



**The Abdus Salam  
International Centre for Theoretical Physics**



**SMR/1847-5**

**Summer School on Particle Physics**

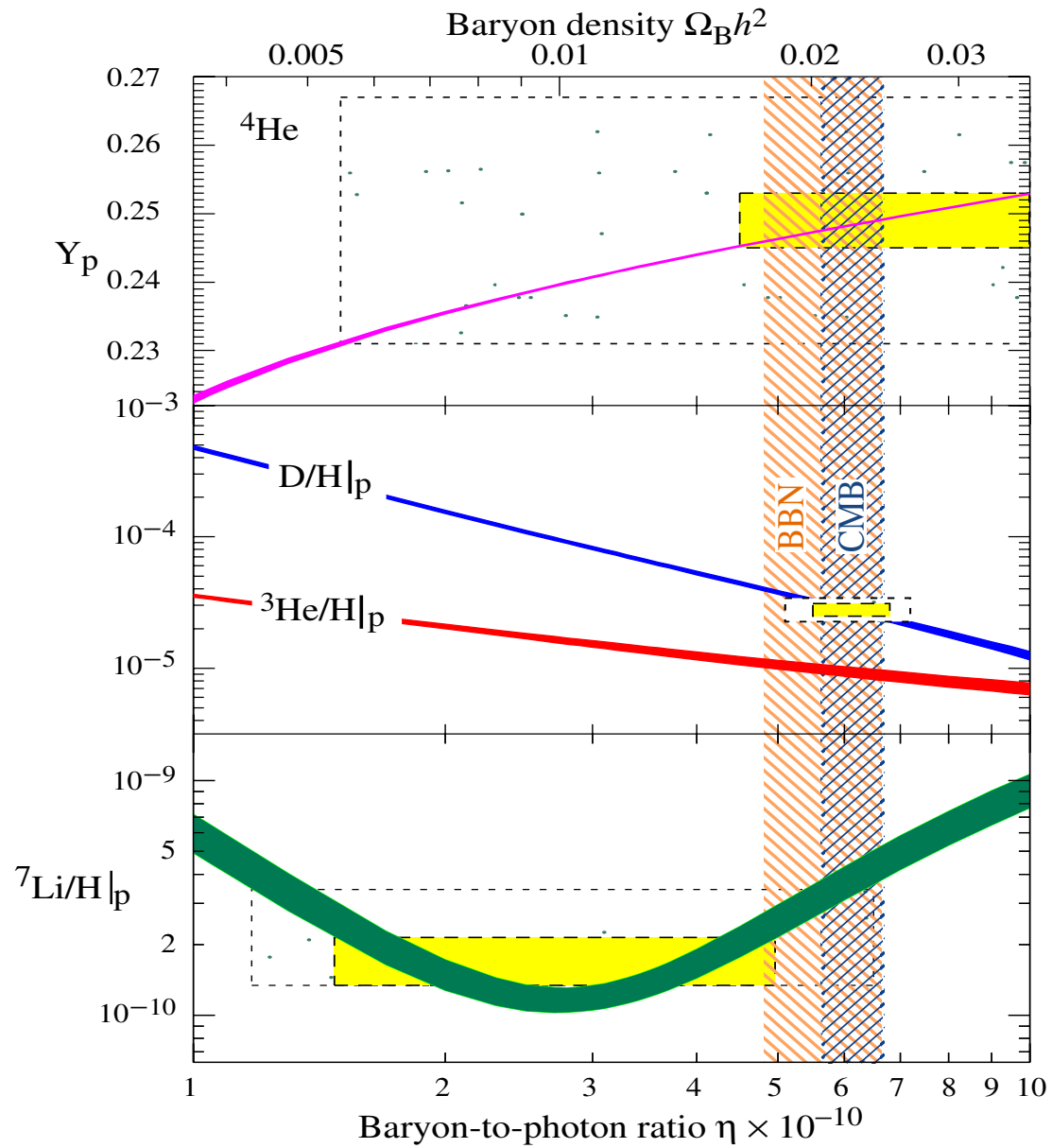
*11 - 22 June 2007*

**Particle Physics and Cosmology**

V. Rubakov

