Has Cosmology taken a Wrong Turn in its Historical Development?

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A review of the historical development of cosmology suggests that there are two approaches. One starts with the special and general theories of relativity and proceeds along the lines of theoretical physics; the other takes account of the fact that the universe consists of matter and that the chemical, physical and thermodynamic properties of matter need to be considered. The second approach is of paramount importance for two reasons; first because facts based on experiments in chemistry and physics have accumulated over two centuries and have a sound provenance, and second because thermodynamic data provide a means of doing thermodynamic calculations to test the validity of theories on the nature and origin of the universe. The thermodynamic data in question are numerical values of properties of matter such as internal energy, ionization energy and entropy.

The physical sciences cover a broad spectrum from laboratory chemical experiments to thermodynamics, theoretical physics, two theories of relativity, mathematics and much else. Mankind has built up an enormous body of knowledge but the history of the development of science has not always been as logical and straightforward as might appear from textbooks.

A chemistry student, reading about the ionic nature of salts, would never have guessed that Arrhenius was regarded as an idiot when he proposed the ionic theory, even although there was a lot of experimental data to support him. Consider also Pasteur's discovery that crystals of optically active compounds are mirror images of each other. When asked how he discovered this, he replied, "In the fields of observation, chance favours only the prepared mind" (only he said it in French).

Another example is the theory of continental drift, which is now widely accepted, although it was dismissed out of hand for 30 years.

I would like to suggest to my readers that cosmology is another feature where a wrong turning has been made. The story starts with a notable success.

The astronomer, Arthur Eddington was a Quaker and a pacifist. After the First World War he wished to bring about a reconciliation between British scientists and Germany. He knew about Einstein's theories of relativity and he knew that the general theory, which is substantially mathematical, predicted that a ray of light passing a massive body like the sun should be deflected to a degree twice as much as that predicted by Newton's corpuscular theory. Eddington had a flair for publicity and he persuaded the Royal Astronomical Society to finance two expeditions to observe the eclipse of the Sun in 1919. One expedition went to the island of Principe off the coast of West Africa the other went to Sobral, Brazil. During such an eclipse, rays of light from distant stars passing the sun could be observed and any deflection could be measured.

At a joint meeting of the Royal Society and The Royal Astronomical Society on 6th November 1919, Eddington dramatically unfolded the great triumph of general relativity. The next day it was in all the newspapers and Einstein became famous.

Ever since then, general relativity has been a happy hunting ground for mathematicians wishing to achieve fame and fortune. The development of this subject has led to the Hot Big Bang (HBB) theory of the origin of the universe. This has come about partly because Einstein and De Sitter showed that the equations of general relativity suggested that the universe would expand unless a "cosmological constant" was introduced. Later Einstein said that the introduction of the cosmological constant was his "biggest mistake". At this point the theoreticians have taken a false turn.

Let us return to the general theory of relativity. Another one of its successes is that it explains the precession of the orbit of Mercury. The mathematics for calculating the orbits of planets takes no account of whether the planet is rocky like Mercury or a gas giant like Jupiter. To put this into scientific terminology, the equations relating to general relativity do not contain any reference to physical properties such as density.

Astronomical observations show a "red shift" in the spectrum of light from distant galaxies; this can be interpreted as galaxies receding from us and from each other, - though this interpretation is disputed by many scientists (see for example [1, 4, 5]). It is argued that in the distant past the galaxies must have been concentrated together.

The theoreticians then make a jump in logic and state that the early universe must have been a uniform hot plasma, and that its expansion would have brought about cooling, though this reasoning is contrary to well established experimental physical chemistry and thermodynamics. Here we have a phenomenon which sometimes happens in life, that a statement is widely believed by reason of perpetual repetition – without critical analysis of the practical evidence.

We must probe this subject carefully and logically. The supposed plasma of the hypothetical primeval universe would have had properties such as density, specific heat capacity, internal energy, enthalpy, ionization energy and entropy, yet none of these properties are represented in Einstein's equations, which were the genesis of the HBB theory.

The universe is mostly hydrogen. But suppose, hypothetically, that the main component of the early universe was not hydrogen but another substance, e.g. oxygen. Oxygen has very different numerical values for density, ionization energy, entropy and the other properties just mentioned; furthermore oxygen is paramagnetic, which hydrogen isn't.

