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Conference threads, debate and correspondence

On Walker's article "A Contradiction in the Theory of Universal Expansion" (*APEIRON* 5, 1)

There is no contradiction if instantaneous velocity is ratioed to instantaneous distance. In his equation on page 2 that would give another term in

$$K = \frac{u + u/c \cdot \frac{x}{\Delta t}}{x(1+u/c)} = \frac{u(1+u/c)}{x(1+u/c)} = \frac{u}{x} = H_0$$

Halton Arp
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On page 1, column 2, para 3, he has treated u as a constant during the whole motion of the emitter from E to E'. This assumption violates the condition that v is proportional to instantaneous distance (A). This may be the root cause of the inconsistency in the outcome. If the withdrawal distance at any instant t be y (*i.e.,* total instantaneous distance is $x+y$), then we may write

$$\frac{dy}{dt} = b(x+y) \Rightarrow x + y = xe^{bt}$$

Hence

$$OE' = OEe^{b(t_0 - t_1)}$$

With this, I hope, the fallacy is eliminated.

Amitabha Ghosh,
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The cosmological principle is based on observational evidence. The photons arriving are used by the observer to determine both distance and recessional velocity of the source as of the instantaneous time of emission of the photons. It has been determined that, for emitting bodies at various distances from the observer, the ratio of the recessional velocity to the vectorial distance of each is approximately the same constant value.

In his equation (1), Walker erroneously takes the ratio of the recessional velocity at the time of emission to the vectorial distance at the time of observation. That mistaken assumption leads to the variable term $(1+u/c)$ appearing in the denominator. This variable term causes equation (3) to be unacceptable. Removal of the term not only makes equation (3) acceptable, but also eliminates both the inconsistency and the remainder of the paper.

As a matter of interest, some might question his assumption that the source is receding at a constant velocity. They might suggest that the speed of recession should increase with distance and that, of course, would change the nature of the variable term. Such an approach is based on the fact that sources at greater distances have greater speeds of recession. At present, however, it is believed that the rate of recession for all sources (regardless of distance and rate of recession), is slowing somewhat due to gravitational attraction toward the centre of the Universe. It is a matter of considerable interest as to whether this effect will be large enough to cease expansion and begin contraction. Walker's assumption of constant velocity of the source is, therefore, approximately correct.

Donald G. Carpenter
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Walker replies

In a uniform general expansion, the recession velocity of an individual galaxy would not increase over time as it draws farther away from an observer. In fact, according to current theory, the recession velocity of galaxies, along with the rate of universal expansion, is presumed constant or decreasing over recent observable epoches.

This is brought out by Steven Weinberg in his 1972 book *Cosmology* (page 449). In discussing the deceleration parameter Q_0, Weinberg states: "Thus, we now know H_0 to within a factor of 2, and it seems likely that $Q_0 > 0$, indicating gravitational *braking*...". In a similar vein, George O. Abell, in his article "The Origins and Evolution of the Universe", (*Mercury*, May-June 1978) states on page 47, "...the...description of gravitation...provided by general relativity...with the cosmological constant equal to zero, dictates that the universe must be slowing down in its expansion."

Accordingly, an individual galaxy's recession rate, V, during light travel time (t_0—t_1), would be constant or diminishing, *not* increasing from V to $V(1+u/c)$ as suggested in Arp's comment. If V were essentially constant, the contradiction reflected in my equation 3 would be unaffected.

If, however, V had been decreasing at a significant rate, then its average value, V_{av}, would be greater than its instantaneous value, V_0, at time t_0. Then my equation (1) becomes:

$$\frac{V_0}{x(1+V_{av}/c)} = K$$

Or,

$$\frac{V_0}{x} = K(1 + V_{av} / c)$$

and it would still be required by assumption **B**, described in my article, that

$$\frac{V_0}{x} = C$$

so that my equation (3) becomes:

$$C = K(1 + V_{av} / c)$$

Here, the value of V_{av}/c at time t_0 still varies from approximately 0 for nearby galaxies with small V, to at least 1 for distant galaxies where $V_0 = c$ and V_{av} is greater than V_0.

In short, the inconsistency will be essentially the same regardless of any realistic change in the expansion rate.

Dr. Ghosh notes that my equation treats velocity V of a galaxy G as a constant over the entire time period (t_0–t_1) and that V, accordingly is not "proportional to instantaneous distance".

However, the standard model, and my assumption **A**, do not require that *V/d* remains constant *over time* but only that, *at any specific point in time*, all galaxies have equal *V/d* ratios. Thus, at any point in time, for several galaxies, G_1 G_2 G_3....G_n, it is required that $V_1/d_1 = V_2/d_2 = V_3/d_3....V_n/d_n$, as expressed in my assumption A.

The assumptions **A** and **B** discussed in my article are not *my* assumptions, as Dr. Carpenter implies, but are found in the expansion theory itself.