*Russian Academy of Sciences, Moscow*

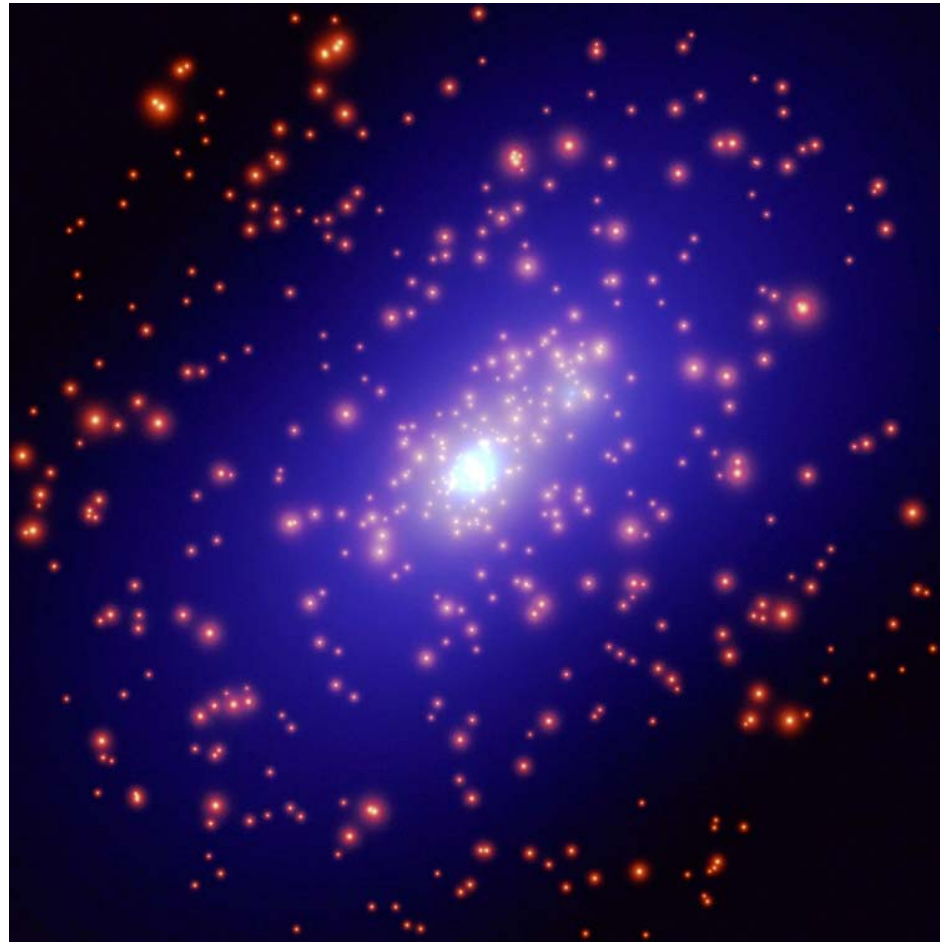
# Big Bang Nucleosynthesis



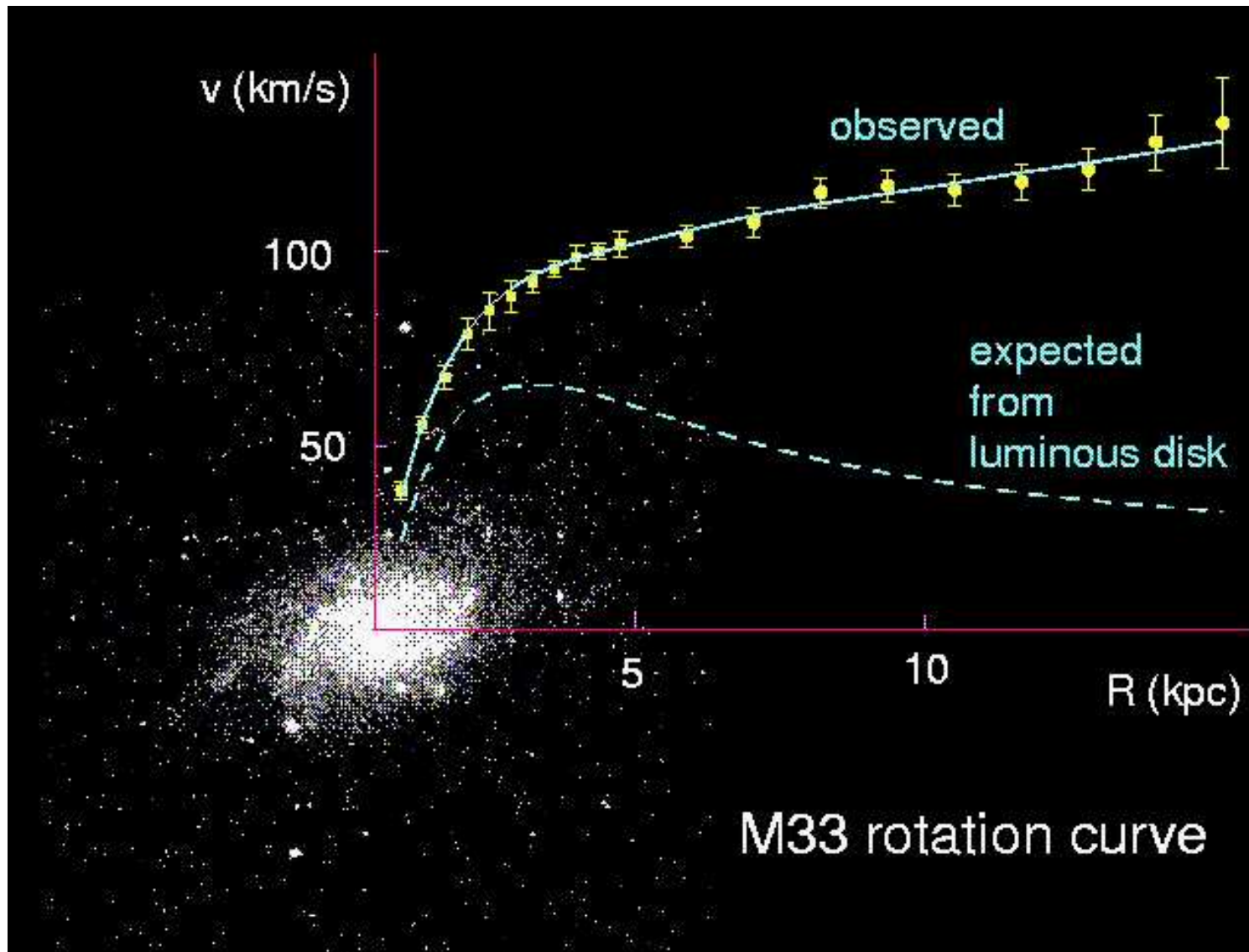
# Dark matter in galaxy clusters: gravitational lensing



