity, but it **may be of any age**, so its well-observed presence just outside the central bulges of spiral galaxies strongly suggests its relatively recent arrival by axial infall from the surrounding aura of enhanced auto-creation.

In the case of M104 (the Sombero galaxy, Fig. 5), of the very large number of globular clusters present in its halo the red, more mature ones systematically lie closer in than the blue, low-metallicity ones [53]. That is just right for the blues to be made of young blue stars recently arrived from outside.

This paper's abstract refers to the presence, in the globular clusters of our own galaxy, of even younger blue stars, which have been called 'blue stragglers' because their youth has been seen as a problem within a supposedly very old assemblage of Pop II stars.

In CT these appear to be the best evidence we have of ongoing auto-creation. The youth of these blue stragglers may not be such as to rule out that they formed before the cluster concerned fell towards the Galaxy. In which case the auto-creation building of the first globular clusters, not galaxies, may turn out to have characterized the elementary build-up of the Universe, each having started, perhaps, by the fragmentation of a Jeans mass.

10. Outward disc Flow in Spiral Galaxies — G-E Field Action: no CDM

In Paper I [1] we saw that Spiral galaxies display morphological features indicating outward flow in the disc. Since dust is the product of stellar activity, these images (Fig. 5) of outer-edge dust confirm that direction.

We also saw in [1] that similar flow must have been present in the protoplanetary disc during planet formation. In that case, arrival of the material had been quasi-polar, followed by close-to-star ionization, rendering it responsive in the disc to G-E field action.

Evidently, in Spiral galaxies, the pattern is the same. Evidence of cold neutral hydrogen gas accretion to Spirals has been accumulating in recent years and is now well established [54] but the dynamics have remained unclear. We now see that newly created, little-ionized, material forms quasi-polar infall streams, is ionized at the bulge, and is then driven radially in the disc by the G-E field of the bulge and core. The dust and bigger uncharged materials are blown outward against gravity aerodynamically by the G-E driven wind. But as the wind weakens with radial distance this capability falls, the 'solids' are parked at the levitation

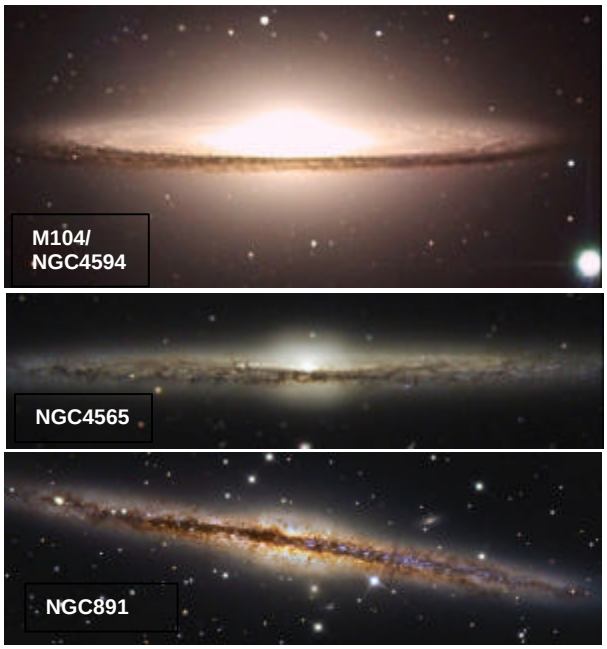

Figure 5. Edge-on viewing of spiral galaxies enables the dust at their optical edges to be seen. Note the slimness of the profiles. M104 (the 'Sombrero' galaxy) is exceptional in having a very large number (>2000) of globular clusters forming its halo, see text. Credit: All three images are cropped and rotated, with permission from Volker Wendel***, www.spiegelteam.de.***

limit, and the plasma materials continue. Before that limit is reached, the dust-levitation force on the arms of the galaxy is apparently what drives them outwards [1].

Hydrogen H II radiation abundantly observed from far outboard of the visible regions of galactic discs confirms the presence of outflowed G-E field-driven plasma that must have been aerodynamically responsible for the outward transport of this dust.

All these signs that the G-E field, a purely radial force, is controlling the dynamics of motions in the disc of Spirals provides a ready explanation of their well-documented, but not invariable, habit [51, 52] of displaying a tangential velocity profile which, after a rise from the centre, may remain essentially flat to far beyond the optical limits of the disc. As noted in [1], Keplerian-tending departures from that flatness will result from, and vary according to, the competing Newtonian force experienced by the neutral-body loading of the flow. Thus it is that the not-infrequent partial departures from that flatness can find a ready explanation in terms of the locally-varying mass-loading (e.g. the arms) of the flow in the disc, whereas the CDM argument is a blunt instrument without such a facility.

Thus our conclusion, already presaged in [1]**,** is further consolidated, namely that there is **now no need at all for the presence of CDM,** widely invoked in

huge amounts to explain the flat tangential profiles of Spiral galaxies. Demands for CDM arising from virial treatments of the long-term stability of clusters may also be denied if we recognize that (i) intrinsic redshifts exaggerate the velocity scatter and (ii) auto-creation makes the effective lifetime of a cluster unknown.

