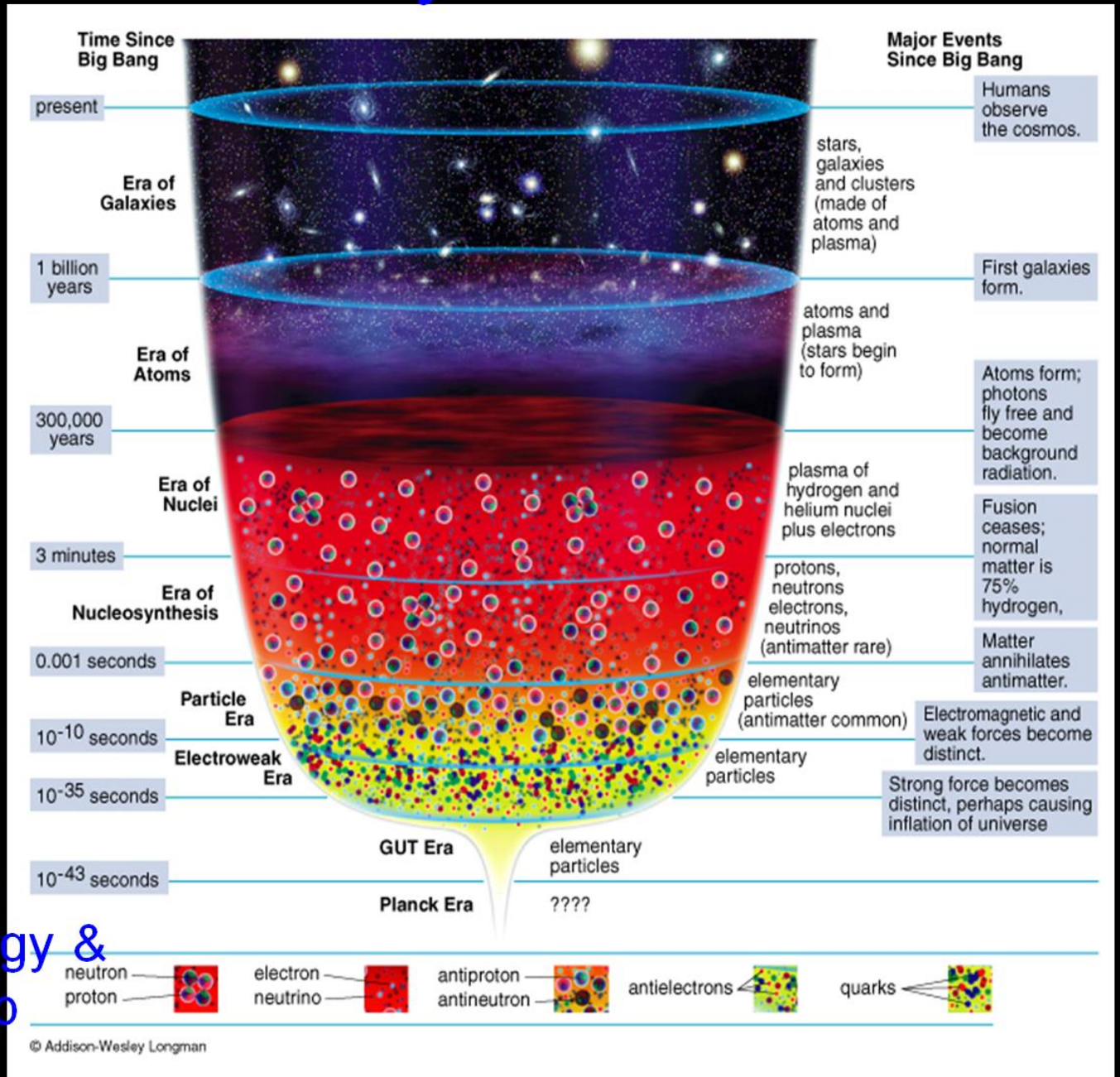
Time

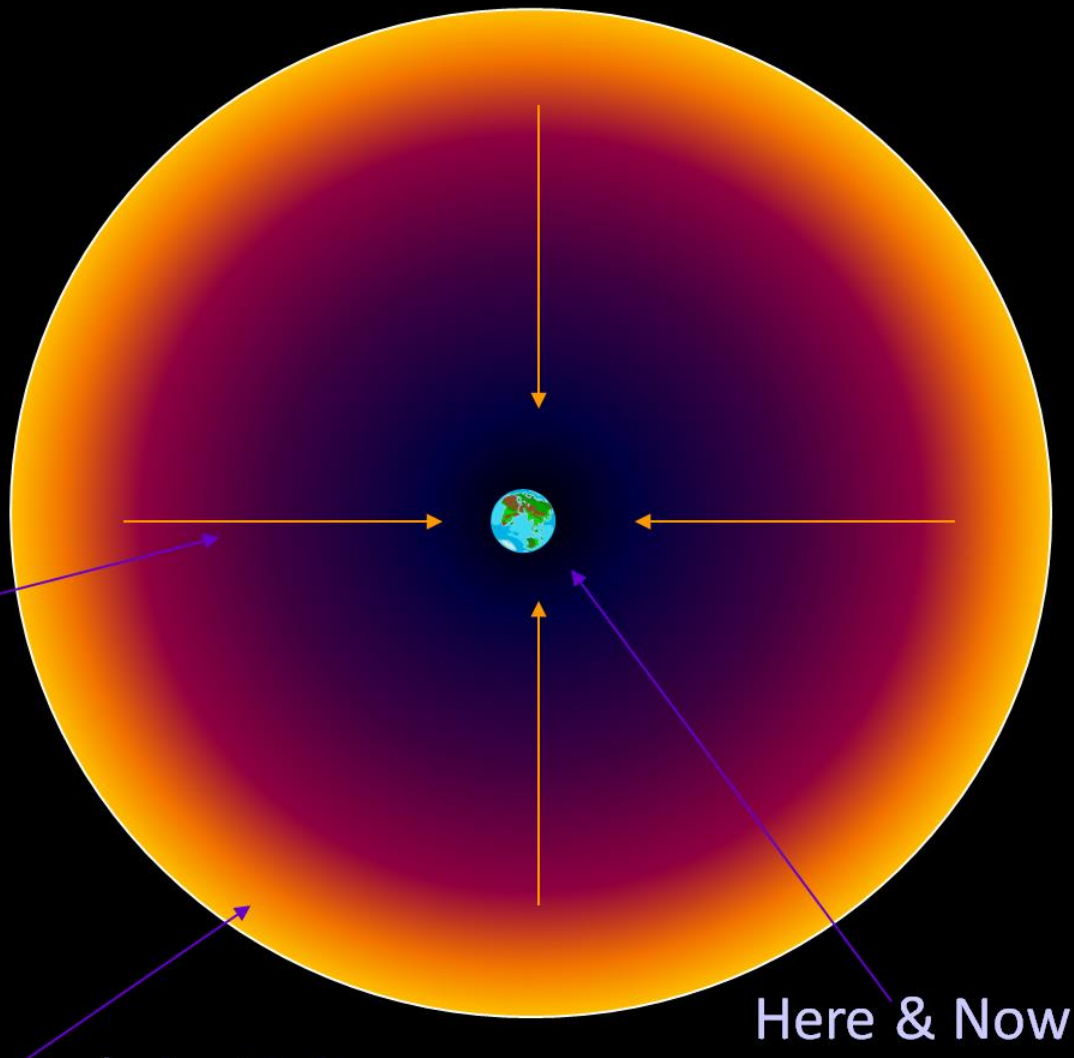
The History of the Universe



High Energy & Temp

The Edge of the Observable Universe:

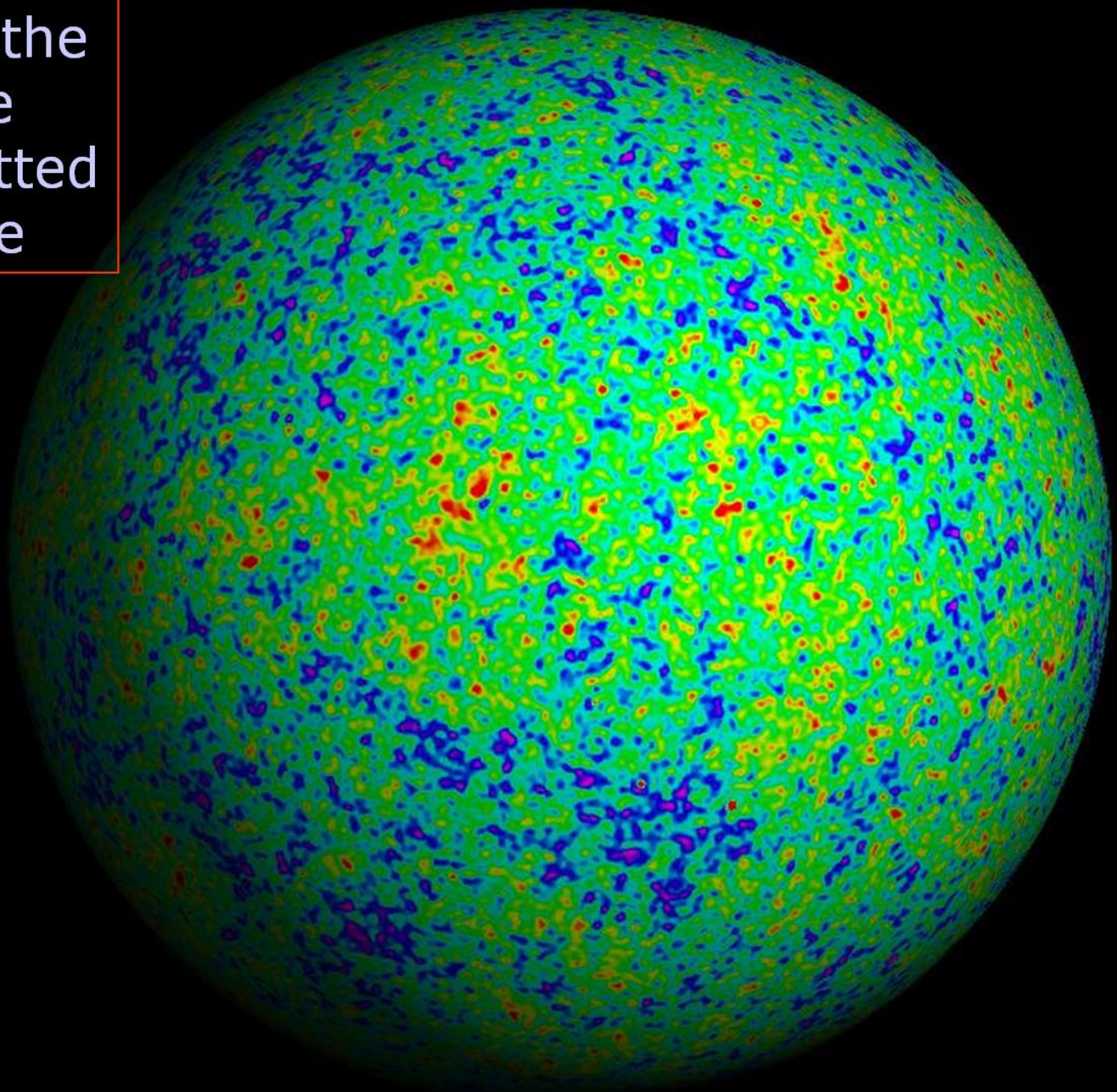
As we look back in space we look back in time. We see:



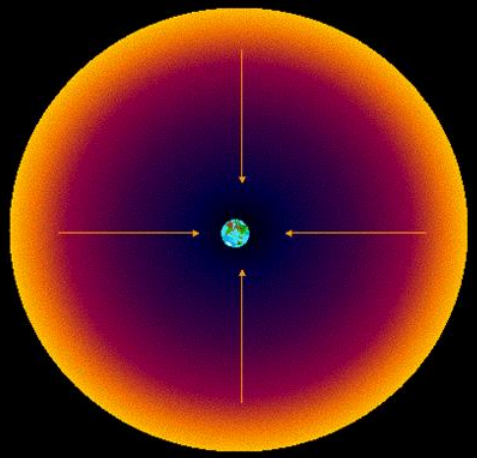
Light traveling from far away = from distant past

