Nobel Prize in Physics 2006 Awarded

For Discovery of Fluctuations in Cosmic Microwave Background Radiation

By Barry Davidoff

The Christmas season of 2006 is an especially memorable one for people in Sweden who are interested in astronomy and space science.

First it hopefully will mark the launch of Christer Fugelsang aboard the space shuttle to become the first Swedish citizen in space.
Second it is one of the few times that the Nobel Committee has chosen to award its Physics prize for major contributions in astronomy and cosmology.

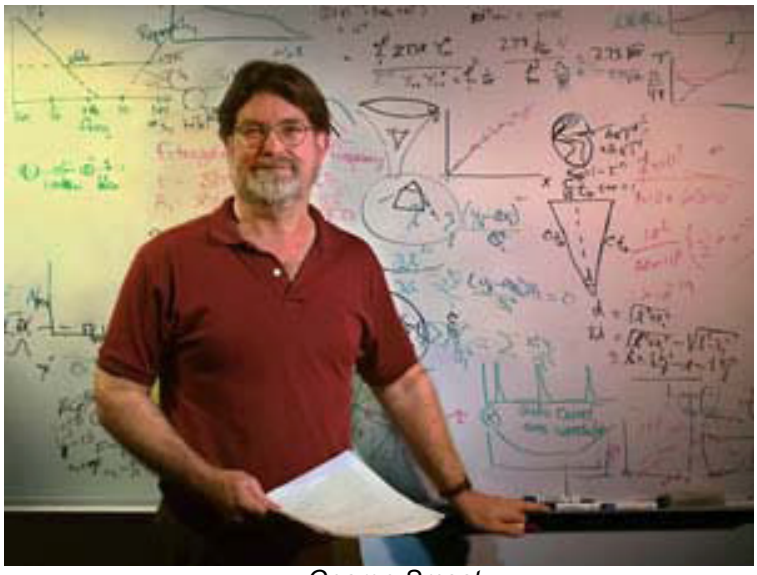
This year's prize goes to George Smoot of the Lawrence Berkley National Laboratory and John Mather of NASA's Goddard Space Flight Center for their discoveries of fluctuations in cosmic microwave background radiation (CMB). Their work serves as major proof of the Bid Bang theory.

According to the Big Bang theory following the explosion of the primordial universe there should be residual radiation in the form of microwave radiation.
This radiation would permeate every region of the universe as it expanded. This radiation corresponds to the radiation emitted by a black body at only 2.7˚ Kelvin.

Arno Penzias and Robert Wilson of Bell Laboratories were awarded the Nobel Physics Prize in 1978 for their discovery of CMB by using radio telescopes.

Originally at the time of the explosion the CMB was evenly distributed over the entire universe at a super-hot 3000˚ C. Over 14 billion years the CMB cooled to reach its present temperature of only 2.7˚ Kelvin.

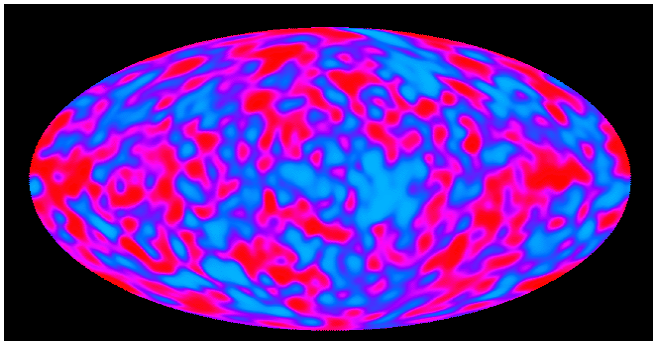
In the 1970's it was revealed that matter was not distributed uniformly since in some parts of the sky there are large clusters of millions of galaxies while other parts of the universe are relatively bare.
Smoot theorized that there should be tiny fluctuations in the residual temperature of the CMB. These tiny fluctuations of temperature in different directions are termed "anisotropy" and are in the order of one 1/100,000 of a degree.



George Smoot

The fluctuations show that ripples and waves were formed by the Big Bang.
Over time these ripples would form into larger bodies of matter and become galaxies and clusters of galaxies.
Unfortunately observation of CMB is blocked by the earth's atmosphere.
Smoot and Mather became the primary investigators of the COBE (COsmic Background radiation Explorer) satellite which was launched in 1989. The COBE satellite mapped the entire universe in ten different wave lengths in its search for CMB.

In 1992 when the map below was unveiled it confirmed the Big Bang theory.



Map of Fluctuation in CMB taken by COBE

The map showed the tiny fluctuations in CMB that had been predicted. These fluctuations correspond to areas where over billions of years matter accumulated to form stars and galaxies.
The map is in an essence a photo of the universe taken only 300,000 years after the Big Bang.
The fluctuations in CMB were caused by ripples and shock waves of the original explosions.
Individual particles of matter would gather in the troughs of the ripples and coalesce into ever larger forms becoming stars and then galaxies.

The Nobel Physics Committee of Kunglia Veteskapsakademien commended John Mather of for being the leader of the NASA team as well as the designing the experiment that measured the basic blackbody radiation of the CMB.
George Smoot was cited for measuring the small variations in the temperature of the CMB that proved its anisotropic properties.