11. Functions of the Axial Infall Streams of Mostly-new Matter: from Galaxies to Clusters

Our proposed auto-creation mechanism is envisaged as being assisted by high environmental energy levels, so one's thoughts go straight to the stellar environment, and the 'blue straggler' story (above) may be a part of that. But the volumes of space that such processes occupy is tiny compared with the volumes of extragalactic space surrounding galaxy clusters, so we envisage that this is where the majority of auto-creation in the Universe is still in progress and will supply the galaxies with growth by infalling streams.

The Newtonian gravity field of a Spiral's disc will tend to focus these streams towards its axis. Both in the bulge and as this matter spreads out in the disc it will maintain star formation and growth in the mass of the galaxy. G-E field action on its plasma will maintain the Spiral dynamics. The rest will then emerge from the disc edges and may contribute to the initiation of satellite galaxies. As the cluster grows, so will its corona-like aura, and the infall of newly created matter from it. So fresh and younger galaxies will tend to form at the outside of the cluster. When these masses begin to affect the focusing of the infall streams reaching Spiral galaxies in the interior, those streams could bring about a major morphological transformation – to a Barred Spiral - next.

12. Birth and life of a Barred Spiral (Fig. 6 a,b,c) Interpretation of bar formation with specific reference to NGC1300 (Fig. 6a).

The polar infall streams (see inset in (b)) are supposed to have been deflected and misaligned by the gravitation of other galaxies in the cluster. This sets up a couple which forms a rotating bar, here called a 'roller-bar', whose length propagates outward (G-E field action) until it reaches, engages with, and halts, the orbital motion of material at the inner end of a spiral arm. Orientation of the roller-bar's axis is fixed by the external influences, so it does not rotate with the spiral arm structure, which continues to rotate about the original axis.

Non-ionized material in the dust lanes which line spiral arms (see images in Paper 1) engages with the bar end and can gravitate along it towards the centre, being twisted into a weak spiral by the faster bar rotation at the centre, where the infall rotational drive is being applied by neutral and invisible infall of 'new' material.

In (c) (NGC1672) we see the end-on view of such a bar, with the dust lanes peeling off the arms (the one on the right is the nearer one) and gravitating towards the centre of the bar, whose CCW rotation is clearly seen. A bit later in the evolution, the infall gravitation of these misaligned convergent dust streams can set up yet another rotation. The vestiges of that are to be seen in the centre of NGC1300 (Fig. 6a) and are clearly visisble as a 'spiral within a spiral' in many other barred galaxies. In NGC1300 this motion appears to have replaced the original, externally imposed, roller-bar motion.

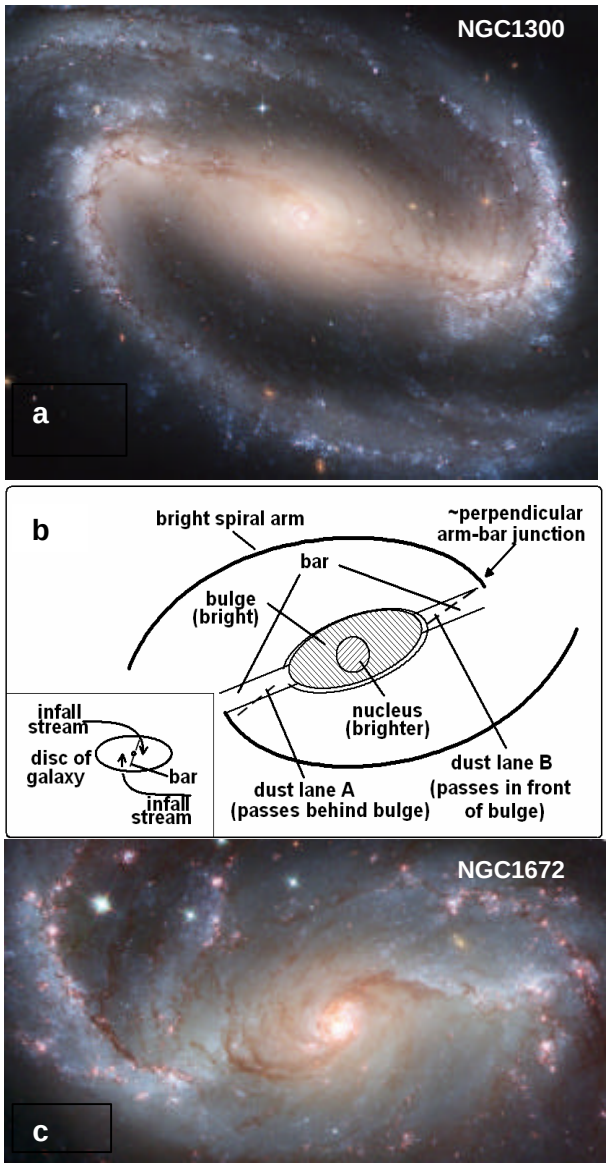

Figure 6. Examples to illustrate transformation of a Spiral galaxy into a Barred Spiral, and its subsequent evolution, see text.
Image credits: (a) NGC1300 APOD 2012 March 25, Hubble Heritage Team, ESA, NASA. (c) NGC1672. APOD 2012 May 13. NASA, ESA, Hubble Heritage Team (STScI/AURA); Acknowledgement: L. Jenkins (GSFC/U. Leicester).
Images have been cropped/rotated to fit the page.