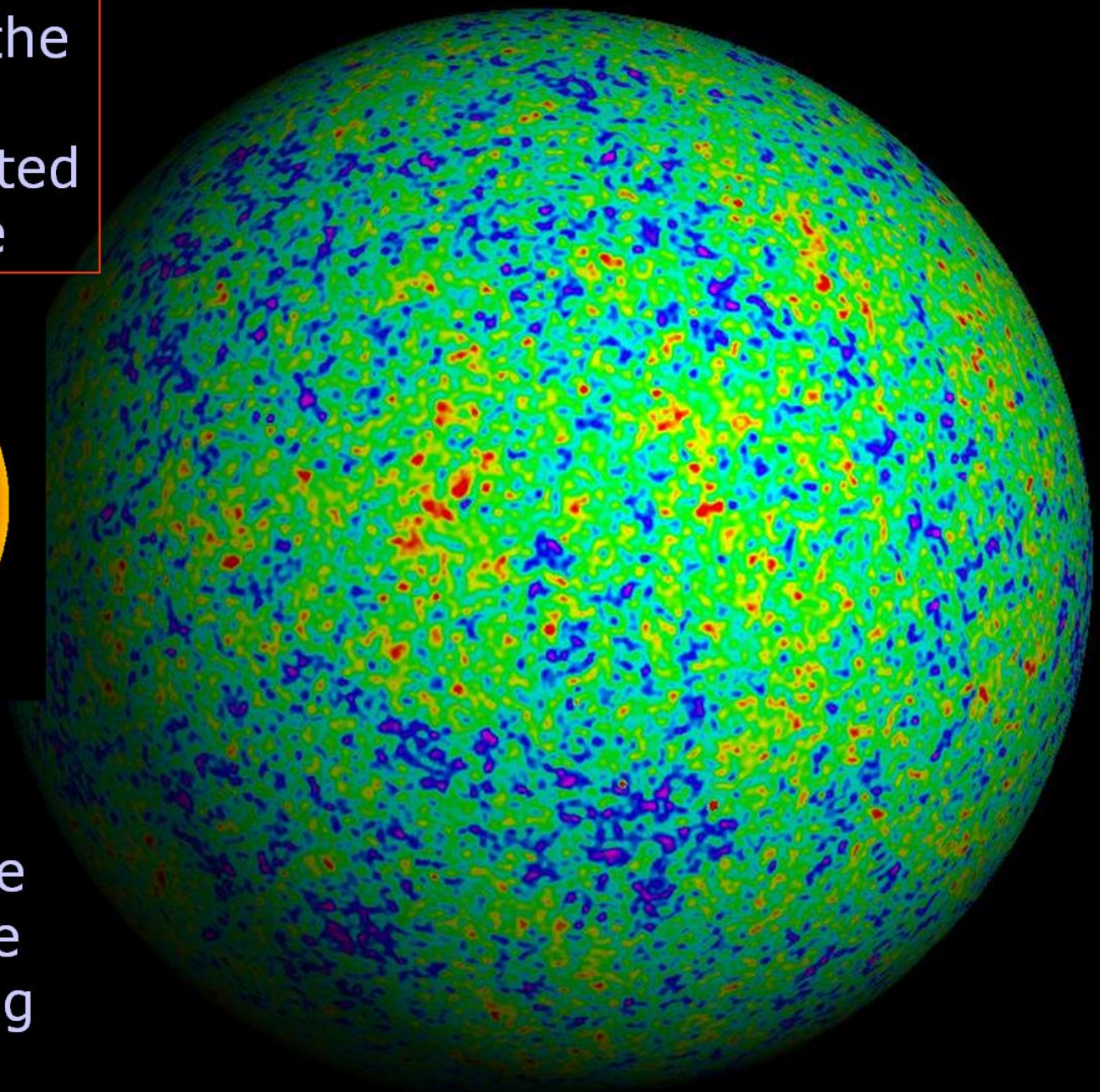
Long ago (about 14 Billion years) the Universe was so hot and dense it was opaque: The edge of the observable universe

