Which flatness problem does inflation solve?

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Abstract

For several reasons, the flatness problem as originally proposed differs from the flatness problem today, both qualitatively and quantitatively; theory, observations, and the recent history of cosmology all play a role in this change.

Summary

The 'old flatness problem' was to explain why $\Omega_\Lambda = 0$ (actually, at the time $\Omega_\Lambda = 1$) was maintained within a couple of orders of magnitude. inflation was suggested as a solution to this flatness problem (Guth, 1981). Related to the necessity of inflation, for this and other reasons, has made inflation a popular topic of study, even leading to predictions which have been confirmed. At the same time, several authors have claimed that the flatness problems is not a real problem at all, at least in the context of classical cosmology, though of course it is still a real problem in quantum cosmology. It is still widely believed that the flatness problem is a real problem, perhaps because few observers provide much better evidence for a flat (or near-flat) universe than a universe in which the curvature is zero. However, in recent years, the variation in $\Omega_\Lambda$ has been significantly reduced, thus the variation in $\Omega_\Lambda$ is much smaller now—which will collapse in the future (expand forever); similarly, $\Omega_m$ is much smaller now—which will expand forever. However, in the general case ($\Omega_\Lambda = \Omega_m = 0$), see Stabell & Refsdal (1966). Thomas-Mann-Str. 9, 63477 Maintal, Germany.

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