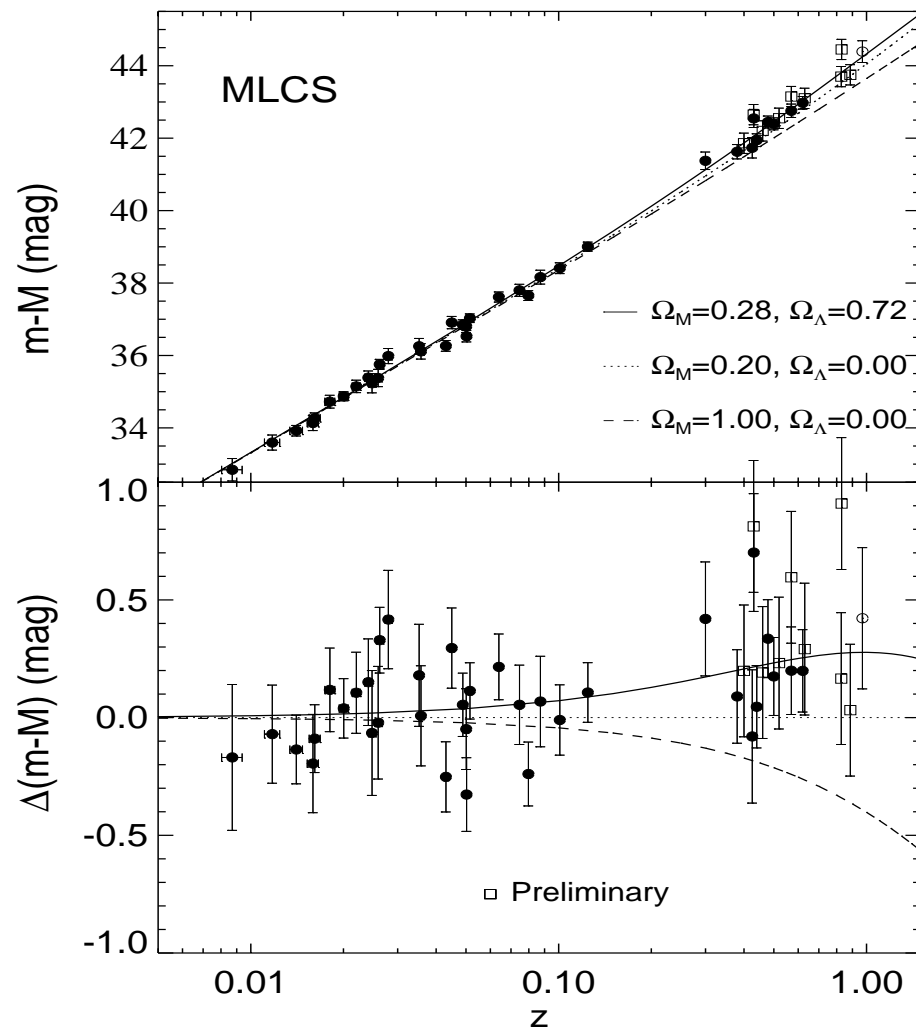
# Reconstructed mass density



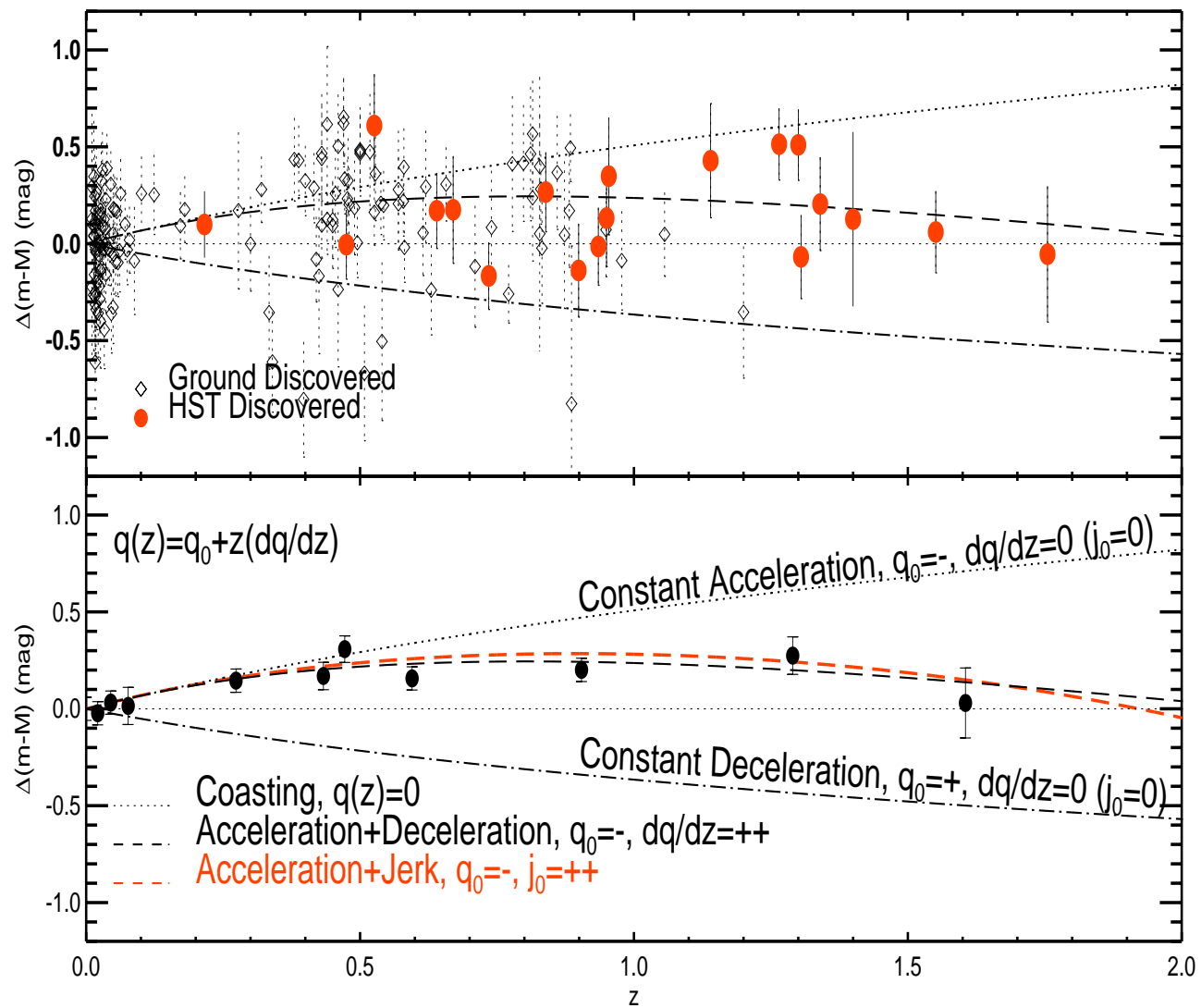
# Dark matter in galaxies: rotation curves