As the continued rotation of the arms takes them past the ends of the bar, its 'consumption' of their non-ionized dust leaves the ionized components of the arms, still supported radially by the G-E field, to continue and perhaps to form a visible ring. This process has just begun in NGC1300 but is clearly seen in others (Fig. 7).

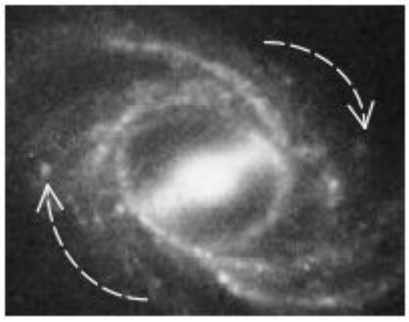

Figure 7. NGC 2523. This shows how the galaxy arm system has continued for ~120 degrees (or perhaps a lot more) to rotate CW past the ends of the stationary bar, leaving a G-E field-levitated ring of residual ionized material from the arms. The main arms, meanwhile, may have ceased unwrapping under G-E field action, see Paper 1 [1], having been shortened by 'consumption' each time they passed the ends of the bar. Image: The Hubble Atlas of Galaxies, p 48 [57].

13. Death of a Barred Spiral: Birth of an Elliptical

Ellipticals display an aging stellar population, little or no internal structure and a dearth of plasma and new star formation. Ovoid in form, much fatter than Spirals, it is well recognized that giant ones predominate in the central regions of major clusters. But why?

When a cluster grows to the point that the infall streams of new matter from outside are captured before they reach the interior, maintenance of the bars of Barred Spirals will cease. Lacking a supply of plasma-genic material, responsive to the G-E field, especially if the arms have also been 'consumed' or become detached, the bar will undergo endwise collapse. The result will be an Elliptical galaxy, the fattening action evidently being due to the central 'spiral within a spiral' established by the misaligned two-stream convergence along the bar. Excellent examples of this are NGC4314, NGC5387, NGC3504, NGC1097 and NGC6951, all illustrated in [57].

This generally coherent interpretation of the features of Barred Spirals makes it clear that the widely-attempted 'pattern speed' determination method [58] fails to detect that the bar is **not** rotating with the arm system e.g. [59]. If it were, ring structure (Fig. 6) would lack a cause and centrifugal force would prevent the along-bar convergence and establishment of central spiral structure, demonstrated above.

14. Continuous Auto-Creation and the Radial Profile of Galaxy Morphologies in a Cluster

Proceeding inwards from outside a major cluster we may now predict the following generality:-

1. A surrounding aura of HI (21cm) radiation in which enhanced auto-creation of neutral hydrogen is in progress, excited by the cluster's coronas;

2. A zone of low-metallicity dwarf galaxies in construction, often with starbursts where local auto-creation has taken a hold;

3. A wide zone of growing and evolving Spirals;

4. A zone in which transformations to Barred Spirals are in progress or complete;

5. A core zone of Ellipticals, living out their old age.

Accumulating evidence seems to favour such a profile.

In connection with (1), note that The Square Kilometer Array (SKA) (effective collecting area) is to be built in the southern hemisphere to investigate the already abundant evidence of this 21cm radiation, but which is currently interpreted in terms of the post-Big Bang sequence. In any cosmology, however, (and Continuous Auto-Creation (CAC) is no exception) the formation of neutral hydrogen is an essential stage.

In regard to (2), note that Dwarf and Irregular galaxies may occur in relative isolation, having become detached from the infall-generating environment in which they first formed. So now, unless they have the density to enable local autocreation to occur within them, they will mature to old age at constant mass with increasing metallicity.

In regard to (4), the fact that galaxies move about relative to one another means that bar-forming infall streams may be interrupted or restarted, so not all Barred Spirals will complete their metamorphism to an Elliptical. Unfortunately, early work on the relation of morphologies to their positions in clusters [60] did not recognize Barred Spirals as a distinct form. It is only recently [61] that this has been done, **but their relative positions in clusters do not seem to have been well documented. That is now very desirable.** But an apparent transition from blue bars to red ones with little star-formimg activity [62] looks like a step in this direction.

In regard to (5) also, galaxy motions may result in

the restoration of infall, previously denied by their entourage, in which case the Elliptical will display a rejuvenation of star formation. So that should not delete it from the Elliptical category.

Giant Spirals in the outfield may be nuclei for future clusters. In such a galaxy, by not having other galaxies around it, competitive for the infall from the aura of auto-creation around it, that infall will maintain its G-E field-driven spiral dynamics. So it will continue to grow in mass until the development of satellites around it interferes with that infall and the Spirals-to-bars-to-Ellipticals metamorphic sequence begins. This may be how it was that the giant Ellipticals, now seen in the cores of clusters, came to have such exceptionally large masses.

15. Back to the Beginning, or Nearly: Formation of Tightly-wound Spirals

For Spiral arms now to be *unwrapping*, they must have been tightly wrapped in the first place. In our CAC cosmology this construction need not, in principle, be confined to the earliest evolution of the Universe but may arise at any time subsequently. On the other hand, the reasoning put forward below for the formation of the observed tightly-wound spirals does seem to require that to begin in relative isolation, well away from a galaxy cluster. I know of no report of one within a cluster, but this needs confirmation.

