Big bang or big violations?

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Abstract Some criticalities of the big bang model are exposed and the exaggerated partiality of some editors in favor of it is mentioned.

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On 17 March 2014, the BICEP2 collaboration announced the surprising detection of swirling B-mode polarization in the CMB. The polarization itself was not spectacular; rather the interpretation of the results was. They have been deemed as evidence for inflation and for quantum-gravitational process at the Plank scale where the fundamental forces should be unified. The pertaining paper was published in June 2014 [1]. The importance of that experimental result immediately drew the attention of the scientific community. After the initial enthusiasm, doubts appeared with regard to the interpretations of the data as foreground contaminations could not be left out. The real critique arose with regard to the accuracy of the dust data used by BICEP2 collaboration in estimating the foreground contamination. Indeed a paper by the Planck collaboration, where doubts on BICEP2 results are confirmed, appeared on the arXiv preprint server on 19 September (arXiv:1409.5738v1- astro-ph.Co). The authors of the paper supported a joint analysis of the Plank and BOCEP2 data sets.

That sequence of events can be considered one of the latest controversial experimental results which seem to be typical of the scientific debate around the big bang theory. The main problem is that some fundamental statements, which are "strong suits" of that theory, can be nevertheless understood in the frame of totally different models or theories. For brevity I want to mention only two books which contain a remarkable amount of arguments contesting the big bang theory [2, 3]. The first one [2] contains a new theory, titled by the author "The Expanding Space Time Theory" which takes an opposing stance to the Standard Cosmological Theory and claims to explain the cosmos much better that the big bang theory. In particular, it is focused on unexplained problems regarding dark energy, dark matter, entropy, the horizon and flatness problem, accelerating cosmological expansion, cosmological inflation, cosmological evolution and other observational discrepancies. The second book [3] reports a striking variety of observational data analyzed in an alternative way to the big bang approach. The focus of these detailed and ample investigations is to demonstrate that we do not need to invoke a big bang process to explain the redshifts, i.e. one of the most important mainstays of the big bang theory and its meanderings. Those are just two examples of "no-big bang" speculative approaches which purport to account for the main features of the universe's origin and evolution.

The big bang theory seems to be so popular that papers which criticize the big bang theory approach are often unwelcome. There is the well-known case of an open letter signed by about 300 scientists (most of whom had several decades of experience in this research field) which was published in New Scientist [4] with the title “Bucking the big bang”. The signatories criticized several aspects of the big bang theory and complained, above all, of the discrimination by some peer review journals editors against those scientists who do not support the big bang theory because essentially they do not accept fundamental aspects of the theory which look like *ad hoc* hypotheses. On the subject of this vein of discrimination, in 2009 Jerry Bergman wrote a paper on intolerance in modern cosmology [5].

Despite decades of research carried out in this field, it is very difficult to imagine an experiment, or a set of experiments, so crucial to be able to falsify the big bang theory. Indeed, one of the most severe criticisms is that the supporters of the big bang theory needed to introduce an ensemble of *ad hoc* entities which are undetectable as a matter of principle, such as dark matter and dark energy. In the history of physics the postulation of elementary particles before we were able to detect them has not been so infrequent but here we talking about “matter” which should permeate the whole universe without any hope of detecting it directly.

If it is true that it is difficult (probably impossible) to imagine and to perform a crucial experiment or observations able to falsify the big bang model, we should probably find arguments more cogent than very indirect deductive reasoning based on observation data that can be interpreted both by means of the big bang theory and by other different theoretical approaches.

Here I want to propose arguments disregarding the competition between the different approaches.

First of all, we should bear in mind that in the idea of a big bang approach there is something extremely illogical. Indeed when we write “bang” we mean “explosion”. To have an explosion we need a physical process which works as the start mechanism for the explosion itself, i.e. a mechanical or chemical or nuclear or electrical process**.** In the mind of the big bang supporter, physics (and therefore time) begun with it. Therefore we need a complex physical process prior to the beginning of physics.

Furthermore, if we accept the idea of a big explosion at a given instant (say t_0), we must accept the existence of a special point (say s_0) where the explosion originated, otherwise we introduce an asymmetry between *space* and *time* forbidden by special relativity. Therefore, if the big bang theory were working, we should try to determine s_0 as well as looking for t_0. But the existence of such a s_0 contradicts the observed expansion “modality”.

An important argument concerns the laws of conservation. The “mass-energy” of an isolated physical system does not change as the system evolves. Except in some special cases concerning elementary particles (e.g. vacuum decay or other exotic processes), we have developed physics theories and models by assuming the any physical process is regulated by the laws of conservation. For macroscopic systems, we believe that the mass-energy is conserved and then the time invariance operates, that the linear momentum is conserved and then space is homogeneous, that the angular momentum is conserved and then the space is isotropic, and so on. However, according to the big bang theory, all the mass-energy composing the universe appeared, in a unspecified time interval, despite the fact that before the bang we had just nothing. Is it a big violation?

Finally, even if we accept the expansion of the universe as demonstrated (and there is not unanimity on that), the big bang theory presumes a huge extrapolation procedure in going back along billions of years and presumes that physical quantities like time, temperature and so on hold their definitions even in such extreme physical situations.

In conclusion, it should be licit to doubt the big bang theory which, despite decades of *ad hoc* modifications, leaves no negligible problems open and we should stigmatize the strong partiality shown by many editors (of peer reviews and of science magazines) as such an attitude does a disservice to the development of physical knowledge even though I am, of course, aware that the evolution of the universe is very difficult to examine because the object of investigation includes the investigators themselves.

To support that doubt, I proposed we think about some critical points which do not depend on the competition between data interpretations.

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