MICROWAVE BACKGROUND ANISOTROPIES IN A BARYON-DOMINATED UNIVERSE

Yasushi Suto[1], Naoteru Gouda[2] and Misao Sasaki[3]
[1]Department of Astronomy, University of California, Berkeley.
[2]Department of Physics, Kyoto University, Japan.
[3]RITP, Hiroshima University, Japan.

We have calculated the anisotropies of the cosmic microwave background radiation in a baryon-dominated model (BDM), using a gauge invariant method. The results on a $4.5'$ angular scale are as follows ($h = 0.5$ and initially Zel'dovich power spectrum assumed):

Ω	(adiabatic model)	(isocurvature model)
0.4	1.2×10^{-4}	6.4×10^{-5}
0.6	7.2×10^{-5}	4.1×10^{-5}
0.8	4.6×10^{-5}	3.0×10^{-5}
1.0	1.4×10^{-5}	0.8×10^{-5}

Apart from the difference of normalization, the results for the adiabatic models are in good agreement with those obtained in a synchronous gauge (Silk and Wilson 1980; Wilson 1983). On the other hand, in the isocurvature models, the above results predict almost an order of magnitude larger values for $\delta T/T$ than those obtained in a synchronous gauge. The above disagreement is mainly ascribed to the difference between the *isothermal* (Wilson and Silk 1981) and *isocurvature* initial conditions. In fact, one can prove that the isocurvature initial conditions are very difficult to be imposed in a synchronous gauge. In addition, we found that the results in a synchronous gauge are contaminated by gauge modes, especially on large scales. This implies that the use of a gauge invariant method is not only useful but also *necessary* in the study of cosmological density perturbations, especially in the isocurvature scenario.

The constraint on the density parameter Ω is obtained by comparing the present results with the observational data by Uson and Wilkinson(1984). We conclude that both adiabatic and isocurvature scenarios in the BDM require $\Omega \gtrsim 0.8$ (this is weakly dependent on the power-law index of the initial spectrum and on h). This suggests that the BDM is compatible with the light elements abundances only if our universe were fairly inhomogeneous at the epoch of primordial nucleosynthesis (Sale and Mathews 1986). In turn, to the extent that we believe in the *standard* primordial nucleosysntheis predictions, the idea of a baryon-dominated universe based on either adiabatic or isocurvature models can be ruled out. The detailed analysis will be published elsewhere (The Astrophysical Journal Letters, in press).

J. Audouze et al. (eds.), Large Scale Structures of the Universe, 513.