If we assume (see the next Section) that the auto-created hydrogen is not devoid of rotational turbulence at all scales, a reasonable mechanism is that this material could, under Newtonian gravity, develop loci of convergence. Conservation of angular momentum will then result in a tightly-wound spiral, getting tighter towards the centre. The G-E field developed by its resulting central mass concentration will not inhibit the acquisition of more such neutral material.

But, when star formation and ionization become established at the centre, ionization will increasingly spread outward through the inner turns of the Spiral. Their resulting response to the G-E field will push them outward, causing the **axial-infall to disc-outflow** pattern, characteristic of mature Spirals (Sect. 10), to set in, and probably terminating the acquisition of material to the edge of the disc.

As we have seen already, the strictly radial nature of the G-E field force means that this outward movement of the turns will occur with little or no change of tangential velocity. This, as noted in Paper I [1], has the geometrical consequence that these turns/arms undergo much splitting to enable them to fit the larger circumference. This feature, well recognized in the photographic record of these tight spirals, has made it impossible to trace far the individual turns of the original spiral. Figure 8 shows two examples at about this stage of their evolution.

In his commentary on NGC 488 (Fig. 8) Sandage 1961 [57] writes:- “There is a change in the characteristics of the spiral arms close to the nucleus. The inner arms are very smooth in texture with no indication of resolution into lumps….The amorphous inner arms can just be seen. As they wind outward they…become ‘lumpy’ with condensations. The luminous arms are nearly circular, with regular dust lanes on their inside edges.”

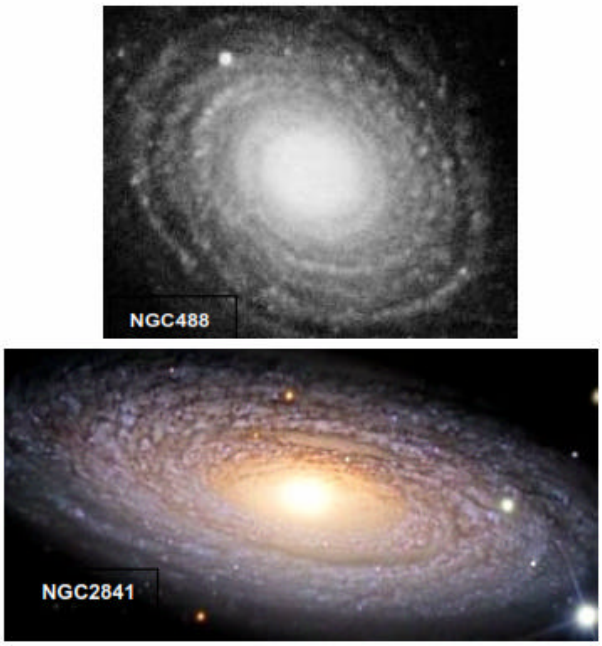

Figure 8. Examples of closely-wound Spirals, possible progenitors of the open two-arm form so widely observed (see text). In NGC 2841 the G-E field has not yet begun to open out the spiral structure significantly. In NGC 488, that process is already under way; its ‘flat’ tangential velocity profile (310-330 km/s) [63] shows that the causative radial G-E-driven disc wind is already present.
Image credits: NGC2841 APOD March 29 2009. Credit & Copyright Johannes Schedler (Panther Observatory) cropped and rotated with permission. NGC 488 from [57].

The knotty problem in Spiral galaxy evolution with which we are now presented is:- How does this now-confused multi-arm structure sort itself out to become the predominantly two-arm structure seen in so many mature Spirals? If we can do that, then those which display more than two arms may record the progress of that transformation.

Our offered solution, outlined here, is this. The

stellar development of dust, and its aerodynamical accumulation as a lining to a vestigial former arm, acts as a filter, from which the ionized remainder of the outward disc wind, now relieved of the neutral load and augmented by the ionization from starbursts in the dust, can now be driven with renewed vigour by the G-E field. This would constitute a mechanism for making a lot more radial space between adjacent arms than the former space between turns. That spacing has clearly begun to affect the outer arms of NGC 488 (Fig. 8). A mutually competitive accommodation of that demand would then be consistent with the general unwrapping already inferred. That such competition should, in the limit, leave the system with only two arms, seems reasonable, but analysis is desirable.

16. CT Cosmogenesis: Particles from Randomly-Moving Aether

The motions of a true superfluid, totally lacking viscosity, are unable to produce rotational motions. But as we noted in Paper 1 (Sect. 4), the electric charge nature of our CT implementation of Maxwell's aether means that Ampere's Law action produces an effective viscosity for relatively shearing motions.

That characteristic has already been useful to our reasoning in three important ways:-

it enables the aether to accommodate and propagate TEM waves [1];

it enabled us to contemplate the construction of vortex-type aether motions as fundamental mass-bearing particles [1];

it ensures that random aether motions, whether particle-tied or not, will produce the observed RTV deflection-type scattering and attenuation of TEM waves (Sect. 3).

So our fourth example is that the primordially existing infinite extent of randomly moving aether, invoked in our CT cosmology (Section 9), is assured of harbouring random rotational motions at all scales. At the smallest of scales these might correspond to the auto-creation of fundamental particles and, at very large scales, to the vorticity and angular momentum content needed (Sect. 15) for the assembly of the earliest tightly-wound spiral galaxies. So much for the circumstances of primary auto-creation.