WMAP map of the "edge of the observable universe" plotted as a sphere



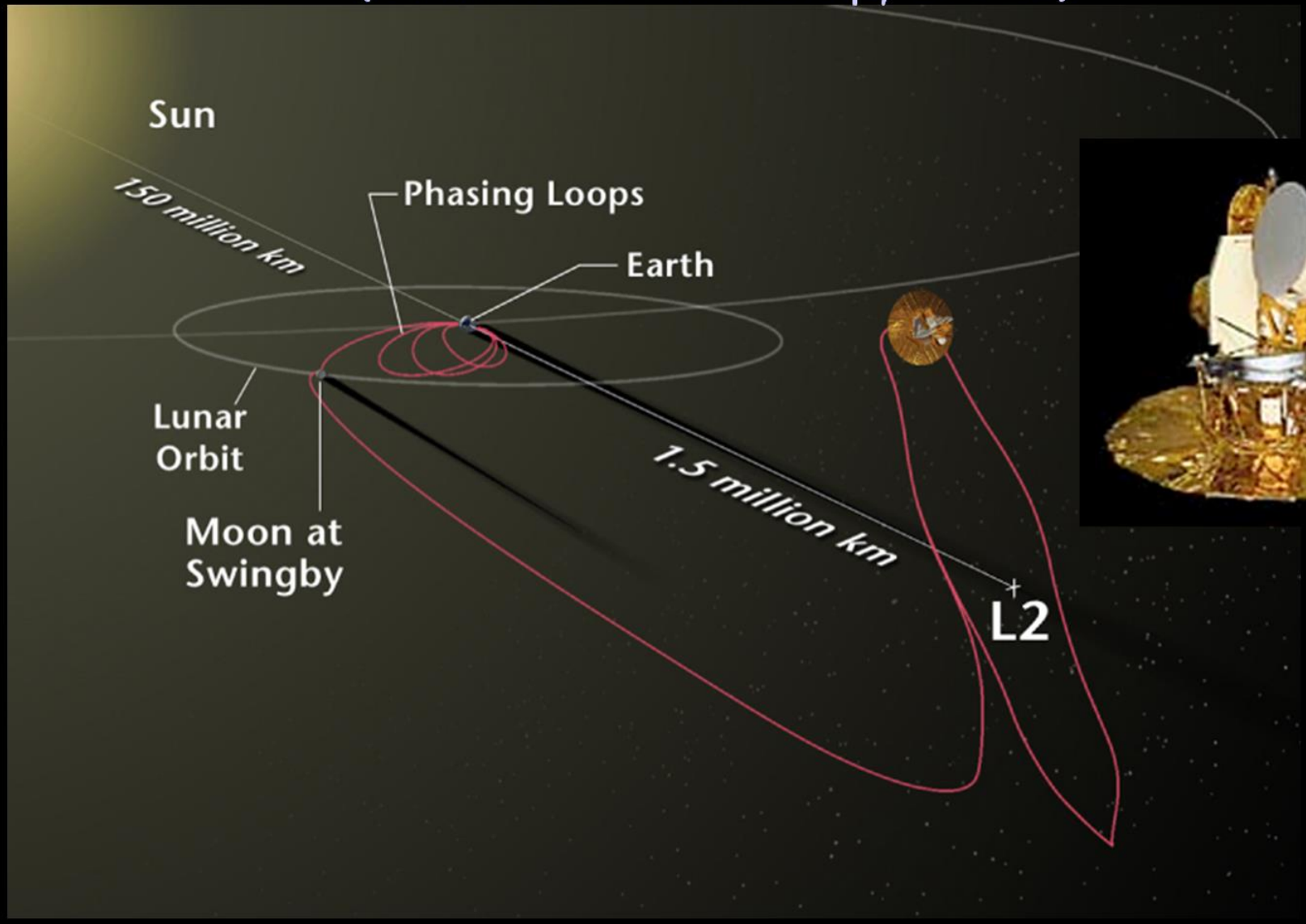
WMAP map of the "edge of the observable