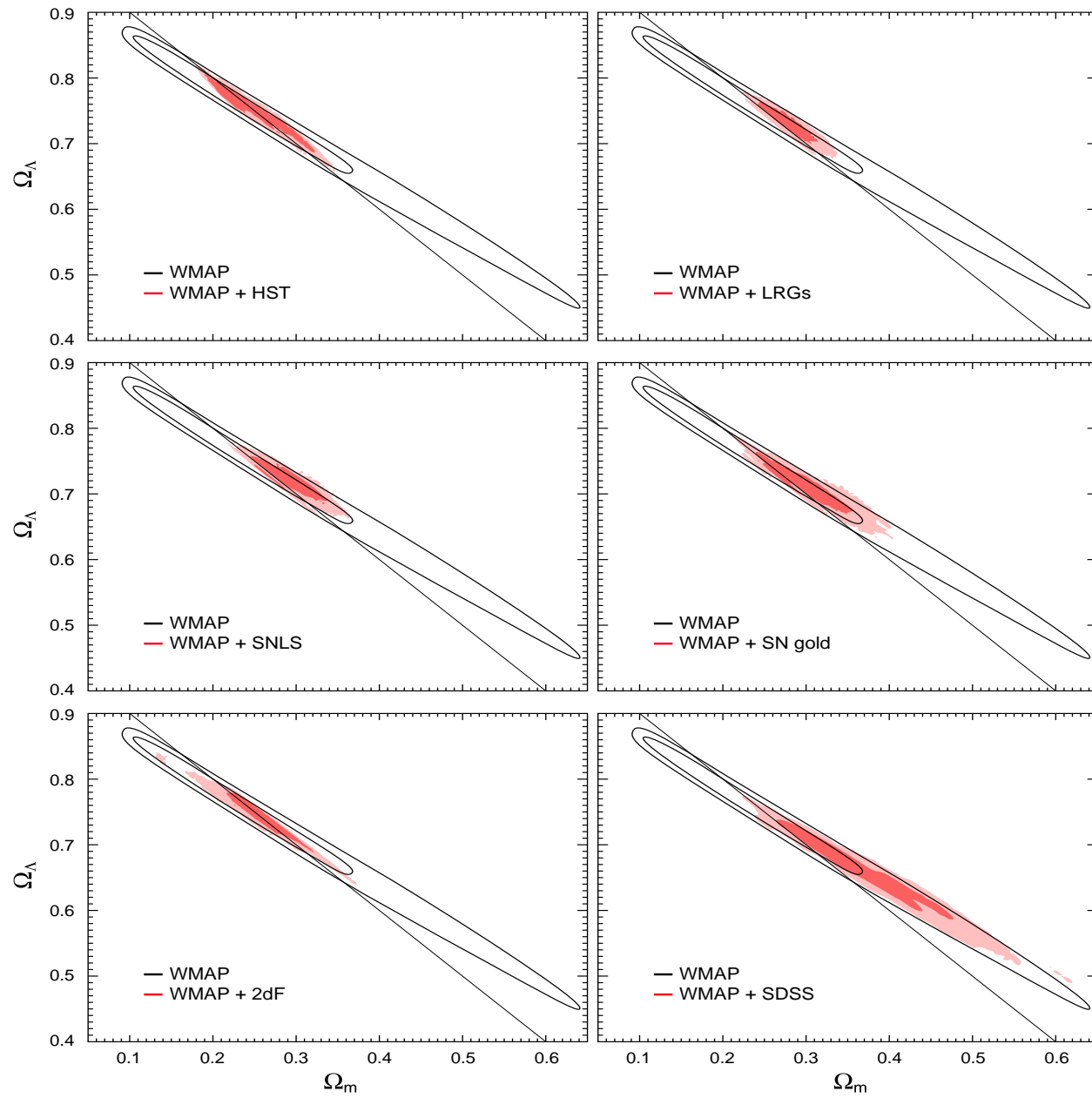
# Standard candles: SNe 1a



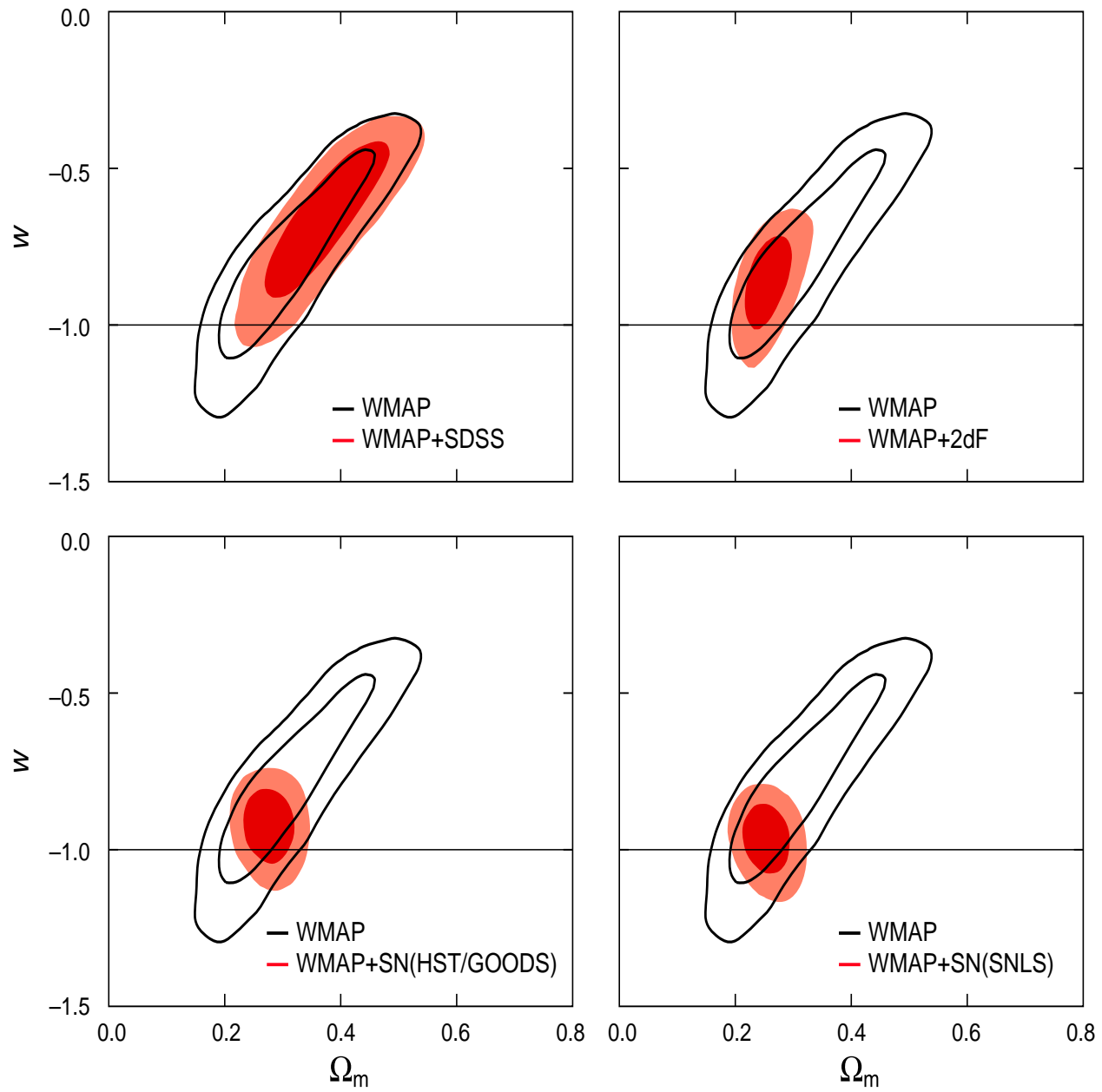
First data: 1998



Recent

