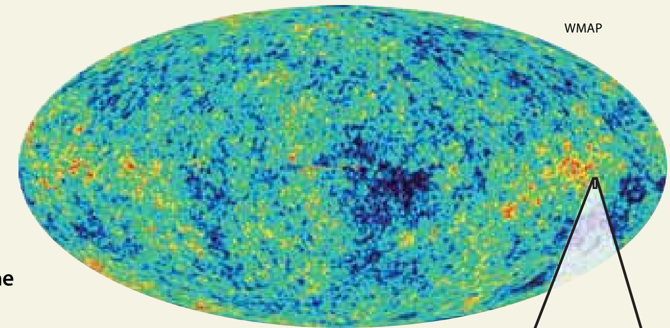
/// THE COSMIC SLINKY TOY AND THE CMB

In the early universe, light and matter were linked together in the form of plasma. Cosmologists believe small variations in the plasma's density were imprinted earlier during a period of rapid acceleration — inflation. The study of these fluctuations may help explain inflation.

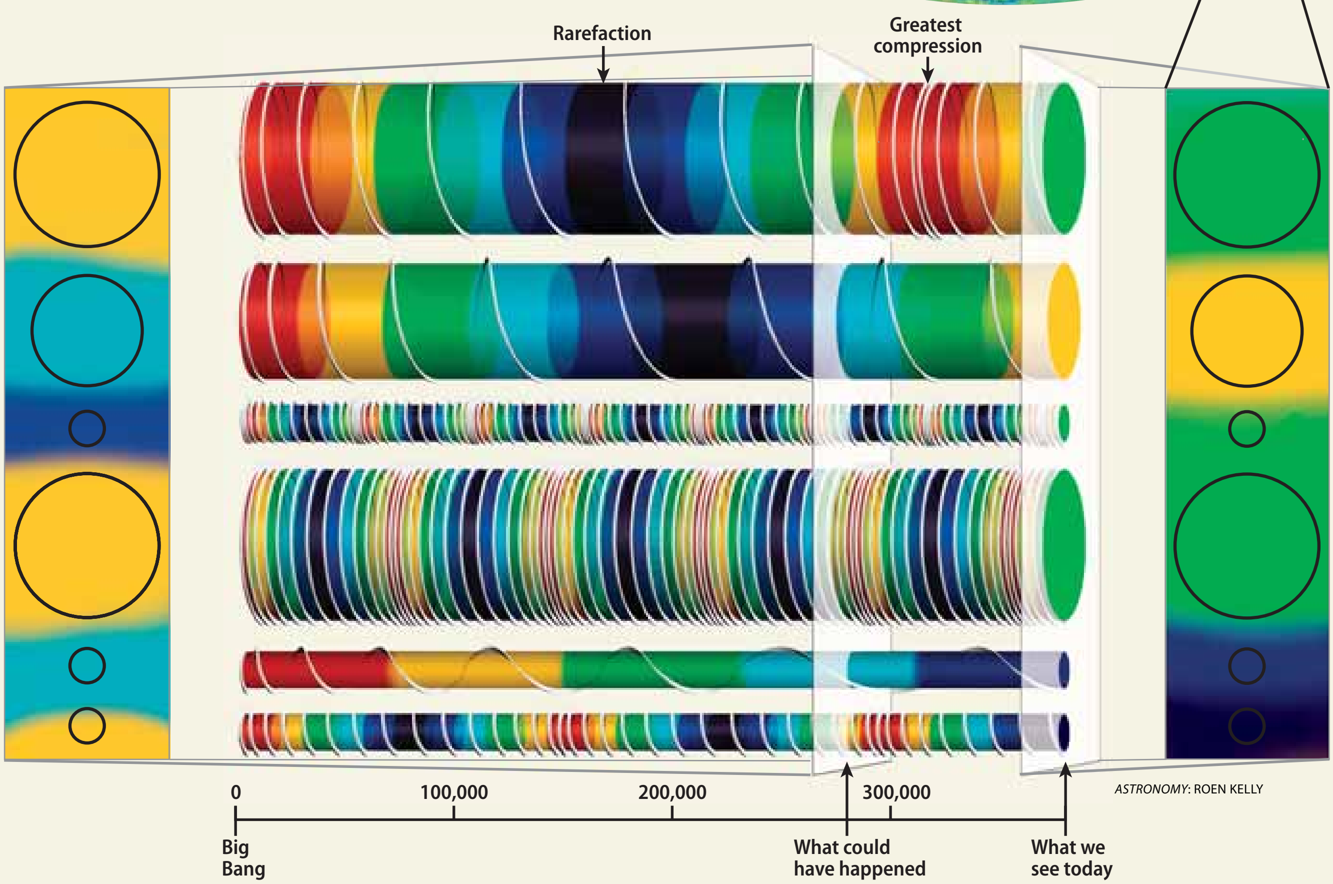
The fluctuations grew through gravitational collapse. Matter and light, linked together, collected in high-density regions, creating deeper gravitational pockets. In effect, the rich got richer, the poor got poorer.

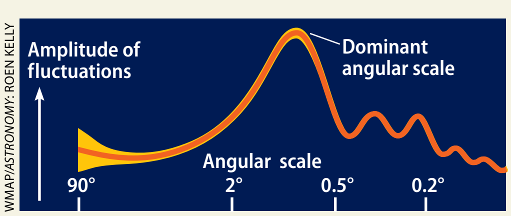
The flow of plasma resembles standing sound waves, or acoustic oscillations. High-density areas are equivalent to compression regions. Low-density areas are like rarefaction regions. (Imagine pushing a Slinky forward periodically.) According to Stephan Meyer, a University of Chicago astrophysicist and a Wilkinson Microwave Anisotropy Probe (WMAP) team member, "acoustic oscillations are one of the things that happen to matter in the process of gravitational collapse."

The fluctuation pattern in the early universe's plasma we see today as standing waves of different amplitudes and frequencies depends on what the universe's contents were when light almost instantly scattered from matter 380,000 years after the Big Bang. At this so-called "surface of last scattering," the acoustic and gravitational fluctuations left an imprint in the cosmic fluid. When light is emitted from a high-density area, it "climbs out" of that region. It thus loses energy and cools (blue splotches). As light "falls into" a high-density region, it gains energy and becomes hotter (red splotches). — *L. K.*



OSCILLATING SLINKY-LIKE TUBES move like sound waves. The CMB pattern depends on the moment of last scattering. This diagram shows two last-scattering options, each with random oscillation patterns, and varying amplitudes and frequencies. If light scattered from matter 100,000 years prior, we would see a different pattern in both the CMB and the universe's structure.





SOUND WAVES FROM THE CMB. The color sky map above can be shown in a plot of the temperature fluctuation's amplitude as a function of its angular size. The flat area on the left corresponds to fluctuations from inflation that are so large they have not yet evolved. The peaks beginning at an angular scale of 1° are sound wave imprints. The largest peak corresponds to the angular scale that evolved into the dominant structure size we see today.