universe" plotted as a sphere





Note: we are really on the inside looking out

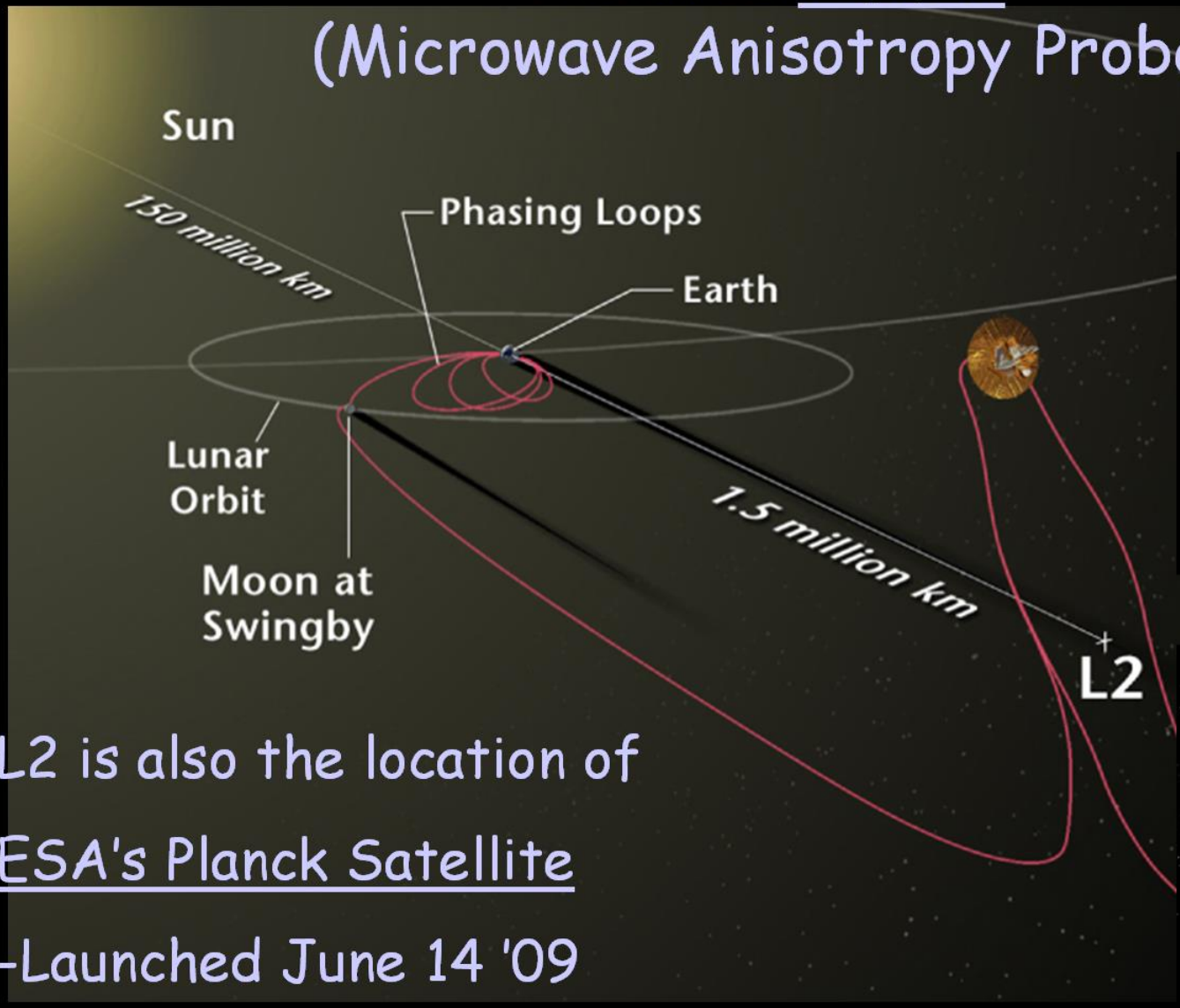
NASA's WMAP
(Microwave Anisotropy Probe)