Note that for ongoing auto-creation at any later stage, when there are already many particles around, any close passage of two particles (especially if it is at high relative velocity) will be an even more fertile way of inducing vorticity in the intervening aether. To acquire that high relative velocity the system must have awaited gravitational action and star formation. This is the basis of our proposed positive feedback mechanism for the progressive auto-creation of galaxies as clusters.

No wonder, then, that at places like CERN, where particles are deliberately made to impact or pass one another at the highest possible velocities, abundant auto-creation of mass-bearing particle vortices is observed, but is currently always (mistakenly in our CT view) attributed to a relativistic mass increase of the original particles, supposed then to have fragmented.

16.1. Primary Auto-creation in Detail — how it all got Started?

The aim here is to auto-create complete hydrogen atoms from the primordial randomly moving aether, copiously endowed with motions of a vorticle nature. Vortical motions of every conceivable kind will be present. Most will be ephemeral; only the stable ones will survive for long within the prevailing environment of random electromagnetic excitation associated with the randomly moving aether. So the process of primary auto-creation has to be the Darwinian one of natural selection and the survival of the fittest.

In Section 5.1 of Paper 1 we speculated that "if the electron exemplifies a particularly stable aether dynamical form, it follows [from Fig. 1] that the mean density of the aether defines the electron as the elementary unit of charge throughout the Universe; and likewise the uniformity of atoms built by its means".

That is an important constraint in our CT Universe, in which there was no linkage between what was going on in different parts of it. Spectral evidence from distant galaxies seems to show that their atoms are the same as ours.

So let us suppose that among the plethora of motions, electron-positron pairs were persistent survivors. But observation shows abundantly that, of the two, positrons have, for some reason, relatively poor durability. So now we have an electron 'survivor' wandering around seeking further ways of enhancing its longevity. Being a charged body it will be extremely susceptible to the random electrical perturbation by the randomly moving aether. So the most effective way of cutting this down (by a factor of at least 10^{36}) will be to pal up with some other embryonic particle or particles that will neutralize its overall charge.

We now suppose that among the plethora of other vortices there were some, very vigorous ones, with an aether deficiency and consequent positive charge, possible progenitors of quarks. In this case, their

powerful aether-sucking property caused them to seek more stability by sucking themselves together in threes, thus, by aether-flow circuiting around the triangle (Fig. 2 of Paper 1), creating a strong bonding action (which we now recognize as the nature of the Strong Nuclear Force). From a random variety of such groupings there would be some whose effective positive charge closely matched the negative charge of an electron.

So an encounter with, and some form of attachment to, an electron would be for the mutual benefit of all, neutralizing their charges and eliminating sensitivity to the otherwise-disruptive vigorous Coulomb-force perturbation by the randomly moving aether. The mechanism by which such an encounter could actually result in the structure which we think we know as the hydrogen atom remains obscure. But BigBang theory does no better in this respect either.

This, we propose, was the basic auto-creation route by which hydrogen atoms came into existence throughout the early Universe, and would be proceeding today in modified form wherever in the Universe auto-creation is active. The important thing is that the hydrogen atom emerges from its testbed environment as the most stable of all possible products of the randomly moving aether — a secure basis from which the nucleosynthetic construction of higher elements can proceed.

16.2. Energy Density and Temperature of the Primordial Aether's Random Motion

According to our CAC cosmology this was the energy resource from which all subsequent energy forms (TEM waves, mass and the energy of its relative motions) have been derived. We found (Sect. 4) the 2.726 K (or whatever) of the CMB currently reaching us to be a rather accurate indication of the true present temperature of the random aether. But the energy content of the CMB radiation is, as synchroton radiation, only a tiny fraction of the energy resource from which it derives.

Estimates may be possible, but there is a further uncertainty. This is that in our treatment of TEM wave transmission effects (Sect. 3*ff*) we assumed that the causative random aether motions relate solely, albeit in a much-smoothed manner, to the particle random motions along the path concerned. We took no account of the residual primordial component of aether random motion additionally still present around us and constituting the underlying engine of continued auto-creation at this time. A very precisely controlled transmission redshift experiment might enable this unaccounted addition to be detected and determined.

The other component of the primordial aether energy density has been converted into the space-density of the mass and the provided energy of its motions and TEM waves. To compile an inventory of these energy components for a supposedly representative sample of the Universe may tax our endeavours to the limit. But the reward would be that by putting it together with an estimate of current aether random energy, it might become possible to estimate how much more than 2.7 K was the effective temperature of aether motion when auto-creation first began in the Universe. Fortunately, in our non-expanding but infinite Universe, every sample volume should on average be like every other, so we don't have to peer into the high-redshift distance to do this.

17. Random Electromagnetic Excitation by the Aether, the Photoelectric Effect and QED

In the preceding Section we drew attention to the potentially disruptive influence, during auto-creation, of the random electromagnetic field arising from random aether motion. At a more familiar level this means that, previously unrecognized, the atoms of everything are experiencing a continuous random electromagnetic excitation.

The ubiquitous nature of the aether means that, to the extent that the electron shells of atoms may provide incomplete shielding, this excitation penetrates to atomic nuclei. That might be responsible for triggering nuclear decay, rather than regard the decay rate of that particular nucleus as one of the immutable constants of Nature, or imaginatively to assign the job to a boson in control of the Weak Force.

