Temperature anisotropies in cosmic microwave background radiation

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Temperature anisotropies in cosmic microwave background radiation, which is direct evidence in support of the hot big bang of the early universe, were discovered in 1992 using a COBE satellite, by a team led by Professor George Smoot who won the Nobel Prize in Physics in 2006 (see page 12). Temperature anisotropies were generated in the very early universe due to the quantum effect and evolved in the expanding universe under various physical processes, such as acoustic oscillation, gravitational redshift, and photon diffusion. This figure shows the typical amplitude of anisotropies as a function of the size (small values of ℓ correspond to large scales). Comparing theoretical predictions with observational data, we can estimate the amount of matter, baryons, space curvature, and so on. Moreover, it offers a clue to nature of the early universe.