Review of: "The Big Bang theory: two fatal flaws"

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Dr. Hartmut Traunmüller discusses a critique of the standard bid bang theory of the evolution of our Universe. He focusses on the observation of the nearly isotropic and redshifted microwave background radiation (CMBR), and argues that such a radiation should not be observed if “all matter originates from a primeval fireball that also emits the light that is redshifted into these microwaves”. His argument is primarily the following: “Since light escapes from its source faster than matter can move, it would need to return for it to still be visible to material observers, but the universe is considered ‘flat’ and non-reflective. This prevents us from observing the redshifted glow of the primeval fireball. Like its observability, its homogeneity would also be transient.” Hence, he calls the present standard view “a blunder”. Within the limited scope of his assumption that ‘all matter originated from a (spatially limited) primeval fireball’, Traunmüller’s criticism might look reasonable, logically. However, his assumption behind the criticism, the picture of a spatially confined primeval fireball, is not the standard picture of a big bang Universe.

It is natural and quite reasonable that those who are familiar with standard cosmological models will not agree with Traunmüller’s criticism, because the *standard big bang theory does not say that all matter originated from a spatially localized fireball*. A priori, there can be closed or open models of the big bang. In a closed model, the Universe is always finite, without a boundary, and hence curved. The observations until now do not favour such a closed Universe. An open model that is spatially flat, favoured by detailed observations, is essentially an infinite Universe with its total matter-energy density is equal to the (time dependent) ‘critical density’ at all times. Though conceptually troublesome to many, the spatially flat (k=0) infinite Universe need to be infinite at all times! In such a Universe, the primeval hot event had happened everywhere in space and the photons are streaming from every point to every other point in the Universe. Therefore, an observer at any point will be receiving light redshifted according to the distance (time) from which they are coming in this near infinite Universe. This will remain true even if the Universe is factually much larger than the Hubble size today, and not necessarily k=0 and flat in a strict way.

So, as far as I understand Traunmüller’s argument, the problems that he points out under the theme ‘relic radiation blunder’ do not constitute a valid criticism.

When A. E. Milne presented his model of an evolving Universe in 1930s, there was no anticipation of the CMBR, and the observations came three decades later. Milne’s Universe also started with spatially confined fireball from which matter expanded isotropically at all possible velocities. There was Special Relativity in the model, but no General Relativity (gravity). Of course, the model predicted Hubble’s law, and many observed features of our Universe. Most remarkably, the model predicted the cosmological principle, of identical homogenous and isotropic Universe for all observers. but Milne’s

Universe does not have a CMBR, which is a fatal flaw. Later, there were proposals that imagined the CMBR as thermalized star light, because the energy densities match well. But, all proposed thermalisation mechanisms are inadequate to generate the perfectly thermalised CMBR that we observe, with its many observed fine details.

A second “fatal flaw” that Traunmüller raises is about the calculation of the line of sight distances as a function of time since big bang. According to Traunmüller, the standard calculation of the comoving distance of some of the high redshift galaxies is much larger than the distance from light can possibly reach us during the time since big bang ($t < 15$ Giga years). However, he also agrees that “The spatial location of GN-z11, shown in Fig. 2, is compatible with an expanding view model, which allows the galaxy to have been close to its calculated spatial distance already at the apparent onset of time”. If the Universe was not expanding, it would be true that light can reach only a distance of 15 Giga-light years in that much time ($d=ct$). With the expansion, there are two possibilities. One is that the distances increase, but light is not part of the expansion (then the redshift is purely from relativistic velocities). Or, light is part of the expanding space and the physical distance travelled is much more than $d=ct$. In both cases, it seems to me, that the CMB will be observed as we do today. In other words, Traunmüller seems to raise the objection after choosing a limited model. This is indeed the shortcoming of what is attempted as a severe criticism. What is required to rule out the big bang model as incorrect and fundamentally flawed would be to show a definite contradiction between what is observed and what can be calculated in a FRW expanding model, consistent with the observations of redshift-distance relation.

I think that the present standard model of the Universe is still provisional – remarkably consistent (given the many theoretical possibilities of discord) and containing some essential features that are concordant with our observations. It is agreed, as many would, that the standard big bang model has some conceptual features that are unsatisfactory, and these may even need significant revision when we understand the composition of cosmic matter-energy better. There have been continuing criticisms, on various counts, and some of which are yet to be resolved completely. Notwithstanding this situation, I conclude that Dr. Traunmüller has not succeeded in showing any convincing fatal flaw in the standard FRW big bang model.