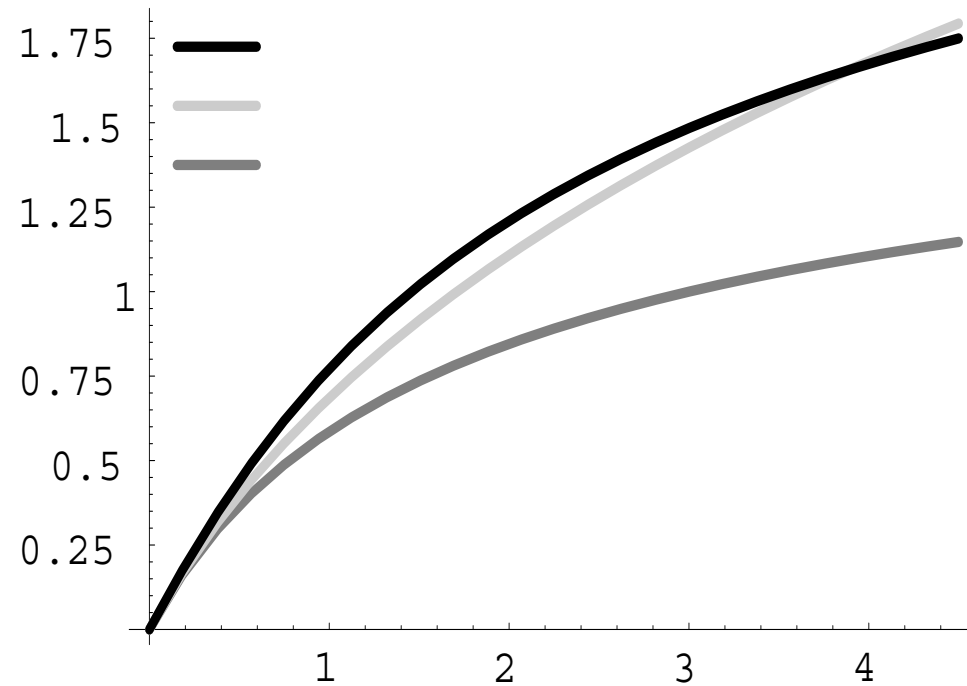






# Degeneracy in parameters:

$H_0 \cdot r_{lum}$  as function of  $z$

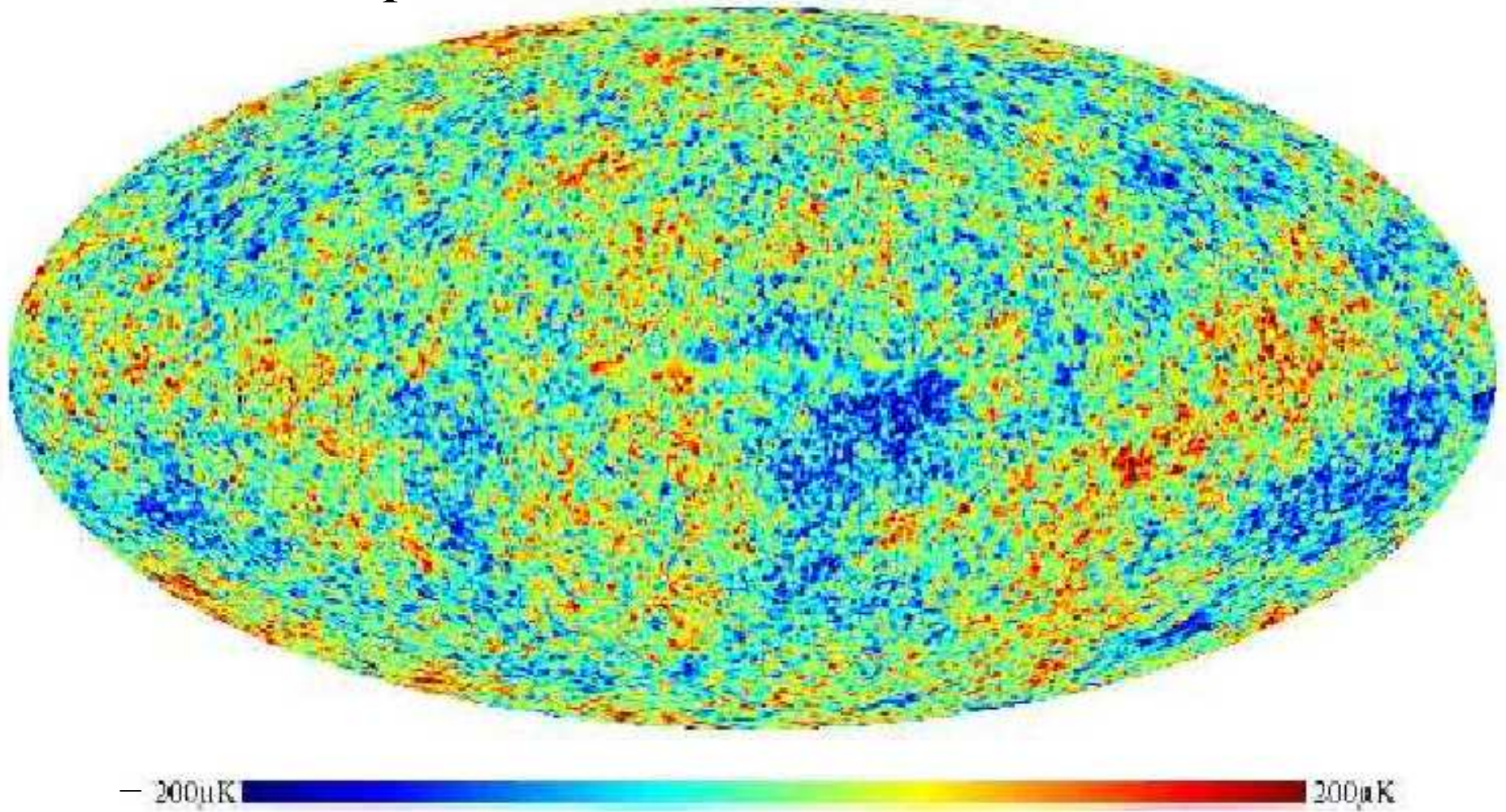


