The Steady State Theory

While the newly born science of cosmology was enjoying a fairly quiet progress in the aftermath of Hubble's discovery and the theoretical models of the expanding universe, the situation was enlivened in 1948, by the appearance of a radical new theory of the universe. Known as the steady state cosmology (SSC) the theory was proposed by three British astrophysicists, Hermann Bondi, Thomas Gold and Fred Hoyle.

The approach to the theory was from two different angles, however. Bondi & Gold argued that for testing a model universe on a large scale, one is necessarily assuming that the laws of physics used in the interpretation of observations must be the same at all points in spacetime. As the universe, encompasses everything, it also includes the laws of physics. As such, in an evolving universe, like the big bang models, one cannot guarantee that the basic physics has all along remained the same. Hence, such models are basically untestable and therefore not scientific. A testable cosmology that guarantees that the laws of physics here and now are the same as in a distant galaxy observed at earlier epoch is one in which the universe does not change in time as well as space. That is, the universe must be in a steady state. This principle they named, the perfect cosmological principle.

Hoyle's approach, was more physical than philosophical and it concentrated on the most obvious observable feature of the universe, namely the existence of matter in it. How did it come about? In the big bang cosmology, it arises in a singular event and as such lies beyond the scope of physics. Hoyle looked for a field theory, involving a scalar field which not only produced matter, but also led to the expansion of the universe. The simplest solutions of his equations, which were the same as those of relativity but with the addition of the scalar field, produced the same steady state model that Bondi and Gold obtained from their perfect cosmological principle.

Has the universe always remained more or less in the same state, or has it evolved through a series of very different states? The opposite conclusions of the steady state theory and the big bang theory prompted astronomers to make observations of the distant parts of the universe as carefully as possible. The 1950s and the 1960s therefore saw a lively debate between the two theories with the healthy fallout that the knowledge of the extragalactic universe improved considerably. We will encounter examples of this in later parsecstones.