Similar reasoning bears upon the physics of the photoelectric effect. The evidently spotty nature of electron emission from a photosensitive surface under continuous radiation was what caused Einstein to adduce that the illuminating TEM wave energy must arrive in concentrated packets. That, in turn, enabled him to grasp the quanta-based alternative explanation offered by Planck for his understanding of black-body cavity-radiation energy distribution. Thus the idea of the quantization of TEM wave energy has seemed observationally secure.

But, although less well known, Planck had initially achieved his blackbody law for cavity radiation by regarding the TEM wave energy as continuous in transit but as promoting discontinuous transitions between

energy levels in emitter or receiver [64]. This avoids conflict with the explicitly continuous nature of TEM waves as defined by Maxwell's equations. So let us explore it further.

From my experience as a youngster, generating smoothly oscillatory electric currents (as proven by their lack of harmonic content) and radiating them as radio waves, I find it unacceptable to have to believe that there was some kind of genie sitting on my aerial chopping up all those electromagnetic fields into little units of the right size for them to be radiated as photons. I argue that if, in these circumstances, the resulting TEM-waves are indeed continuous in transit, then it is wholly inconsistent to suppose that in some other situation TEM-waves are 'different' and only exist as packaged items.

It is true that when an atom radiates, it must indeed represent a jump between stable dynamical (internal) configurations, but that is a function of the source, not of the nature of TEM waves.

We have seen that neither the solar redshift (Sect. 5) nor gravitational lensing (Sect. 8 of Paper 1) seem to require TEM-waves to have the mass property. So what about that 'spotty' emission of photoelectrons from a surface under low-level distributed illumination, which so influenced Einstein's thinking? This is the point at which we need to consider the invasive random excitation by the randomly moving aether. It means that an atom with a loosely bound electron may, at random intervals, be excited to near-release energy. At that moment the additional excitation by a low level TEM-wave field will trigger release of the electron. It does *not* mean, as has hitherto been supposed, that the entire release (quantum/photon) energy has been brought to that point within the illuminating beam. Because the aether excitation is random it may instantaneously either add or subtract from that of the incoming TEM-wave, so the mean effect will appear to be zero and correspond to the TEM-wave input only.

This is a nice demonstration that in cases where one of the inputs is a random one, the use of averaging, with the aim of improving the precision of the answer, may completely obscure its physical interpretation.

By recognizing TEM waves as continua during transmission, not as corpuscular quanta, we seem to approach a resolution of the much-debated two-slit-one-quantum experiments, see [65] for example. In CT there is no longer any question of 'splitting a quantum and joining it up again on the far side'. The wave energy from the source can be divided according both to the physical disposition of the slits and to the random displacement of the wave structure by the random movement of the aether by which it is being propagated. The latter may or may not be enough to prevent the formation of a coherent interference pattern when the wave energies are brought together on the far side but it will (slightly) affect the division of energy going through the slits.

Accordingly I suggest that random excitation by the all-pervasive aether might provide an entirely new foundation for the statistical overlay upon classical electrodynamics which seems to lie at the heart of quantum electrodynamics (QED). The important difference seen in CT is that the amplitude of this statistical overlay is not quantifiable once and for all, nor specific to that particle, but is primarily related to the random motions of mass- and charge-bearing particles in that specific environment.

Another name for that statistical overlay is 'quantum tunelling' which underlies the Schrödinger equation of quantum mechanics. It plays an important part in (for example) our understanding of how the Coulomb force defences holding two protons apart inside a star can momentarily drop their guard and enable them to get close enough together for further interaction and for nucleosynthesis to proceed.

Thus in CT, the statistical behaviour of particles would emerge, not as an inherent stochastic wave-function property of those individual particles, but as due to being energized by the random motion of the aether in which they are steeped. Thus we escape the dilemma posed by the determinism arising from classical and relativistic treatments and the indeterminism affirmed by QED, a dilemma emphasized by Dirac [66, 67]. It seems to me that both the Heisenberg uncertainty principle and the EPR paradox may arise from trying to fit both determinism and indeterminism into the nature of an item.

In CT they are independent. So we can have particles or TEM waves that are deterministic in natural behaviour, but we cannot observe that in **real** nature because of the ubiquitous intervention of the randomly moving aether. This looks to be yet another example in which Einstein's insistence on excluding 'third party' (aether) involvement has seriously misled the scientific path.

The fact that the stochastic perturbation of outcome recognized in QED is mainly at the particle scale and vanishes at large scales seems consistent with the scale of aether random motion being primarily that of the individual motions of particles.

This insight appears now to warrant serious consid-

eration, motivated by the abundant evidence for such random motion outlined in Sections 2 - 6 of this paper. Evidence for the Zero Point Field (ZPF) and zero point energy might be accommodated in the same way, but we cannot pursue that here.

18. CT in Relation to Dirac-Vigier Perspectives

This paper, together with Paper 1, is written for the VIIIth conference held in tribute to the work of Jean-Pierre Vigier, so it is appropriate here to refer to the significance of his work for the subjects dealt with in these two papers. Note at once his direct involvement in two of my citations, namely [13] and [31].