$$\Omega_M = 0.3, \Omega_\Lambda = 0.7$$

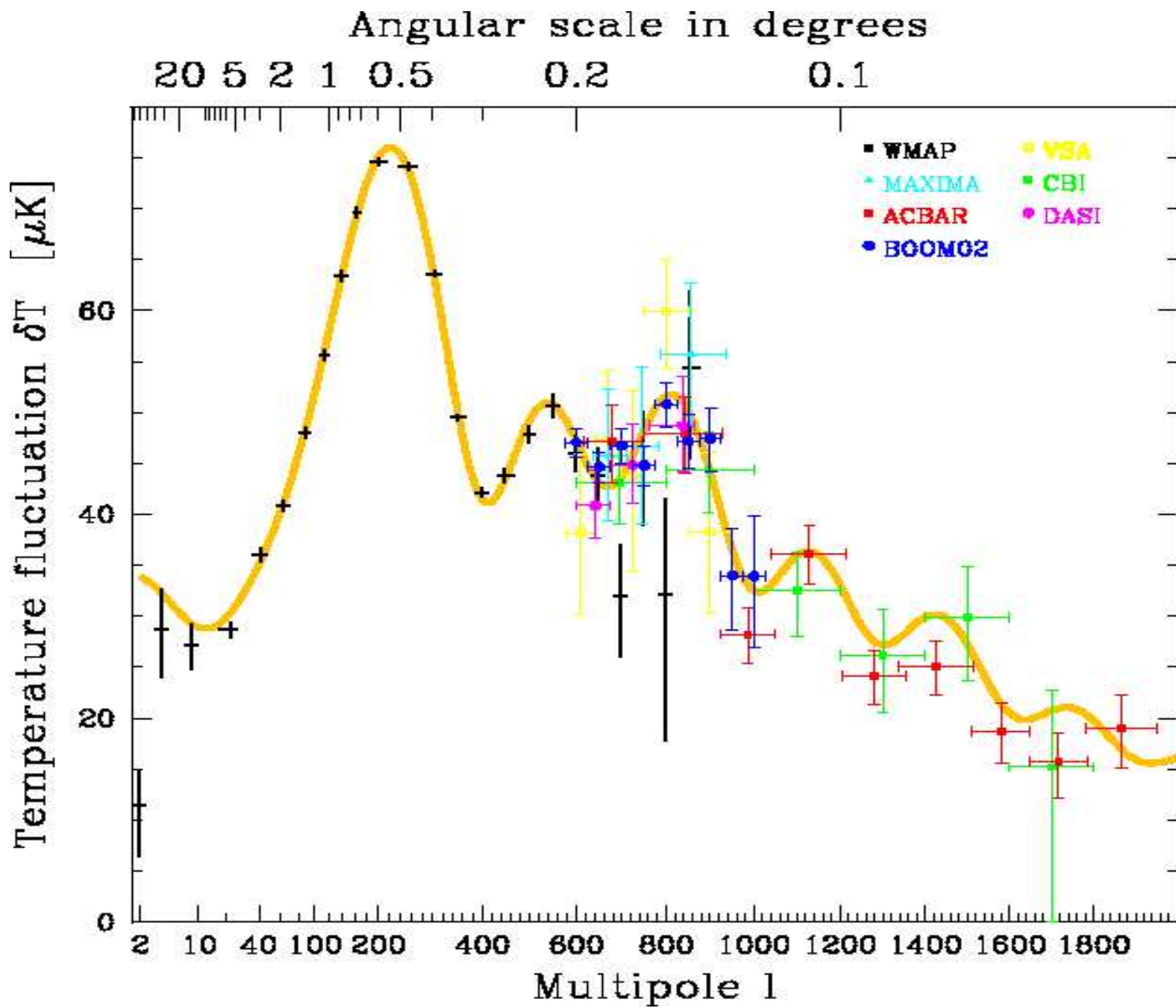
$$\Omega_M = 0.3, \Omega_\Lambda = 0, \Omega_{curv} = 0.7$$