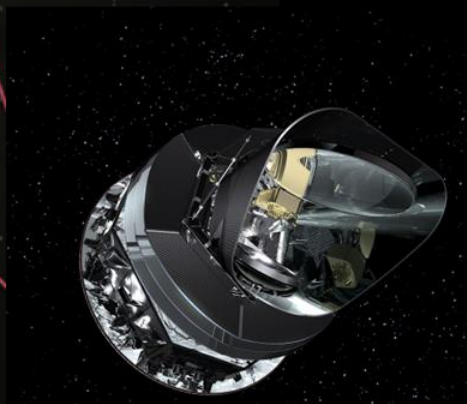


-Launched June 30 '01

-Reached "L2" Oct 1 '01

NASA's WMAP
(Microwave Anisotropy Probe)





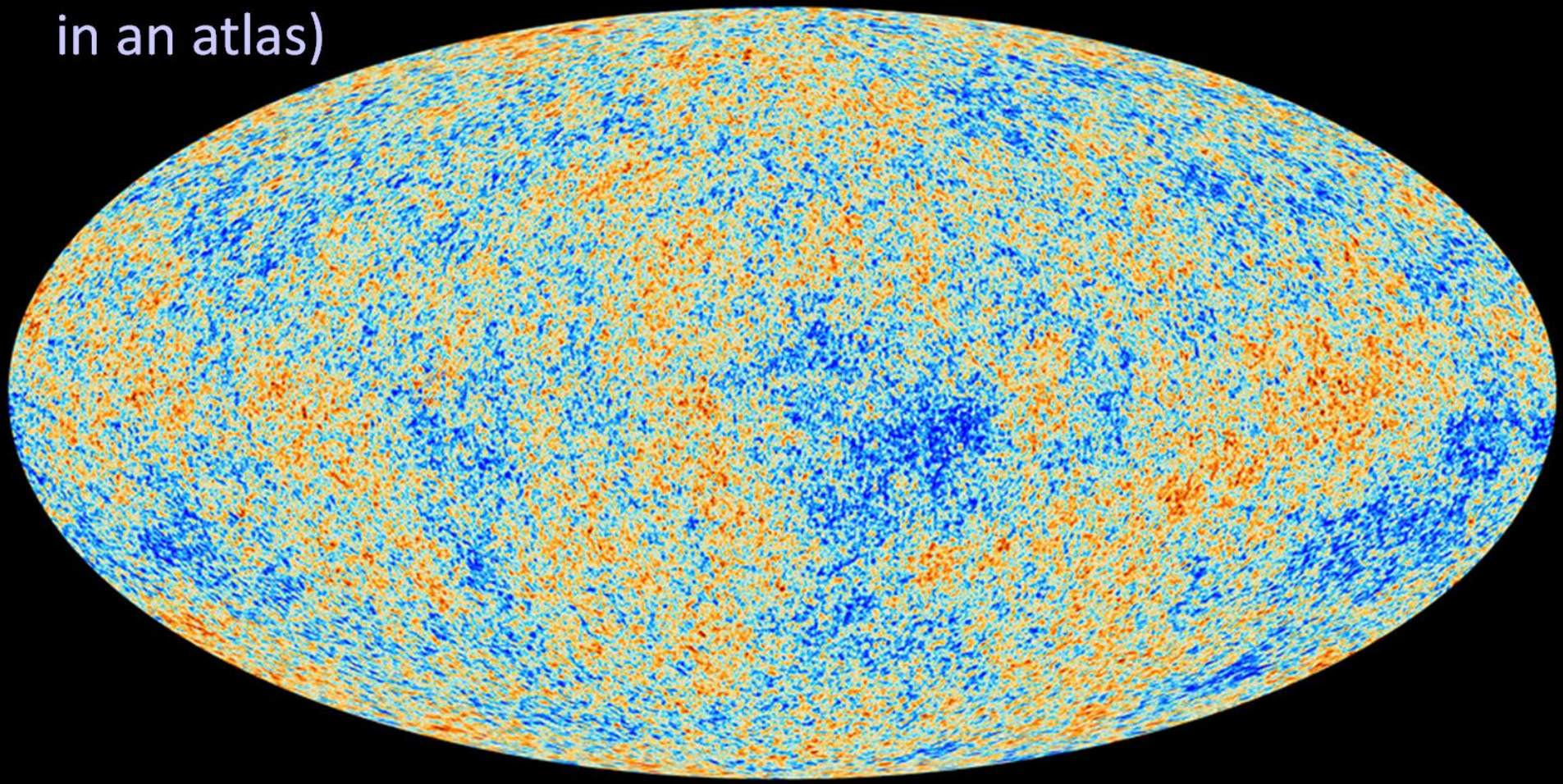
L2 is also the location of

ESA's Planck Satellite

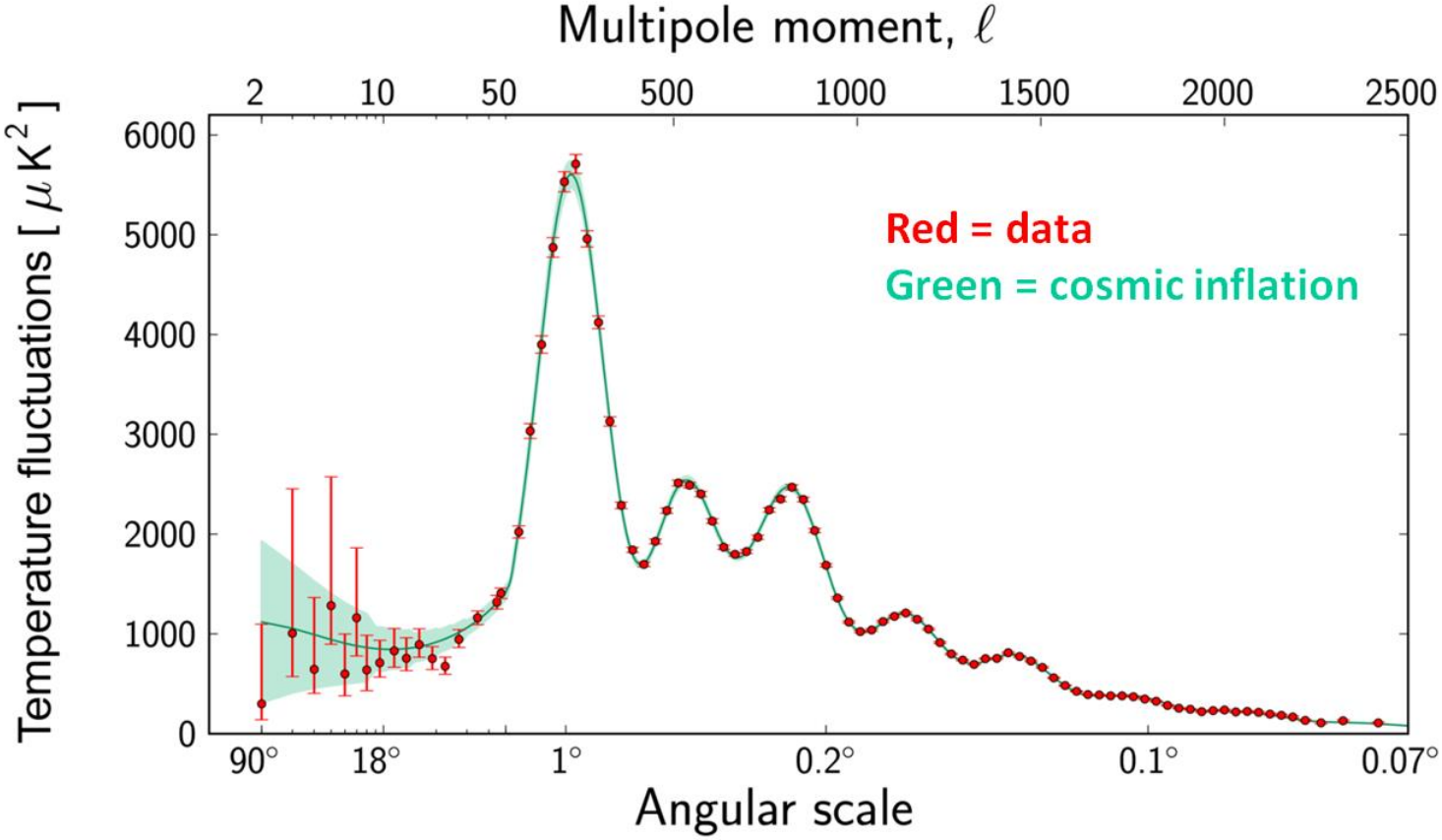
-Launched June 14 '09