An oxygen based universe would be **different** from a hydrogen based universe and therefore this **difference** should be evident in any cosmological theory. It follows that these properties, including their numerical values, ought to register in any valid theory; these values, - particularly internal energy, ionization energy and entropy, - should be a means of distinguishing between a hydrogen universe and an oxygen universe, but these properties do not appear in Einstein's equations and the theoreticians do not evaluate these properties; they are in the realm of physical chemistry which is an experimental science beyond the scope of theoreticians. This is evident from the fact that books on astrophysics and cosmology contain numerous errors in thermodynamics (twelve such errors are given in [2]).

The fallacy of the Hot Big Bang theory can be demonstrated in other ways; for example, the ionization energy of hydrogen is 1,318,000,000 Joules per kilogram; this is an enormous figure which ought to appear in the calculations of cosmologists, but it doesn't.

However, some promoters of the HBB theory claim that the discovery of the Cosmic Microwave Background (CMB) radiation proves conclusively that that theory is correct. This radiation has a nearly perfect black-body spectrum; but rigorous thermodynamic calculations show that if the HBB theory were correct, the CMB radiation ought to have a smeared spectrum, not a perfect black-body spectrum. This was explained in my paper at the *2nd Crisis in Cosmology Conference* in 2008 [3], and is referenced in **The Static Universe** by Hilton Ratcliffe [5].

There is yet another objection to the HBB theory. Towards the end of the so-called de-coupling era the universe will have been mostly atomic hydrogen and some electrons. The electron affinity of hydrogen is 78,000,000 Joules per kilogram, which is a moderately large value, and therefore the chemical equilibrium ought to rest strongly on the side of the formation of negative hydrogen ions. So far as I am aware, there is no observational evidence of negative hydrogen ions in the early universe, and it does not get a mention in accounts on cosmology such as Weinberg's latest study of the de-coupling era [6].

In a nutshell there are two approaches to cosmology, one commences with general relativity, and proceeds along a theoretical path, the other path considers the fact that the universe contains matter and takes account of its chemical and thermodynamic properties – with the additional knowledge of the numerical values of these properties which are established experimentally.

I do not doubt the contribution that theoretical physics has made to science, but the wealth of thermodynamic data, built up over 160 years, should not be ignored.

The "Open Letter to the Scientific Community" [1] has discussed the "fatal contradictions" in the HBB Theory and points out that it doesn't work without some additional hypotheses being latched onto it, e.g. inflation theory and dark energy. The latest flavour of the month is negative energy. No other theory in science requires extra hypothetical speculations in order to validate it.

Readers will recall the "phlogiston theory of combustion" which necessitated "phlogiston" to have a negative weight as an "add-on". This absurd notion led to its rejection.

As I was finishing off this paper, Sir Paul Nurse presented a television programme about science [7] and he commented that the fault of some scientists is that they "cherry pick" experimental results or observations which suit their pet theory and ignore the contrary results. Do my readers find this in the field of cosmology?

I invite my readers to adopt the "prepared mind" of Pasteur.

References

[1] "An Open Letter to the Scientific Community", *New Scientist*, May 22, 2004, http://cosmologystatement.org; it led to the formation of the *Alternative Cosmology Group*, supported by over 400 scientists.

[2] Bernard R. Bligh, **The Big Bang Exploded! Cosmology Corrected, A Commentary with Thermodynamics** (Bernard R. Bligh 2000).

[3] Bernard R. Bligh, "The Cosmic Microwave Background Radiation does NOT prove that the Hot Big Bang Theory is Correct", *2nd Crisis is Cosmology Conference, Astronomical Society of the Pacific Conference Series* **413**: 39 (2008).

[4] Fred Hoyle, Geoffrey Burbidge, Jaynat V. Narlikar, **A Different Approach to Cosmology, from a Static Universe through the Big Bang towards Reality** (Cambridge University Press, 2000).

[5] Hilton Ratcliffe, **The Static Universe: Exploding the Myth of Cosmic Expansion** (Apeiron, Montreal, 2010), p. 133.

[6] Steven Weinberg, **Cosmology** (Oxford University Press, 2008), p. 124.

[7] Paul Nurse (President of the Royal Society London), "Science Under Attack" (BBC2 Television, 24 January 2011).