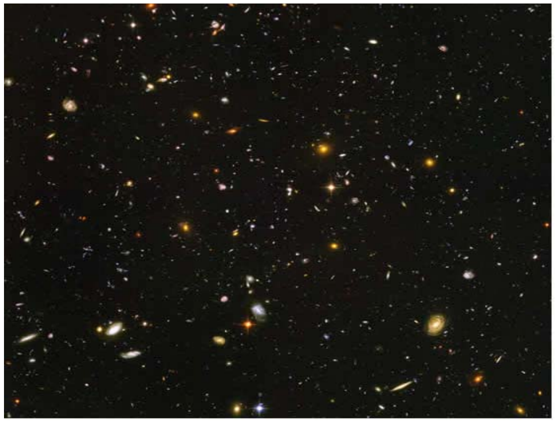
The

Grand Unified Theory

of

Classical Physics

April 2014



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Part 3:

Cosmology

Power Spectrum of the Cosmic Microwave Background Radiation (CMBR)

The cosmic microwave background radiation (CMBR) corresponds to an average temperature of 2.725 K, with deviations of 30 μK or so in different parts of the sky representing slight variations in the density of matter.

The Universe is a 3-sphere hyperspace of constant positive curvature that expands and contracts cyclically in all directions relative to an embedded space-time observer at his r-sphere.

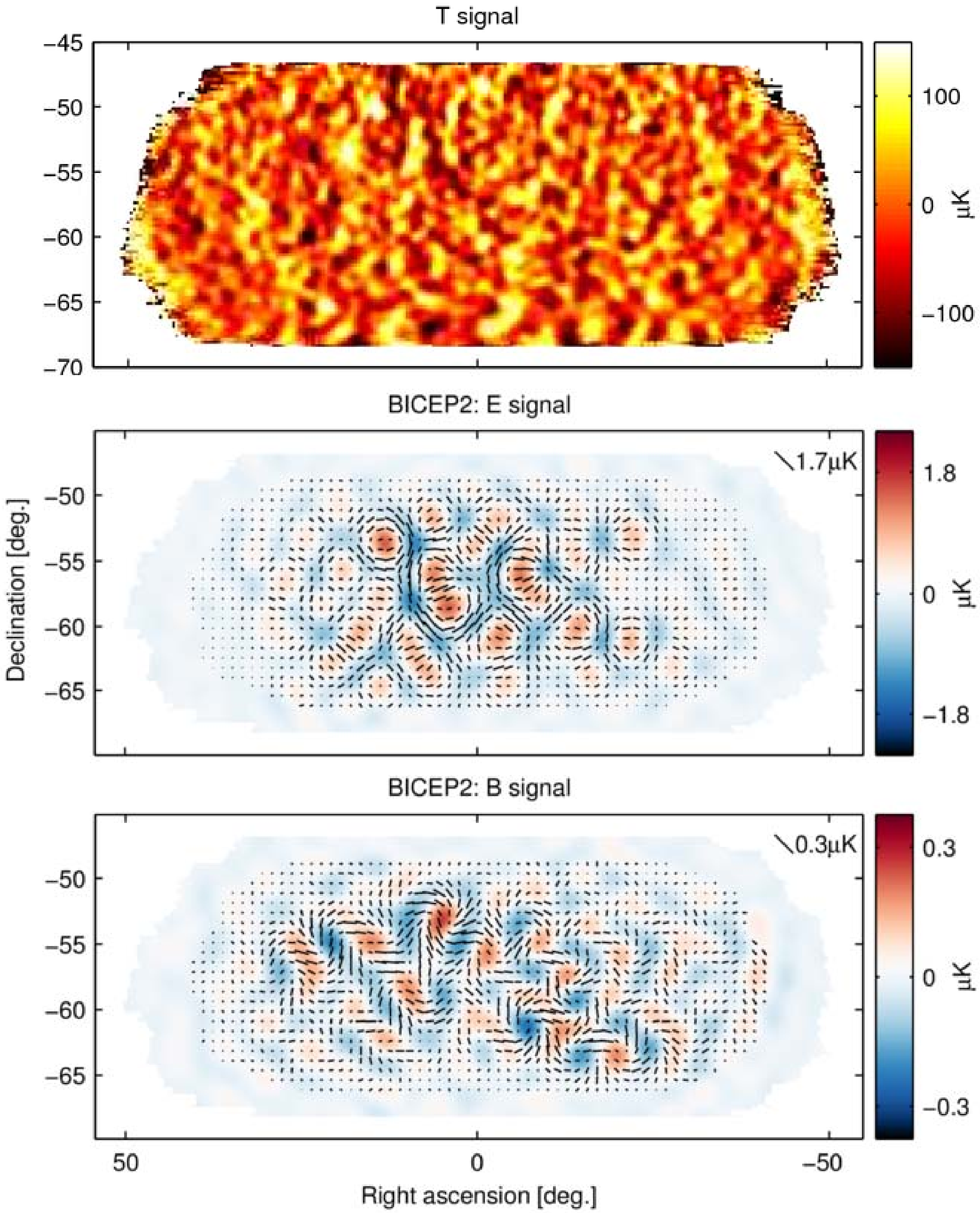
The harmonic oscillation of the radius of the Universe and thus its volume gives rise to delays and advances to light spheres of the continuum of r-spheres of the Universe.