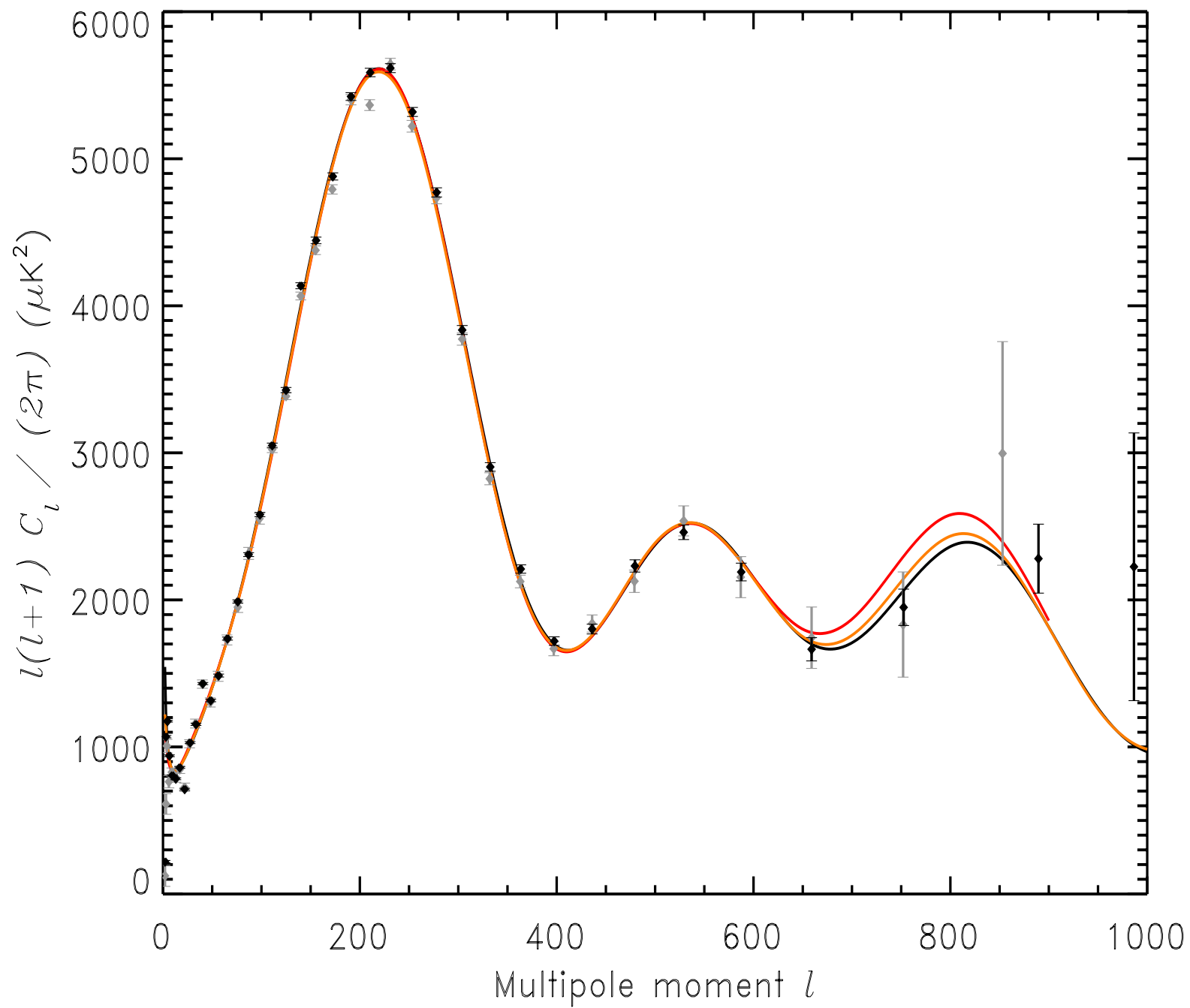
$$\Omega_M = 1, \Omega_\Lambda = \Omega_{curv} = 0$$