As outlined in the Introduction to Paper 1 [1] and enlarged upon in Section 3, the origin of CT lay in my 1959 discovery that specific features of the high-flight-altitude daylight sky brightness, are attributable to what we have called 'RTV scattering', requiring the presence of an aether, although it had been discarded for Relativity by Einstein in 1905. From that moment until very recently my development of CT was done in ignorance of the prior pleas for reinstatement of the aether made by that famously independent-minded physicist Paul Dirac in 1951/52 [68]. Further, to find that he, and subsequently Jean-Pierre Vigier [69, 70], have concluded, as we do in CT, that fundamental particles must be of non-zero-size in order to accommodate aether-motion activity within them, seems a remarkable concatenation of results, in view of the very different routes by which they were reached. The fact that they were seeking to fit this view into a relativistic setting does not detract from their underlying motive having been to escape the relativistic constraint of zero-sized particles, like we do in CT.

Add to this, I find it highly encouraging that our observation-supported arguments, and our implementing of Maxwell's aether as electrical in nature, offer (as discussed in the preceding Section) to provide the stochastic basis for QED behaviour so influentially sought by these authors.

Even more remarkable to me has been to discover Vigier's 1995 rendering of the "Fundamental problems of quantum physics" [71]. In this not only did he strongly favour a return to the 'ether concept' in a chaotically moving state but, astonishingly, then went on to envisage many of the consequences explored and supported by our findings in the present two papers under the Continuum Theory banner. These include TEM wave redshift as a propagation effect (using the old description as 'tired light') and a non-expanding Universe. The only significant disparity in his account was his retention of Relativity's non-zero mass photons.

Any comparison of Dirac's ideas with those advanced in CT should, to avoid confusion, note that Dirac's 'sea' of negative-energy particles is separate from his views on the aether and bears no relation whatever to CT's aether composed of negative electric charge.

A further important clarification is that Vigier and various others have sought to invoke superluminal communication both within particles and between them. In CT, by contrast, our rigorously applied principle is that ***nothing (neither particles nor TEM wave transmission) can exceed the value of c relative to the local immediately environmental aether, as determined by its charge density at that point.***

The superluminal velocities invoked in our QSO model (Sect. 7) are *orthogonally directed with respect to the sightline to the distant observer,* and are built up by the gradient of aether tangential velocity between that point and the observer. TEM wave transmission directly towards the observer remains at ***c.***

One final point. The term 'wave-particle duality' can be used in two different circumstances. One is the QED context of a disturbing wave-function. The other concerns electron diffraction by a slit; this is brought within reach of explanation by making particles out of aether, i.e. electromagnetic in their very nature, as adopted in CT.

19. Loose Ends and Experimental Checks

19.1. Loose ends.

1. Viscous heating during a.m. exchange in protoplanetary discs. In Section 12 of Paper 1 we pointed out dynamical shortcomings of the so-called Nice model for solar planetary formation by condensation from a hot nebula. But there is a further reason for our rejection of it.

That model and its subsequent developments invokes viscous nebular action for a.m. partition between the solar and disc material. For the close-in exoplanets (a position seen as original in CT – Paper 1) the same mechanism has been invoked to argue for their prior high-a.m. positions from which they then migrated inward.

But the energy inefficiency and major heating aspects demanded by that viscous shearing action, first treated by [72] but apparently not appreciated by proponents of the mechanism, means that the **increase** in disc temperature (potentially several 10^3 K) would

defeat the objective of condensing planets from it, which requires, approximately, that $T < 1800$K.

2. Electron shells as a cavity, the eccentric nucleus and the Mössbauer redshift experiments.[73, 74]. These sought to observe the Earth's relativistic gravitational redshift by noting the wavelength difference between upward- and downward-received gamma rays from the decay of ^{57}Fe. They overlooked that the support, within an atom, of any nucleus in a gravity field inevitably implies that its position is eccentric, but by many orders smaller than had ever needed consideration in ordinary spectroscopy. It so happens that the normal Fe-decay gamma emission wavelength (8.6×10^{-11} cm) is similar to the effective radius of its K-shell electron cavity. So I propose that cavity resonances were responsible for the up-down $\sim 10^{-15}$ fractional difference in emission wavelength, and for the exceptionally narrow bandwidth of the emissions by this atom (which was the practical reason for chosing it for these experiments). In CT, the nuclear energy-jump on decay is not an absolutely fixed photon quantity, but may be environmentally affected, so resonance could do that. Hence the result is not seen here as secure support for GR.

19.2. Experimental Checks.

In addition to the three described in Paper 1 [1], the following six specific experimental checks would also be valuable, related to matters discussed in the present paper. Of these, No. 5 is important because of the possible rigour of the experimental control, but the repeats 2, 3 and 4 were also recommended by J-C Pecker (personal communication, Dec. 2010).

1. Daylight sky brightness and colour distribution at 6-10 km above ground. Section 3, Item (3). This should be done to check and perhaps extend the 'RTV scattering' explanation I reached in 1959-60.

2. A corresponding space-vehicle repeat of the Pioneer 10 observations of the *gegenshein* at >1 AU from Earth.

3. Repeat the 1968 solar superior conjunction carrier-wave redshift observations by Pioneer 6; Section 5.2 (a). And the associated spectral line-broadening. To consolidate them as observed examples of RTV redshift and RLV frequency dispersion.

4. Repeat the Sadeh et al. (1968) several-year recording of the Taurus A absorption line redshift when traversing the solar corona; Section 5.2 (b).

