CONSTRAINTS ON THE MATTER FLUCTUATION SPECTRUM FROM X-RAY CLUSTER NUMBER COUNTS

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We find that the observed $\log N$–$\log S$ relation of X-ray clusters (Ebeling et al. 1997; Rosati et al. 1997) can be reproduced remarkably well with a certain range of values for the fluctuation amplitude σ_8 and the cosmological density parameter Ω_0 in cold dark matter (CDM) universes (Kitayama & Suto 1997). The 1σ confidence limits on σ_8 in the CDM models with $n = 1$ and $h = 0.7$ are expressed as $(0.54 \pm 0.02)\Omega_0^{-0.35-0.82\Omega_0+0.55\Omega_0^2}$ $(\lambda_0 = 1-\Omega_0)$ and $(0.54 \pm 0.02)\Omega_0^{-0.28-0.91\Omega_0+0.68\Omega_0^2}$ $(\lambda_0 = 0)$, where n is the primordial spectral index, and h and λ_0 are the dimensionless Hubble and cosmological constants. The errors quoted above indicate the statistical ones from the observed $\log N$–$\log S$ only, and the systematic uncertainty from our theoretical modelling of X-ray flux in the best-fit value of σ_8 is about 15%. In the case of $n = 1$, we find that the CDM models with $(\Omega_0, \lambda_0, h, \sigma_8) \simeq (0.3, 0.7, 0.7, 1)$ and $(0.45, 0, 0.7, 0.8)$ simultaneously account for the cluster $\log N$–$\log S$, X-ray temperature functions, and the normalization from the *COBE* 4 year data. The derived values assume the observations are without systematic errors, and we discuss in details other theoretical uncertainties which may change the limits on Ω_0 and σ_8 from the $\log N$–$\log S$ relation. We have shown the power of this new approach which will become a strong tool as the observations attain more precision.

References

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