

# Creation and Big Bang Cosmology

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Recent discussions have raised the issue of the metaphysical implications of standard Big Bang cosmology. Grünbaum's argument that the causal principle cannot be applied to the origin of the universe rests on a pseudo-dilemma, since the cause could act neither before nor after  $t=0$ , but at  $t=0$ . Lévy-Leblond's advocacy of a remetrication of cosmic time to push the singularity to  $-$  involves various conceptual difficulties and is in any case unavailing, since the universe's beginning is not eliminated. Maddox's aversion to the possible metaphysical implications of the standard model evinces a narrow scientism. Standard Big Bang cosmogeny does therefore seem to have those metaphysical implications which some have found so discomfiting.

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Several years ago popular science writer Robert Jastrow ruffled scientific feathers by asserting in his little book *God and the Astronomers* [(1978), pp. 113-116] that many cosmologists have a deep-seated aversion to the possible metaphysical and, indeed, theological implications of classical Big Bang cosmogeny. Recent correspondence to the British science magazine *Nature* seems to bear out this judgment [Maddox (1989), Lévy-Leblond (1989), Grünbaum (1990)]. J. Maddox eagerly anticipates the downfall of the Big Bang model because in it creationists have "ample justification" for their theistic creed; J.-M. Lévy-Leblond seeks instead to subvert the metaphysical implications of the Big Bang theory by a remetrication of cosmic time so as to push the origin of the universe back to infinity, where "it seems to belong"; A. Grünbaum sees no exigency for such a device, since the conception of a cause of the initial cosmological singularity is self-contradictory and the question of what caused the universe's origin therefore a "pseudo-problem."

In reflecting on this dispute, it seems to me that Grünbaum's attempt to elicit a contradiction from the conception of a cause of the Big Bang fails and that Maddox is therefore correct in holding that the classical model does have certain metaphysical implications; on the other hand, the attempts of Maddox and Lévy-Leblond to avert or discredit those implications also fail.

Grünbaum's argument is that even if we assume that *t*<sub>0</sub> is a well-defined instant at which the Big Bang singularity occurred, that "event" cannot have a prior cause because there simply did not exist any instants before *t*<sub>0</sub>. The Big Bang singularity "cannot have any cause at all in the universe" (presumably because backward causation is impossible) nor can it "be the effect of any prior cause" (because time did not exist prior to *t*<sub>0</sub>). As Grünbaum elsewhere makes clear [(1991), p. 248], this argument does not depend essentially upon the assumption that *t*<sub>0</sub> was the first instant of time, rather than a singular point constituting the boundary of time, which, on the analogy of a series of fractions converging toward zero as the limit, has no first instant. In either case, the objection remains the same: since no instants of time existed prior to *t*<sub>0</sub>, there can be no antecedent cause of the initial cosmological singularity. Therefore, that singularity must be uniquely uncaused and the ultimate origin question posed by Maddox inappropriate.

Unfortunately, Grünbaum's objection is pretty clearly a pseudo-dilemma. For he fails to consider the obvious alternative that the cause of the Big Bang operated *at t*<sub>0</sub>, that is, simultaneously (or coincidentally<sup>{1}</sup>) with the Big Bang. Philosophical discussions of causal directionality routinely treat simultaneous causation, the question being how to distinguish *A* as the cause and *B* as the effect when these occur together at the same time [Dummett and Flew (1954); Mackie (1966); Suchting (1968-69); Brier (1974), pp. 91-98; Brand (1979)].<sup>{2}</sup> Even on a mundane level, we regularly experience simultaneous causation; to borrow an example from Kant, a heavy ball's resting on a cushion being the cause of a depression in that cushion.<sup>{3}</sup> Indeed, some philosophers argue that *all* efficient causation is simultaneous, for if the causal conditions sufficient for some event *E* were present prior to the time *t* of *E*'s occurrence, then *E* would happen prior to *t*; similarly if the causal conditions for *E* were to vanish at *t* after having existed at *t* < *t*, then *E* would not occur at *t*. In any case, there seems to be no conceptual difficulty in saying that the cause of the origin of the universe acted simultaneously (or coincidentally) with the origination of the universe. We should therefore say that the cause of the origin of the universe is causally prior to the Big Bang, though not temporally prior to the Big Bang. In such a case, the cause may be said to exist spacelessly and timelessly *sans* the universe, but temporally subsequent to the moment of creation.