The cosmological principle, contrary to Dr. Carpenter's statement, was introduced by Einstein, Friedmann, and others at the beginning of the 20th century and is *entirely independent of later observational measurements and vectorial considerations*. (*cf.* Rudnicki, K. 1989

"The Importance of Cosmological Principles for Research in Cosmology." *APEIRON* **4**, p.3) It follows, as a matter of standard geometry that, at an observer's present time, the recession velocities of galaxies away from him should be in constant proportion to their distances. (Rudnicki 1989, p.3; Abell, G.E., *Mercury*, May-June 1978, p.45)

This is the theoretical assumption **A** discussed in my article and correctly reflected in my equation (1). Here, V is the *constant* recession velocity of the observed galaxy over light travel time $(t_0 - t_x)$ and therefore is also the present time recession velocity. My equation (1) correctly states this constant relation between V and present distance, $X(1+v/c)$, and Dr. Carpenter's comments do not apply.

In order to compare the constant V/d relation required by the cosmological principle with that which would apply in a relativistic expansion, theorists start with the "observable" distance traveled by light (my distance X), which becomes the observer's radial coordinate vector r_1 to the galaxy's location at time t_1 when the light was emitted. The theory then defines present time distance (proper motion distance) as $R_0 r_1$, where R_0 is the value of the Robertson Walker metric at the present time. (Weinberg, S. 1972, p.423) Since $R_0 r_1$ is present distance d_0 and $d_0/r_1 = R_0$ and since R_0 is constant for all galaxies at time t_0, it follows that d_0 is proportional to light travel distance r_1. Furthermore, the recession velocity at the present time becomes $R'_0 r_1$ (Weinberg, S. 1971, p.417), where R'_0 is the differential of R with respect to time at t_0, so that:

$$\frac{V}{d_0} = \frac{R_0' r_1}{R_0 r_1} = \frac{R_0'}{R_0} = H_0$$

where H_O is the *theoretical* Hubble constant at the present time (Weinberg, S., 1972, p.441; Bondi, H. 1961, p.108).

Accordingly, the present time recession velocity, $R'r_1$, is proportional to distance R_0r_1, which has been shown proportional to light travel distance r_1. Thus, the theory *tacitly* assumes that present time recession velocity (my V) is proportional to light travel distance (my X) at time t_0. This is the assumption **B** discussed in my article and correctly reflected in my equation (2).

The inconsistent equation (3) follows unavoidably from equations (1) and (2), so that assumptions **A** and **B** of the theory clearly contradict each other.

In closing, I feel that the exchange of ideas *APEIRON* is generating should prove most beneficial in stimulating new viewpoints and fresh approaches in areas which are uncertain and controversial.

Fred L. Walker
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On Arp's Article "Extragalactic Evidence for Quantum Causality" (*APEIRON* 5, 7)

This discussion not only promises to close a significant gap between particle physics and cosmological processes but also suggests an explanation for the redshift which is not expansion related. Arp cites the recent conviction among physicists that material particles may be created in space by fluctuations of the "material vacuum". He suggests that the quantized redshift in light from the galaxies may generate such fluctuations along with quantized low energy particles in the material vacuum of extragalactic space. These formative, "non-localized" particles would presumably consist, in some form, of vortical forcefields in the material vacuum which would further evolve, by quantum processes, into higher energy states, eventually becoming localized within galaxies. There, with further quantum evolution, they would eventually become the basic high energy particles which make up the stars.

It goes without saying that the energy the material vacuum imparted to this process of matter creation would first be drawn from the light radiated by galaxies, thus causing the light to be redshifted. The resulting redshift in galactic light is thus explained quite independently from any expansionary cause.

My paper, "A Contradiction in the Theory of Universal Expansion", only hints in a general way at such a possibility, as an alternative explanation for the redshifts which would still be present in the stationary universe, and points out that such a cyclical energy flow, from particle mass in stars to energy radiation to energized material in space and back into the galaxies, would restore a welcome balance in cosmical mass/energy transformations—a balance which is critically lacking in the open-ended processes of the big bang and universal expansion.

In his discussion of quantum causality, Halton Arp also refers to the powerful evidence, accumulated over several decades by Arp himself and others (Arp 1987) that quasars are formative new galaxies and are to be found in close association with other galaxies throughout the universe.

This well-founded concept of close quasar/galaxy association is in direct opposition to current ideas of universal expansion but these opposing arguments are invalidated, along with the expansion concept itself, by the inconsistencies discussed in my "contradiction" paper, which may therefore be seen to provide useful support for the galaxy/quasar relationship previously discussed.

Likewise, if the concepts of the creation of material particles in extragalactic space and of quasars originating in close association with other galaxies are accepted, these processes must be seen as powerful evidence that the universe is indeed stationary.

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On Clube's paper "Lorentzian Gravity and Cosmology" (*APEIRON* 5, 11)

He has produced very important evidence in the past for outflow from our galactic center. This evidence has gone unremarked because, I suppose, it is conclusive proof of an ejection origin for spiral galaxy structure as opposed to the density wave theory. I am disappointed Clube did not reference my discussion "The Persistent Problem of Spiral Galaxies" in *IEEE Transactions on Plasma Science*, Vol. PS-*14*, No. 6, Dec 1986. Everyone's contribution to the ejection theory is reviewed there.

