Philosophy of Cosmology. A Glimpse from the Outside

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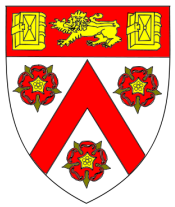

Plan of Talk

1. Setting aside ...
2. Explaining initial conditions, and the values of constants?
   - Initial considerations
   - What is explanation?
   - Anthropic explanation, selection effects
3. The multiverse
   - A naive definition
   - The scheme of explanation
   - What role for the other alternatives?
4. Probability and explanation revisited
5. Observationally indistinguishable spacetimes

Setting aside ...

Old metaphysical conundrums e.g.: whether time can have a beginning or end, whether space can be infinite; alleged antinomies ... global causal pathologies (CTCs) allowed by local relativistic physics.

Old epistemological conundrums e.g.:
(i) whether there can be a science of cosmology given that there is only one universe—rather the laws of cosmology are the laws of relativistic and quantum physics;
(ii) how to justify cosmological principles that constrain models—surely inductively. (Not by their modesty, since there can be selection effects.)

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This leaves...

(A): Cosmology as a source for case studies in philosophy: e.g.

(i) idea of a purely observational science;

(ii) the calibration of instruments, e.g. for the distance ladder.

(B): Initial/boundary conditions and the values of parameters as a topic for assessment and explanation, unlike in most of physics.
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Initial considerations

Standard example: the usual motivations for inflation: flatness and horizon problems.

Issues: (i) the regress of explanation about fine-tuning: (addressed by eternal inflation; which suggests a multiverse).
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What is explanation?

I think there is no essence of explanation. But many (cf. Hempel) take it to require : deduction from true premises that include a law (universal generalization; cf. Hume) of a confirmed theory: of (i) the explanandum (event); or of (ii) the high probability of the event; or of (iii) even the low probability of the event.

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A naive definition

Let a *multiverse* be a spacetime that is topologically connected, but comprises disjoint, or effectively disjoint, parts that are causally disconnected—or effectively causally disconnected.

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(ii) each possible world is connected, and disconnected from every other;

(iii) any consistent theory, with any parameter values, is true at some possible worlds.

Each of these features distinguishes such worlds from:

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The scheme of explanation

Suppose we observe a parameter p to equal p_0, while the laws dictate only that $p \in R$, with $p_0 \in R$. We ask: *why does p have value p_0?*

The multiverse answer: That p has value p_0 is explained (at least: is un-puzzling), because it is only parochially true. In each part of the multiverse suitable observers (if such there be, or could be, in the given part) will observe their part's parochial value.

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Explanation apart: the 'nothing special' thought that allays puzzlement does NOT require the equal reality of the other parts of the multiverse.

Think of a probabilistic process, in the usual sense. We explain the outcome by citing the process. We might say the explanation shows the outcome is 'nothing special'. But the explanation succeeds without the equal reality of the alternatives.

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Observationally indistinguishable spacetimes

Almost every spacetime is observationally indistinguishable from another.

A spacetime (M, g) is *observationally indistinguishable* from (M', g') iff for all points $p \in M$, there is a point $p' \in M'$ such that $I^-(p)$ and $I^-(p')$ are isometric.

Let (M, g) be a spacetime that:

(i) is not *causally bizarre* (i.e. there is no point $p \in M$ such that $I^-(p) = M$), and

(ii) satisfies any set Γ of conditions that are *local* (i.e. any two locally isometric spacetimes either both satisfy the condition, or both violate it).

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