But why think that such a cause exists at all? Very simply, the causal inference is based in the metaphysical intuition that *something cannot come out of absolutely nothing*. A pure potentiality cannot actualize itself. In the case of the universe (including any boundary points), there was not anything physically prior to the initial singularity.<sup>{4}</sup> The potentiality for the existence of the universe could not therefore have lain in itself, since it did not exist prior to the singularity. On the theistic hypothesis, the potentiality of the universe's existence lay in the power of God to create it. On the atheistic hypothesis, there did not even exist the potentiality for the existence of the universe. But then it seems inconceivable that the universe should become actual if there did not exist any potentiality for its existence. It seems to me therefore that a little reflection leads us to the conclusion that the origin of the universe had a cause.

From the nature of the case involved, that cause must have transcended space and time (at least *sans* the universe) and therefore be uncaused, changeless, eternal, immaterial, and enormously powerful. Moreover, as I have argued elsewhere [Craig (1979), pp. 149-153; (1991), pp. 104-108], the cause is most plausibly construed to be personal. For the only way in which a temporal effect could originate from an eternal, changeless cause would seem to be if the cause is a personal agent who eternally chooses to create an effect in time. A changeless, mechanically operating cause would produce either an immemorial effect or none at all; but an agent endowed with free will can have an eternal determination to operate causally at a (first) moment of time and thereby to produce a temporally first effect. Therefore, the cause of the universe is plausibly regarded as personal. This conclusion receives confirmation from the incredible complexity of the initial conditions given in the early universe, which bespeak intelligent design [Leslie (1990)]. These attributes are some of the core properties of what theists mean by "God."

Lévy-Leblond will avoid this metaphysical implication by adopting Misner's remetrication of cosmic time, which converts the range of physical time from  $]t_0, \infty[$  to  $] -\infty, +\infty[$ . He apparently thinks that by making the initial cosmological singularity infinitely distant in the metric past, one can thereby safely ignore the metaphysical issues it raises. But why should we regard Misner's temporal metric as a factually objective description of the actual past of the universe rather than the standard metric? Lévy-Leblond seems to suggest three reasons: (i) since the singularity does not belong to the past of the universe, lying as it does on the boundary of the past, this "out-of-reach instant" may be said to be infinitely remote; (ii) on the analogy of the limit velocity  $c$  and absolute zero, we should accept "the idea of a time origin before which the concept of time makes no sense"; (iii) since according to GTR the choice of coordinates used to describe the universe is arbitrary, we are at liberty to modify the spatio-temporal parameters through which the Robertson-Walker metric is expressed and thus send the origin of time back to minus infinity.

But these are insufficient grounds for preferring Misner's remetrication: (i) The singularity is out-of-reach on the standard metric only if one proceeds toward it through an open interval instant by instant; but if we regress by distances of equal non-zero temporal intervals, then we do reach an absolute origin of the universe in a finite number of steps, in that we arrive at a first year, or hour, or second, or what have you, even though those temporal segments lack a first instant [Smith (1985)]. The singularity is the boundary point of the first temporal segment and therefore is not infinitely remote. (ii) On the standard metric we *already* have a time origin before which the concept of time makes no sense, so that this provides no justification for a remetrication. (iii) While GTR, when considered *in abstracto*, does not lay down any formula for slicing up the spacetime manifold of points, certain models of spacetime, like the Friedmann model, have a dynamic, evolving physical geometry that is tied to the boundary conditions of homogeneity and isotropy of the cosmological fluid and which results in certain natural symmetries which serve as markers for the preferred foliation of spacetime and the assigning of a cosmic time parameter [Misner, *et al.* (1973), p. 714]. The underdetermination of the theory *in abstracto* is simply irrelevant to preferring some non-standard clock to record cosmic time over the standard clock.