As for gravitational effects of hyperinflated mass, I do not believe the association of objects with greatly different redshifts can be thus explained. Rather I think that the existence of non-velocity redshifts has been mistakenly interpreted in terms of "dark" matter and extragalactic "streaming". I would expect the highly discordant redshifts to be of rather low mass. My view would be that large mass is achieved relatively gradually for old assemblages of matter and shows the appropriate gradients of field strength.

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Clube replies

In commenting on my recent paper (Clube 1989) in your journal, Halton Arp has taken me to task for not referring to his paper (Arp 1986) concerning "The persistent problem of spiral structure". I stand admonished. He also claims that "non-velocity" components of the cosmological redshift exist which are currently misinterpreted as effects due to the presence of "dark matter" and large scale "extragalactic streaming". Whilst there is no doubt that Chip has blazed a very important trail in pointing out the empirical evidence for non-velocity redshifts in galactic nuclei and their compact ejecta, it seems to me that any argument based on the supposed local enhancement and/or quantization of cosmological redshifts which is also seen as excluding the action of gravity has no secure basis in physics and is not sufficient in itself to justify rejection of dark matter and extragalactic streaming.

The point to be noted here is that it was Tolman (1929) who first claimed that the only significant gravity in the universe was that due to standard galactic masses controlling velocities on the order of a few 10^2 kms^{-1}, as observed in the Local Group. He then pointed out that this amount of gravity was quite inadequate to explain the observed cosmological redshift as a gravitational effect and it was only then that Eddington (1931) resolved the impending crisis (or so it seemed to him) by proposing the expansion of the underlying substratum as an *additional* new effect to explain the cosmological redshift.

In retrospect, of course, it is quite surprising that astrophysicists at this time did not countenance the possibility of further matter in the universe and of higher velocities in general for galaxies. Had they done so, as we now do, perhaps they might have been more ready to accept the possibility of still explaining the cosmological redshift as a combined quadratic Doppler and gravitational effect (*i.e.,* as arising when electromagnetic radiation passes through the various gravity fields in relative motion along the line of sight). In the event, Eddington's rather esoteric influence was to prevail and astronomers gradually fell into line behind the idea of an expanding substratum (or geometry), and those during the 1930's and 1940's who argued that some level of dark matter in the universe (e.g. Zwicky; clusters of galaxies) and extragalactic streaming (e.g. Shapley; metagalactic structure) were successfully sidelined and condemned. The effect of all this went very deep since it trained several generations of astronomers to the idea that dark matter and extragalactic streaming are not natural. As it happens, the more recent work on galaxies has tended to vindicate the early findings of Zwicky and Shapley it is now increasingly possible to question whether effects that can be understood in terms of hot dark matter and extreme extragalactic streaming will not in the end provide the evidence for all the gravity that is necessary to explain the cosmological redshift as a combined quadratic Doppler and gravitational effect. Expressing this effect in the language of the 1920's, *i.e.,* with an appropriate gravitational law and flat space-time, each significant step in the transmission path of radiation through the universe (characteristic length a) from gravity field to gravity field (each with characteristic mass m) produces a Doppler displacement which is linear in the relative velocity of the fields (u) but includes also a term in u^2/c^2 which is always positive (*i.e.,* redshifted). In a stationary universe over a cosmological path of many characteristic lengths, $\Sigma u \rightarrow 0$ whilst the $\Sigma u^2/c^2$ term ($\alpha\ Gma^{-1}$) steadily increases in accordance with the Hubble law provided u^2 is sufficiently large.

Should the "hot dark matter, extreme extragalactic streaming" picture be upheld, it may well come to be recognised that Eddington has led astronomers up the garden path for the last 60 years and that the sooner we all get back to a stationary universe (valid until 1930), the better. With such an advance, we might then come to see Arp's non-velocity redshifts in galactic nuclei in their correct perspective, as the best possible evidence for extreme gravitational redshifts associated with highly evolved superstars in the centres of galaxies. We should then be able to remind ourselves that this possibility was put out of court by simply assuming (Schmidt 1975) no galactic nucleus could have a mass that exceeded that of a standard galaxy. To make such an assumption, however, is obviously to impose on astrophysics an important physical belief for which there is no evidence. After all, most physicists look for transitions from the substratum to explain the existence of mass and who would say at present that such a disposition is not significantly enhanced in regimes of extreme gravitational potential? (N.B. Enhanced masses do not contravene the energy conservation law, since the velocity of light in the local substratum is correspondingly reduced.) Indeed, if this arbitrary limit on the mass of an evolved superstar is abandoned it is clear that the gravity of galaxies can vary significantly with time, thereby introducing the means of resolving "the persistent problem of spiral structure" to which Dr. Arp, quite rightly, draws our attention.

References

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Back to Arp...

For the first time I realized that creation and subsequent ejection of matter could alter a galaxy's mass. That would give independent support to Clube's important arguments that there was evidence galaxies could change mass.

But I do not base my criticism of "missing mass" on quasar redshift quantization. Instead, in pairs, groups and clusters of galaxies, if redshift differences which cannot be velocity are removed (such as systematic redshift excesses of companion galaxies and late-type spirals), there is not enough real velocity left to represent a violation of theoretically expected motions within the observed masses.

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