Three cosmological dogmas – Einsteins influence on early relativistic cosmology

TOBIAS JUNG[1]

[1]Universität Augsburg, Lehrstuhl für Philosophie und Wissenschaftstheorie,
Universitätsstr. 10, D-86135 Augsburg, Germany
tobias.jung@web.de

It is well known that Einstein (1917) was the first to propose a relativistic cosmological model, i. e. a cosmologically significant solution of his field equations of the general theory of relativity. Essential features of the Einstein model were its staticness – to obtain a static model Einstein had to introduce the cosmological constant alias "the biggest blunder in my life" into his original field equations –, and its being spatially closed. Thus, the Einstein model can be represented at each cosmic time by a finite but unbounded 3-dimensional sphere with its radius never changing. In Newtonian language, the attractive gravitational force is balanced by a positive cosmological constant which acts as a repulsive force. For more than a decade, Einstein defended his model in several respects.

Against the work of Friedmann (1922, 1924) and Lemaître (1927) he raised the objection that their models are not static. Einstein (1922) accused Friedmann of an error in his calculations, but had to refrain from this statement (Einstein 1923). During the fifth Solvay meeting at Brussels in 1927 Einstein told Lemaître that in his opinion non static world models are "simply disgusting".

Also, he wrote a comment about the hierarchical Newtonian model proposed by Selety (1922). In this case Einstein did not agree with Selety's infinite universe. He had presented a couple of arguments against infinite space in his "Four lectures on the theory of relativity" given at Princeton University in May 1921. Similarly, he mentioned that "the world [has to be] spatially self-enclosed" in his King's College Lecture in London in 1921 and in an article about "Space-time" which was published in the Encyclopedia Britannica in 1929.

Clearly, a static universe can only be obtained if one assumes a positive cosmological constant – otherwise the gravitational attraction would not be balanced or overcome but amplified. This assumption was not explicitly defended by Einstein but remained unchallenged in most cosmological models.

The three important ingredients for the Einstein model, namely its staticness, its being spatially closed though unbounded and its positive cosmological constant remained crucial for the respectability of cosmological models for several years and restricted relativistic cosmology. Even after the staticness had to be dropped due to the discovery of the redshift-distance relation of the spiral nebulae and its interpretation as a general expansion of the universe the other two assumptions still remained widely accepted. Except for Friedmann (1924) the firsts to take negatively curved models into account were Heckmann (1932) and Robertson (1933) in their systematic reviews of all homogeneous and isotropic cosmological models.

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