The discovery of the cosmic background radiation was a major turning point in the history of cosmology. The steady state theory quickly lost credibility and the big bang theory was established. Scientists soon began to take cosmology much more seriously.

Of the five pillars, cosmic background radiation is one of the strongest, and its strength is not hard to understand. Think about it for a moment. A prediction is made that there should be radiation throughout the universe—an "echo" of the big bang. Astronomers search for it, and it is found. In particular, it is found to have a temperature of 3 K, which is very close to the predicted temperature. Let's begin by considering the history of the discovery.

DICKE AND PEEBLES

Throughout the early 1960s, Robert Dicke of Princeton conducted a Friday night seminar. They had started out as seminars on gravity physics, but Dicke soon began to take an interest in cosmology and many of the seminars began to center around cosmology. Oddly enough, only a few years earlier, he had hardly given cosmology a thought.
At the time he was conducting these seminars, there was considerable interest in both the big bang and steady state theories. The central problem in cosmology, in fact, was: Which of the two theories is correct? This was not an easy problem to solve, as observational data at this stage were still meager.

Dicke preferred the big bang theory, but he was far from satisfied by it. As far as he was concerned, it had serious problems. For example: What happened before the big bang? It seemed as if you could trace the universe back in time, but when you got to the big bang you could go no further; you couldn't say anything about what might have happened before it. Was it, in fact, possible to determine anything about what happened before the big bang? Furthermore, was it possible to explain things immediately after the big bang? Dicke was determined to find out. One way around some of the problems, he reasoned, was to assume that the universe oscillated. If instead of a single big bang there had been several big bangs and collapses, things would be much simpler.

Dicke was convinced that several cycles had occurred. But it immediately became obvious to him that if they had, there was another problem. It was possible that something from the previous universe may have survived when that universe collapsed in a "big crunch" and if so, we should be able to detect it. On the other hand, it was also possible that our universe started "from scratch" with everything in the previous universe being reprocessed. If this was the case, temperatures early on had to have been extremely high. Dicke determined that a temperature close to 1 billion degrees would be needed to split up all of the atoms and nuclei from the previous universe.

Dicke explained his ideas to his colleagues, and suggested that a search be made for evidence that a previous universe had collapsed, heated, then bounced back creating our universe. He pointed out that if the temperature at the time of the bounce was exceedingly high, there would have been a considerable amount of radiation, and this radiation couldn't have escaped, and therefore should still be here. It would, of course, have cooled considerably as the universe expanded.