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Observational Cosmology in the 1960s¹

CHRISTOPHER SMEENK, Univ of Western Ontario

This talk considers the historical development of observational cosmology up to the 1960s, pursuing two main themes. Early work in relativistic cosmology characterized the effect of spacetime geometry on the appearance of distant objects – e.g., cosmological red-shift as a function of distance. Results of this form are unsatisfying because they hold only for an exact spacetime geometry, and it is clear that the actual universe departs from any of these simple exact models. McCrea and McVittie initiated a program of deriving observational relations that hold for a broad class of solutions, not only in the highly symmetric FLRW models, culminating in the work of Kristian and Sachs. This first line of work makes it possible to describe cosmological observations in a spacetime geometry approximating that of the real universe. The second theme regards the scope of cosmological observations. Physical cosmology succeeded in establishing a standard model by utilizing alternative empirical routes, shifting away from a reliance on galaxies as tracers of large-scale spacetime geometry. Lematre had considered the effect of cosmological evolution on a wide variety of physical processes, but his results were limited and speculative. In light of other developments in physics, in the 60s it was possible to use these alternative routes – including primordial element abundances and the background radiation – as strong evidence in favor of the big bang model.

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