Observational Indistinguishability and Geodesic Incompleteness

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Abstract

It has been suggested by Clark Glymour that the spatio-temporal structure of the universe might be underdetermined by all observational data that could ever, theoretically, be gathered. It is possible for two spacetimes to be observationally indistinguishable (OI) yet topologically distinct. David Malament extended the argument for the underdetermination of spacetime structure by showing that under quite general conditions (such as the absence of any closed timelike curves) a spacetime will always have an OI counterpart (at least in weak sense). Because the plight of the cosmologist seemed to be so discouraging in this regard, Malament considered the relationship between global properties and OI spacetimes. This information is helpful to the cosmologist. It allows, in principle, one to reject some spacetime models based on observational evidence. In this paper, I consider the relationship between variants of geodesic incompleteness and different senses (some old and some new) of OI. In light of the findings, it seems that (for the most part) the predicament of the cosmologist is not good. Quite generally, versions of geodesic incompleteness are not conserved even under the strongest formulations of OI.

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