5. Repeat the Sadeh et al. (1968) observations of ground-level path redshift using tightly monitored caesium clocks; Section 6. And check its potential extrapolation in the CT frame to the cosmic redshift and the redshifts observed in (3) and (4) above.

6. Examine the spectrum of the star S2 in SGR A* for the presence of the Aberration-Related (A-R) redshift predicted in Section 7.1 and Section 7.2 (Item 13).

20. Philosophy, Review and some Conclusions

20.1. Philosophy

The deeper that one roots a physical idea, the greater should be the variety of benefits at higher levels, but only *if it is right*. For the Continuum Theory, outlined in this paper and in Paper 1, our physical implementation of Maxwell's aether constitutes a deeper level than appears ever to have been attempted before. So one expects the variety of its implications to be very great indeed, and hopes that these will be rewarding. But one must recognize that this may require the abandonment of ideas formerly sincerely held but less deeply rooted. To achieve that convincingly it needs to be specific enough at root level, but yet not so rigid as to deny natural variability in its development. So, at all levels, we have concentrated here on how things work, thereby reaching out to involve lots of potentially variable factors and observables. We feel such linkages provide strength to the whole.

20.2. Review

The Aether. We have implemented the aether as a continuum of electric charge, so that it satisfies Maxwell's equations for the support and transport of TEM waves. We have then found (Sect. 16) that, through the involvement of Ampère's Law, this kind of aether turns out to have other positive consequences in the Universe. For example, in the absence of Ampère's Law action its superfluid random motions would be devoid of rotations. Those are needed to explain the observed deflection (not impact) scattering of TEM waves (Sect. 2 & 3) and the resultant attenuation we infer responsible for Olbers' Paradox**.** Also for making rotation-configured particles out of aether in auto-creation. If the aether were absent or of any other kind of superfluid, such as often envisaged by others, these would be lacking.

Particles. We have pursued the 19th century idea that fundamental particles are vortical constructs of aether in motion, responsible for gravitational action. Thus TEM waves and particles are both 'made of aether'; hence the name 'Continuum Theory' (CT). The ultra-high charge density we find for the aether, and the charge densities of the particles made from it (Paper 1), changes it to being the principal agent in the Universe – gravitation, inertia, electric fields.

20.3. Some principal conclusions

(The conclusions which follow relate to the present paper and are in addition to those given at the end of Paper 1.)

1. Particles that are vortical constructs of aether in motion but are themselves in random motion means that the surrounding aether is in random motion too.

2. That motion causes four cumulative wavelength-independent transmission effects on TEM waves; redshift, frequency dispersion, scattering, attenuation. All are hugely enhanced by ionization.

3. The redshift is observed as:- solar redshift on emergent radiation; on external sightlines traversing the solar corona; with caesium clocks over long ground-level paths; excesses for W-R in binary stars; cosmic redshift; and in a variety of other situations.

4. The CMB 2.7K radiation is due to synchrotron radiation due to aether random motion (1), from the gas/plasma along intergalactic paths that reach us.

5. The attenuation (2) across the Universe, over and above inverse square law, is responsible for Olbers' Paradox and means that high-redshift galaxy distances determined by standard-candle method have been substantially over-estimated.

6. With cosmic redshift as a transmission effect (3), the reason for Dark Energy vanishes.

7. The aether's linkage of gravitation and inertia (Paper 1) leads to a fertile model for QSOs with large amounts of intrinsic redshift and the 'in-house' generation of forest absorption lines, so the indicated temperatures do not relate to the intergalactic medium and cloud containment problems are resolved.

8. The Universe is not expanding; its entire mass content has been made, and continues to be added to, by auto-creation from random aether motion over an indefinable time.

9. After an exhaustive sequence of selection for matching charge and mutual attraction, to improve their longevity in the face of disruption by the random aether's electromagnetic excitation, the electron and trios of quarks finally win the day as hydrogen atoms.

10. For this auto-creation, and its mass-increase counterpart in particle accelerators, not to contradict energy conservation laws, it is necessary in all such calculations, to recognize the energy content of aether motion, beit random, systematic in particle interiors or embodied in TEM waves.

11. That hydrogen (9) probably forms the bulk of the mass of the Universe; enhanced auto-creation in the environment of galaxies provides Spiral galaxies with young, low metallicity, quasi-polar infall to drive their dynamics and star formation.

12. Poor access by those streams to the interiors of galaxy clusters results, first in transforming a Spiral to a Barred Spiral, and then to an Elliptical in the deep interior.

13. The arms of most Spirals when we see them are unwrapping by the action of the G-E field on the ionized material in the arms, but they must have formed as tightly-wrapped spirals to start with. Such Spirals are formed of mainly neutral H until star formation and ionization sets in at the core and the G-E field starts to unwrap them.

14. The ubiquitous random electromagnetic excitation of everything by the randomly moving aether, yields an explanation of the spotty emission of photoelectrons without appeal to quanta. This does not conflict with Planck's original treatment of cavity radiation. So CT, like Planck, sees TEM wave energies in transit as subdivisible without constraint, the quantization being decided, if appropriate, by preferred energy levels in source or receiver.

15. That same random excitation by the aether, likely to be particularly evident at the smallest scale, appears to offer a very favourable new basis for QED, especially as it separates the random influence ('Hidden Parameters') from being inherent in a particle.

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