COSMOLOGY PROJECT: Ω_m FROM CLUSTER BARYON FRACTIONS

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In this talk I will briefly summarize the most recent results constraining the mass content of the Universe (Ω_m) using cluster baryon fractions. We know that the mass of the biggest cluster of galaxies is expected to provide an almost fair sample of the matter content in the Universe (White et al. 1993, Eke et al. 1998). Therefore, the ratio of baryonic-to-total mass in clusters should be roughly similar to the Ω_b/Ω_m value in the Universe. The most recent and strong constrains over Ω_m using cluster baryons fractions were obtained by Allen et al. 2008. Based on a sample of 42 hot (kT > 5 keV), X–ray luminous, dynamically relaxed galaxy clusters spanning the redshift range $0.05 < z < 1.1$ and using standards priors on the Hubble constant (H_0) and the mean baryon density ($\Omega_b h^2$), they estimated the mass content of the Universe to be $\Omega_m = 0.28 \pm 0.06$ (68% confidence limits). The restriction to use clusters with the highest possible degree of dynamical relaxation minimizes systematic scatter in the fraction of gas (f_{gas}) data. This is important because f_{gas} can also be used to probe the acceleration of the Universe. Allen et al. results provide a clear and independent detection of the effects of the dark energy on the expansion of the Universe at $\sim 99.99\%$ confidence for a standard non-flat ΛCDM model. This accuracy is comparable to that obtained from current SNIa work (e.g Riess et al. 2007, Miknaitis et al. 2007), a fact that is remarkable considering the differences between the astrophysical processes and scale sizes that dominate cluster of galaxies and SNIa. One way to obtain even tighter constraints on the cosmological parameters and also remove the dependence of priors assumptions on H_0 and $\Omega_b h^2$ is combine the f_{gas} data with independent constraints from the Cosmic Microwave Background (CMB) and SNIa studies. Allen et al. 2008, combining CMB, SNIa and f_{gas} obtained: $\Omega_m = 0.253 \pm 0.021$ and $w = -0.98 \pm 0.07$. It's good to remind that the tight constraints obtained by Allen et al. 2008 were only using 42 Chandra galaxy clusters. In the future, space telescopes like eROSITA (launch date 2012) and the Wide Field X–Ray Telescope will help us to increase our samples of cluster by an order of magnitude and measure f_{gas} with an accuracy better than $\sim$5%.

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