The gravitational field fronts from particle production would otherwise propagate at relative velocity c.

However, as the radius of the initially entirely uniform radiation-filled Universe decreases gravity fronts are advanced or delayed as the distance between r-spheres changes such that constructive interference of fronts occur.

The resulting slight variations in the density of matter are observed from our present r-sphere as spherical harmonics corresponding to the spherical contraction and expansion in all directions.

For each r-sphere, the angular variation in density corresponds to an angular distribution of the power of the Universe and thus the temperature of the Universe according to the Stefan-Boltzmann law.



CMBR Continued

Color scale temperature variations and temperature variations of the E-mode and B-mode polarization of the CMBR of the Universe in degrees μK .

Courtesy of NASA, G. Hinshaw, *et al*.

CMBR Continued

The temperature variation ΔT is given by the spacetime Fourier transform of $T_U\left(t\right)$ in three dimensions in spherical coordinates plus time over the oscillatory period starting at matter formation at the initial time of contraction through the initiation of expansion to the present time in the expansion cycle, $r_{sphere} = 14.02\ X\ 10^{9}\ light\ years \cdot$

$$\Delta T(s,\Theta,\Phi,\omega) =$$

$$C_{Tsphere}\int_0^{\infty}\int_0^{2\pi}\int_0^{\pi}\int_0^{\infty}\left[\begin{array}{l} T_U\left(t\right)\dfrac{1}{r_{sphere}^2}\delta(r-r_{sphere}) \\ \exp\left(\begin{array}{l} -i2\pi sr[\cos\Theta\cos\theta \\ +\sin\Theta\sin\theta\cos(\phi-\Phi)] \end{array}\right)\exp\left(-i\omega t\right) \end{array}\right] r^2\sin\theta dr d\theta d\phi dt$$

$$= 77\mathrm{sinc}\left(\frac{\pi}{140}\left(\ell-\ell_0\right)\right)\ \mu K$$

$$= 77\mathrm{sinc}\left(\frac{\pi}{140}\left(\ell-197\right)\right)\ \mu K$$

$\ell > 0$, Fourier wavenumber s is the multipole moment $\ell = \dfrac{2\pi}{\theta}$, $\dfrac{\pi}{\ell_{sphere}}$ is substituted for r_{sphere}, $\ell_{sphere} = 140$ is $\aleph_o / r_{sphere}$, $C_{Tsphere} = \left(\dfrac{ct}{\aleph_0}\right)^{-2} = \left(197\right)^{-2}$, the phase shift due relative position of r_{sphere} to $\aleph_o$ is $\ell_0 = \dfrac{\aleph_0}{ct} = 197$.

CMBR Continued

Polarized light is produced by Thompson scattering of the CMBR by stellar and interstellar medium plasma electrons (essentially ionized hydrogen) over the half period of contraction $T_U/2 = 4.92\ X\ 10^{11}\ \text{years}$ plus the time of expansion $t = 10^{10}\ years$. The phase shift corresponds to an opposite sign of the shift

$$\Delta T_{\text{E-mode}}(\ell) = C_{eff\text{Thompson}}77\text{sinc}\left(\frac{\pi}{140}\left(\ell+197\right)\right)\ \mu K$$

$\ell > 0$ and C_{eff} is the Thompson polarization constant.