-Data now complete, additional analysis underway

Cosmic Microwave Background (CMB) map produced by the Planck satellite (sphere shown using a projection, like in an atlas)

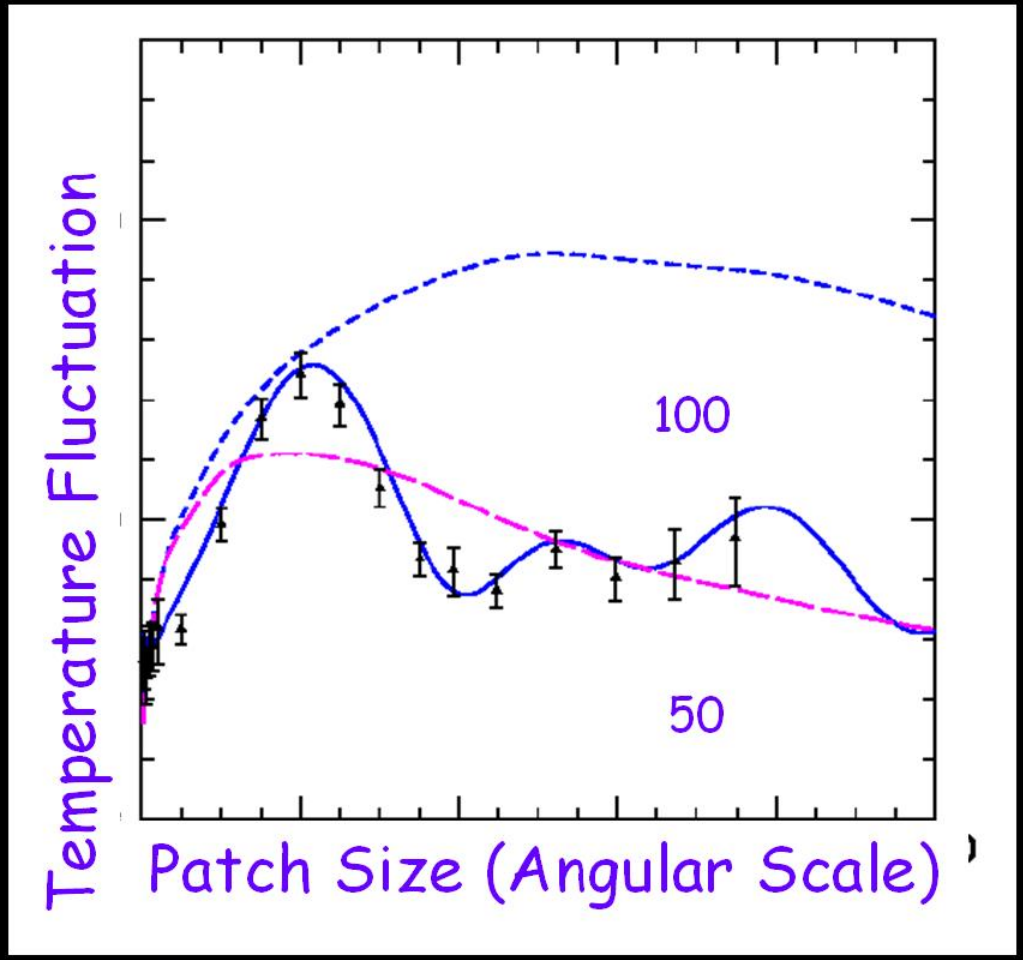


The map shows minute variations in the temperature (just 1 part in 100,000, or in the 5^{th} decimal place).



This plot shows one way to quantify the feature in the CMB map. Roughly, the x-axis labels patch size, and the y-axis show how strongly the temperature typically varies among patches of that size.

Using the CMB to learn about the Universe



solid=inflation model

dashed=defect models

(magenta=desperate)