On the other hand, there are positive reasons for rejecting Lévy-Leblond's prescription: (i) While the metric of time is conventional in a trivial sense shared by all physical quantities, our choice of a metric is constrained by our pre-theoretical conceptions of temporal congruence. A metric which assigned equal temporal intervals to, say, my eating my lunch and to the period of galaxy formation may satisfy all the formal axioms for congruence and yet it would still just not be a theory of *temporal congruence*; any property shared to an equal degree by the interval of galaxy formation and by my lunch just is not temporal duration [Friedman (1973), pp. 231-232]. In the same way, a metric which assigns to the universe an infinite age and infinite past temporal duration, as Milne realized in proposing his parameter  $t$  [Milne (1948)], just is not factually objective, but is a mathematical artifice. (ii) By sending the initial cosmological singularity back to minus infinity ( $1 + \infty$ ), Lévy-Leblond lands himself squarely in the absurdity of an infinite past as argued by G. J. Whitrow [1980], namely, that it is impossible for any present event to retreat infinitely distant into the past. Typically, one responds to Whitrow by pointing out that an infinite past does not entail infinitely distant events; but for Lévy-Leblond such a recourse is not open because he has made the origin of the universe into an infinitely distant "event" or entity on the boundary of the past. (iii) In the same vein, Misner's remetrication, despite his protestations, does fall prey to Zeno's Paradoxes of motion in that it would be impossible to proceed through the infinite series of intervals separating any time  $t$  from the singular origin of the universe [Bartels (1986), p. 112]. The usual escape route--that the intervals converge in size toward zero--cannot work for Misner because, by redefining what counts as temporally congruent in order to achieve an infinite age for the universe, he has, in effect, made the intervals equal in length, so that Zeno's Dichotomy paradox goes through with a vengeance. (iv) Since Misner's time scale does not remove the *physical* beginning of the universe at the initial cosmological singularity, but merely reassigns its date, it ultimately does nothing to avoid the metaphysical problems associated with an absolute origin. We should only be required to say that on this peculiar time scale, the universe came into being and so was created an infinite time ago. {5} Lévy-Leblond's prescription for avoiding the metaphysical implications so feared by Maddox thus seems utterly unavailing.

Which brings us back to Maddox's concern: is it discreditable to draw these sorts of metaphysical inferences? Maddox seems to think that such inferences obfuscate "an important issue, that of the ultimate

origin of the world." But it seems to me that he has made up his mind in advance as to what sort of answers to that question are going to be deemed acceptable. That seems to be philosophical prejudice on his part. As Jastrow emphasized, the scientist's pursuit of the past ends at the moment of creation; but simply as thinking men and women desiring to discover the meaning of life and the universe, are we to be debarred *a priori* from drawing what may seem to us plausible metaphysical conclusions?

Of course, as Grünbaum reminds us, it is an empirical question as to whether classical Big Bang cosmogeny is a realistic account of the origin of the universe. But alternative models, whether quantum models [Craig (1993)] or plasma models [Kevles (1991)], have not yet proved to be convincing. Therefore, it seems to me that, like it or not, currently accepted cosmological theory does lend tangible support to the theistic doctrine of *creatio ex nihilo*.

### Endnotes

{1}--coincidentally in case "simultaneity" is strictly defined in terms of occurrence *at the same time*. Since the singularity is not an instant or moment of time, but a boundary of time, a cause producing its effect at the singularity could not be strictly said to be simultaneous with its effect. Nonetheless they both occur coincidentally (in the literal sense of the word), that is, they both occur at *to*.

{2} In the case of God's creating the universe, it is, of course, evident which is the cause and which the effect, since it is metaphysically impossible for God to have an external cause.

{3} It would be in vain to object to the proposed solution that simultaneous causation is impossible due to the finite velocity of the propagation of physical causal influences, for (i) the objection fails to reckon with the fact that remote causes are linked by causal chains to the immediate causes of the events in question, such that for any arbitrarily chosen non-zero interval of time in which the event occurs simultaneously with its cause, one can denominate non-zero subintervals in which remote, intermediate, and immediate causes can be identified in the causal chain, with the result that simultaneous causation is never eliminated, and (ii) the objection is irrelevant to the case of creation, since God is not a physical object dependent upon finite velocity causal signals, but, as one who transcends space, is immediately present through His knowledge and power to every point in space (or on its boundary).

{4} This should not be interpreted to mean that there was an empty time prior to the singularity, for time begins *ex hypothesi* at the moment of creation. I mean that it is false that something existed prior to the singularity.

{5} Notice, therefore, that Lévy-Leblond's article has been mistitled, for on his view the universe has an infinitely distant beginning point.

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