New Cosmological Data and the Values of the Fundamental Parameters
IAU Symposium, Vol. 201, 2005
Anthony Lasenby and Althea Wilkinson, eds.

How flat is the Universe?

M. Roos and S. M. Harun-or-Rashid
Physics Department, Division of High Energy Physics, P.O.B. 9, FIN-00014, University of Helsinki, Finland

Abstract. We consider independent astrophysical constraints in the space of the density parameters Ω_m of gravitating matter and Ω_Λ of vacuum energy.

1. Introduction and Results

We combine ten independent astrophysical constraints in the space of the density parameters Ω_m of gravitating matter and Ω_Λ of vacuum energy. The constraints are indicated schematically in Fig. 2. We find (Fig. 1) that $\Omega_m = 0.32 \pm 0.06$, $\Omega_\Lambda = 0.64 \pm 0.08$, where the errors correspond to the two-dimensional 68% confidence range. The total χ^2 is 6.4 for 8 degrees of freedom, testifying that the various systematic errors included are generous. Flatness of the Universe is essentially determined by the BOOMERANG and MAXIMA-1 experiments alone as $\Omega_0 = \Omega_m + \Omega_\Lambda = 0.95 \pm 0.06$ (one-dimensional 68% confidence range). We also determine Ω_m in the exactly flat case. Six supplementary flat-case constraints can then be included in our fit, with the result $\Omega_m = 1 - \Omega_\Lambda = 0.33 \pm 0.03$ (one-dimensional 68% confidence range). The total χ^2 is 12.7 for 15 degrees of freedom. It follows that the age of the Universe is $t_0 = 13.5 \pm 1.3$ (0.68/h) Gyr.

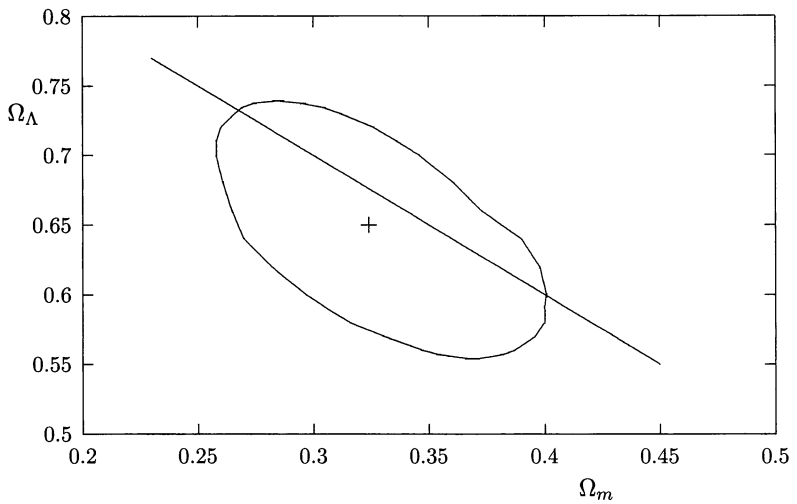

Figure 1. The 1σ statistical confidence region in the (Ω_m, Ω_Λ)-plane is shown. The '+' marks the best fit: (Ω_m, Ω_Λ) = (0.32,0.64). The diagonal line corresponds to a flat cosmology.

https://doi.org/10.1017/S0074180900216902 Published online by Cambridge University Press

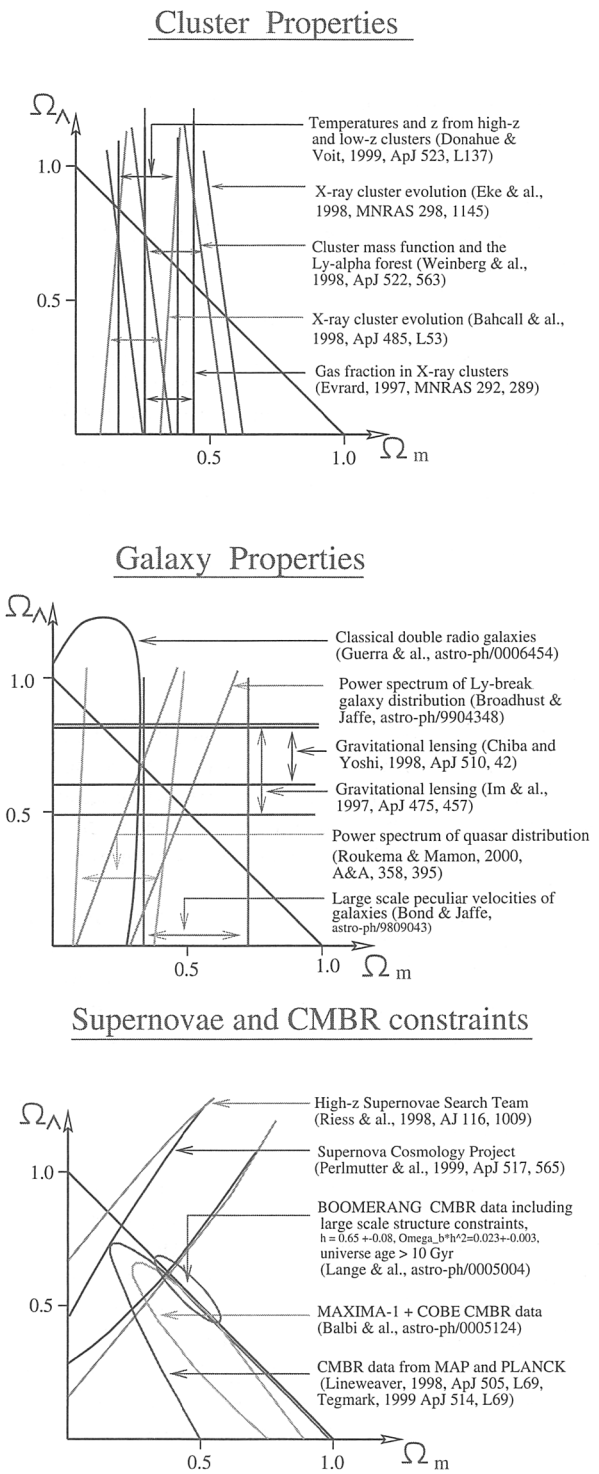

Figure 2. Schematic showing the constraints used.

https://doi.org/10.1017/S0074180900216902 Published online by Cambridge University Press