

CMB ANISOTROPIES PRODUCED BY NONLINEAR VOIDS

NOBUYUKI SAKAI AND JUN'ICHI YOKOYAMA

*Yukawa Institute for Theoretical Physics, Kyoto University
Kyoto 606-8502, Japan*

AND

NAOSHI SUGIYAMA

*Department of Physics, Kyoto University
Kyoto 606-8502, Japan*

Although the CMB anisotropy is an important probe of primordial fluctuations at recombination, which carries information on the cosmological parameters as well as the nature of dark matter, CMB photons are also affected gravitationally by nonlinear structures between recombination and the present epoch. In this paper, using Thompson & Vishniac's model [1], we investigate the effect of a void network on the CMB anisotropy in the Einstein-de Sitter background. In particular, we estimate both the Rees-Sciama effect [2] and the gravitational lensing effect (see, e.g., [3]).

As well as the Sachs-Wolfe effect (estimated in [4]), the Rees-Sciama effect can be appreciable if primordial voids exist at recombination, which is realized in some inflationary models associated with a first-order phase transition (see, e.g., [5]). The gravitational lensing effect, on the other hand, smoothes out the primary anisotropy, and it is not negligible even if nonlinear voids form at relatively late time ($z \approx 5$); this result is consistent with the previous results for a CDM model [3]. Although those effects may be "noise" for determining the cosmological model, they would give some constraints on the configuration or origin of voids with the next generation of CMB satellites.

References

1. K.L. Thompson & E.T. Vishniac, *ApJ* **313** (1987) 517.
2. M.J. Rees & D.W. Sciama, *Nature* **217** (1968) 511.
3. U. Seljak, *ApJ* **463** (1996) 1.
4. C. Baccigalupi, L. Amendola & F. Occhionero, *MNRAS* **288** (1997) 387.
5. L. Amendola *et al.*, *Phys. Rev. D* **54** (1996) 7199.