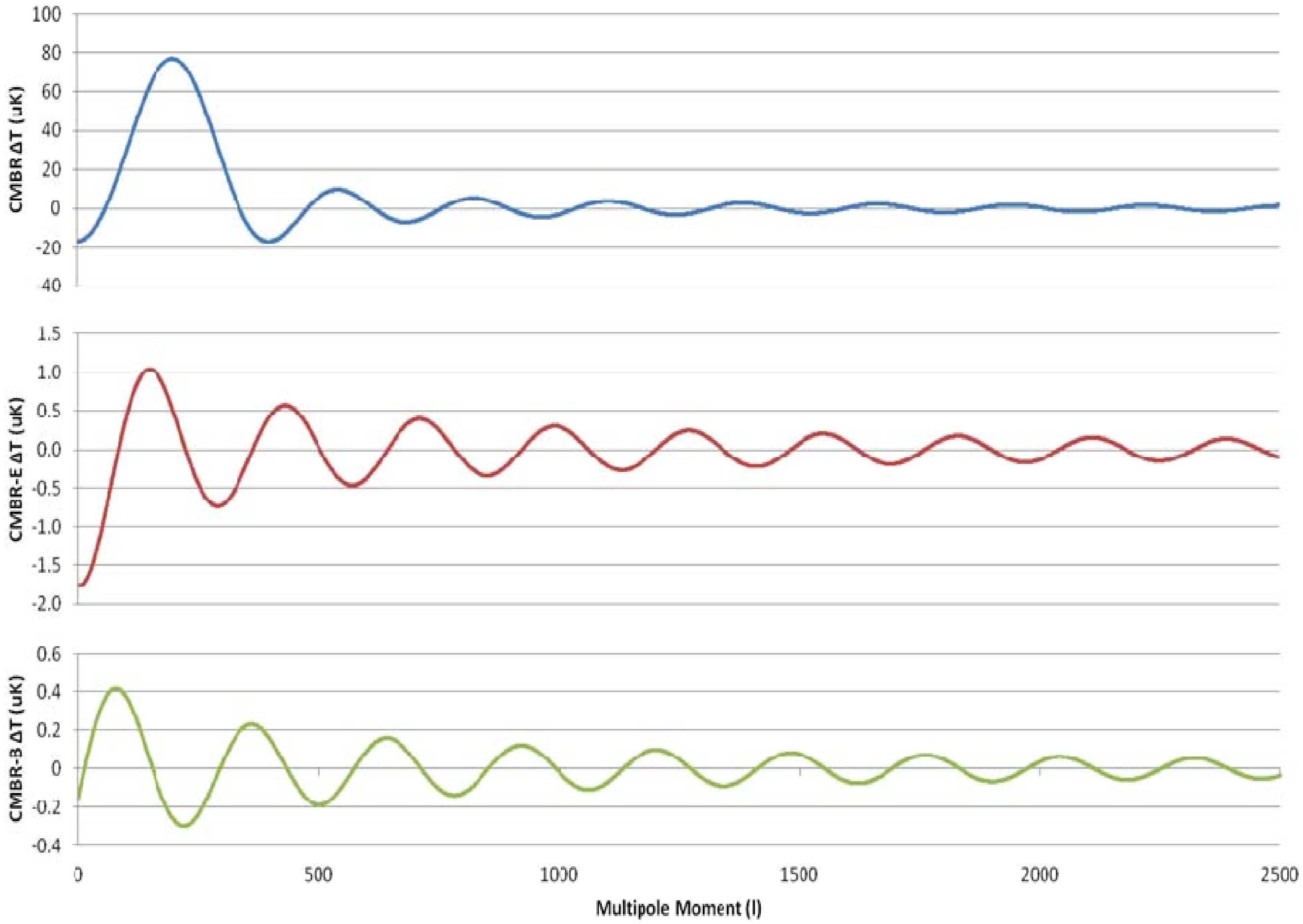
While propagating through accelerating expansion of spacetime, E-mode light experiences the same spacetime gradients as in the case of gravitational lensing; consequently, E-mode is converted to B-mode polarization. The B-mode radiation is shifted by $\dfrac{\pi}{2}$ relative to the E-mode radiation:

$$\Delta T_{\text{B-mode}}(\ell) = r^{1/2}C_{\text{effThompson}}77\text{sinc}\left(\frac{\pi}{140}\left(\ell+197+70\right)\right)\ \mu K$$

$$\ell > 0 \quad , \quad r^{1/2} = \frac{\Delta T\left(B\text{-mode}\right)}{\Delta T\left(E\text{-mode}\right)} = \frac{\Delta\aleph = 1/2\ddot{\aleph}t^2}{(ct)} = \left(\frac{4.02\ X\ 10^9\ light\ years}{10^{10}\ light\ years}\right) = 0.40$$

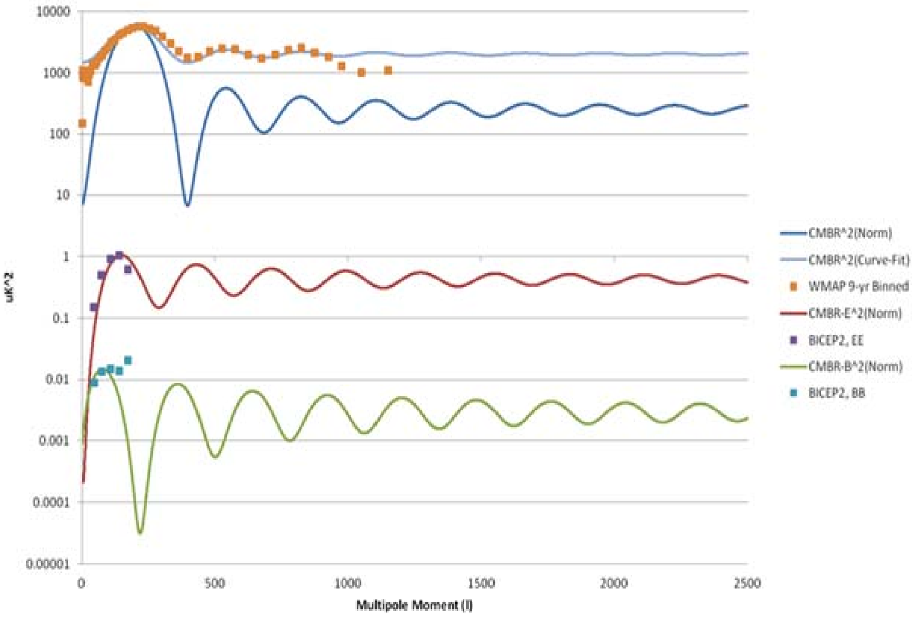
CMBR Continued

The temperature variations and temperature variations of the E-mode and B-mode polarization of the CMBR of the Universe in degrees μK as a function of multipole moment ℓ .

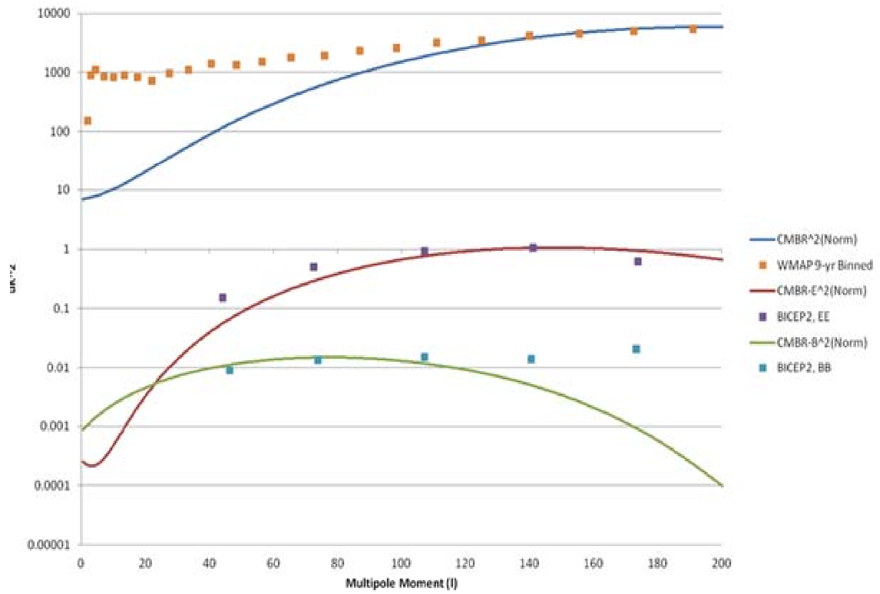


CMBR Continued

The power spectrum comprising spherical harmonic coefficient $\frac{\ell(\ell+1)C_\ell}{2\pi}\left[\mu K^2\right]$ amplitudes as a function of multipole ℓ for the temperature variations and temperature variations of the E-mode and B-mode polarization of the CMBR of the Universe. The experimental data points of BICEP2 for the E-mode peak at $\ell = 140$ and then the B-mode peak as $\ell = 70$, $r = 0.20^{+0.07}_{-0.05}$ are superimposed. A. Plot over the range $0 \le \ell \le 2500$. B. Plot over the range $0 \le \ell \le 200$.



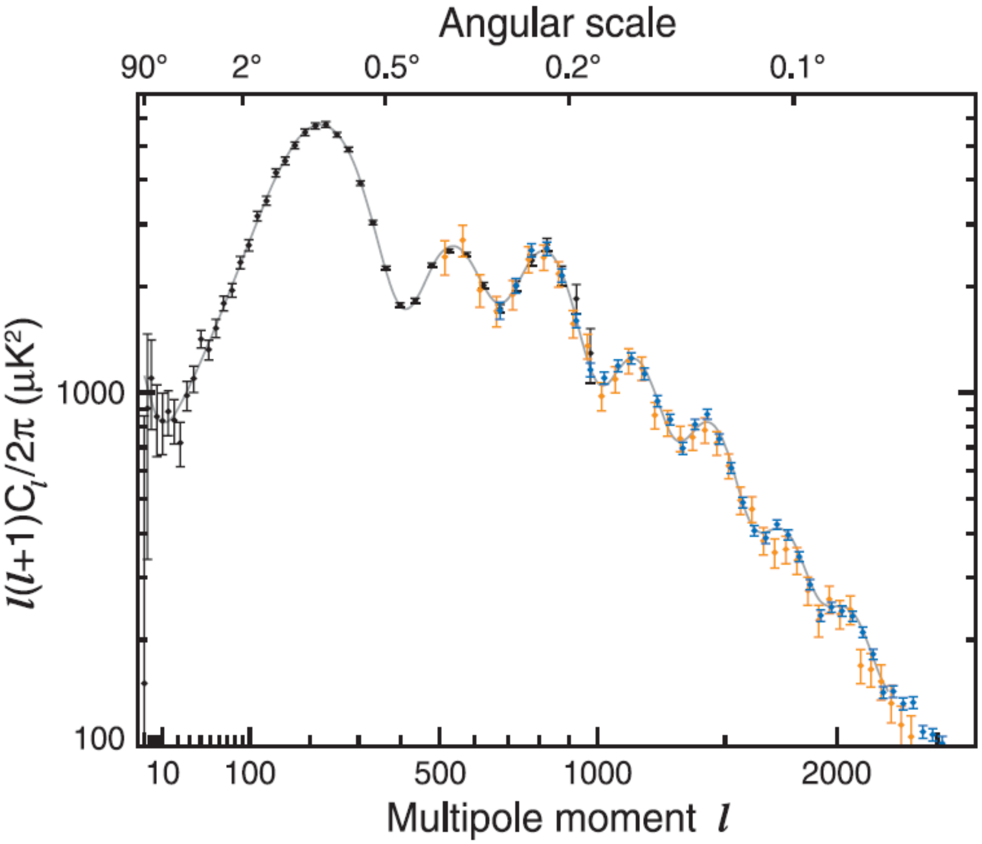
(A)



(B)

CMBR Continued

The experimental power spectrum of WMAP with the data of SPT and ACT and best curve fit comprising spherical harmonic coefficient $\frac{\ell\left(\ell+1\right)C_{\ell}}{2\pi}\left[\mu K^{2}\right]$ amplitudes as a function of multipole ℓ for the temperature variations of the CMBR of the Universe. Courtesy of NASA, G. Hinshaw, *et al*.



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