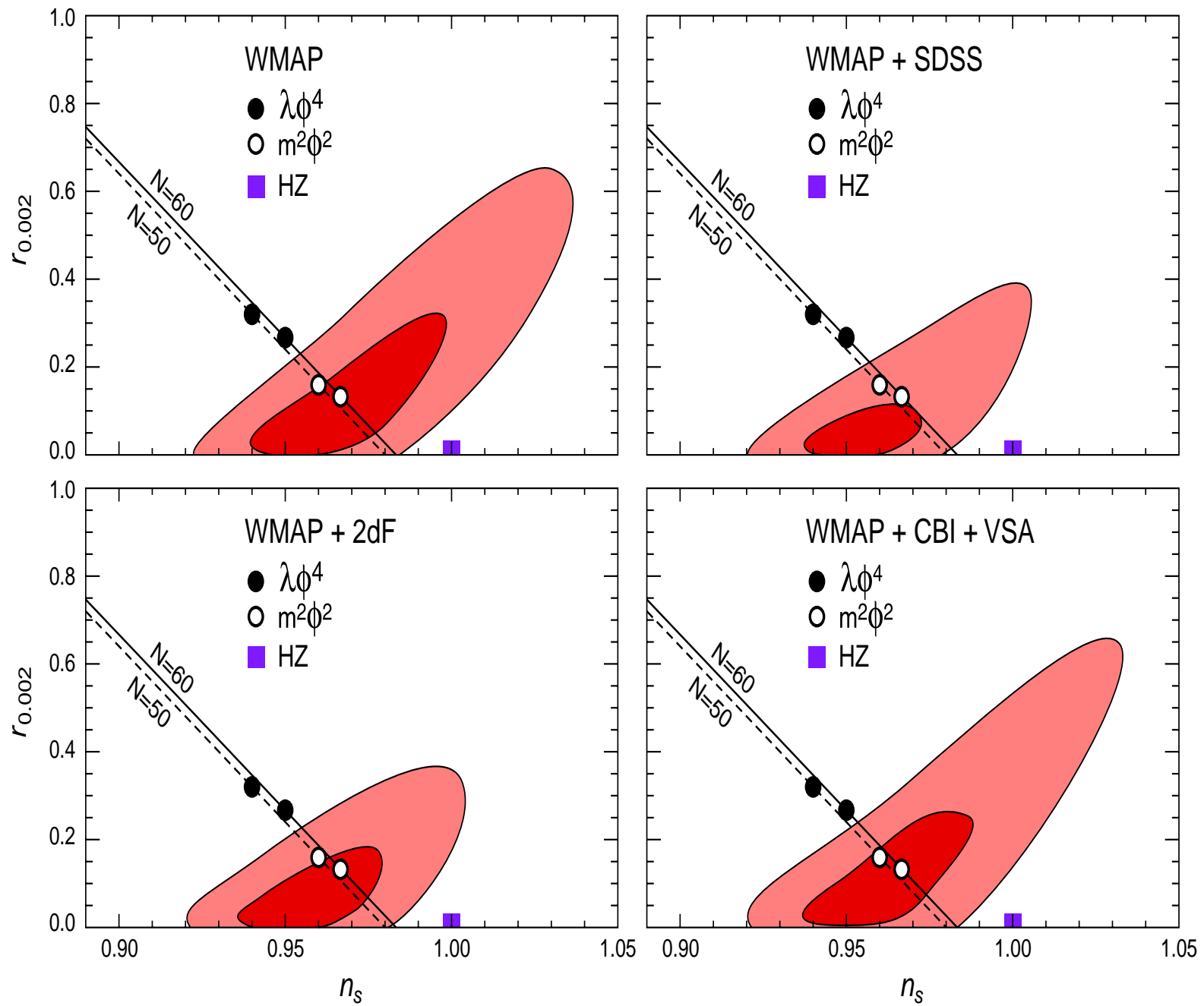
$$T = 2.725^{\circ}K, \quad \frac{\delta T}{T} \sim 10^{-5}$$



WMAP

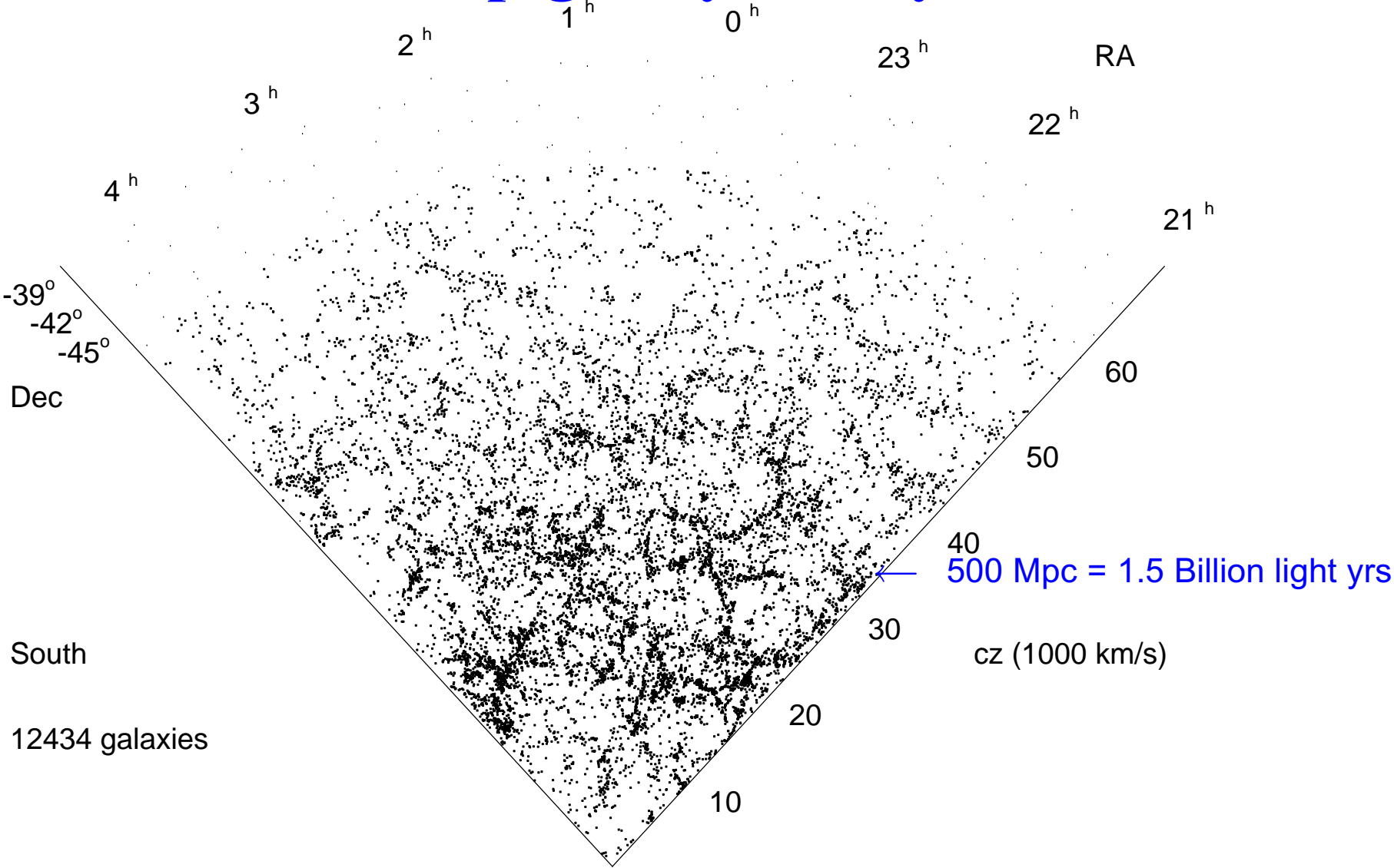




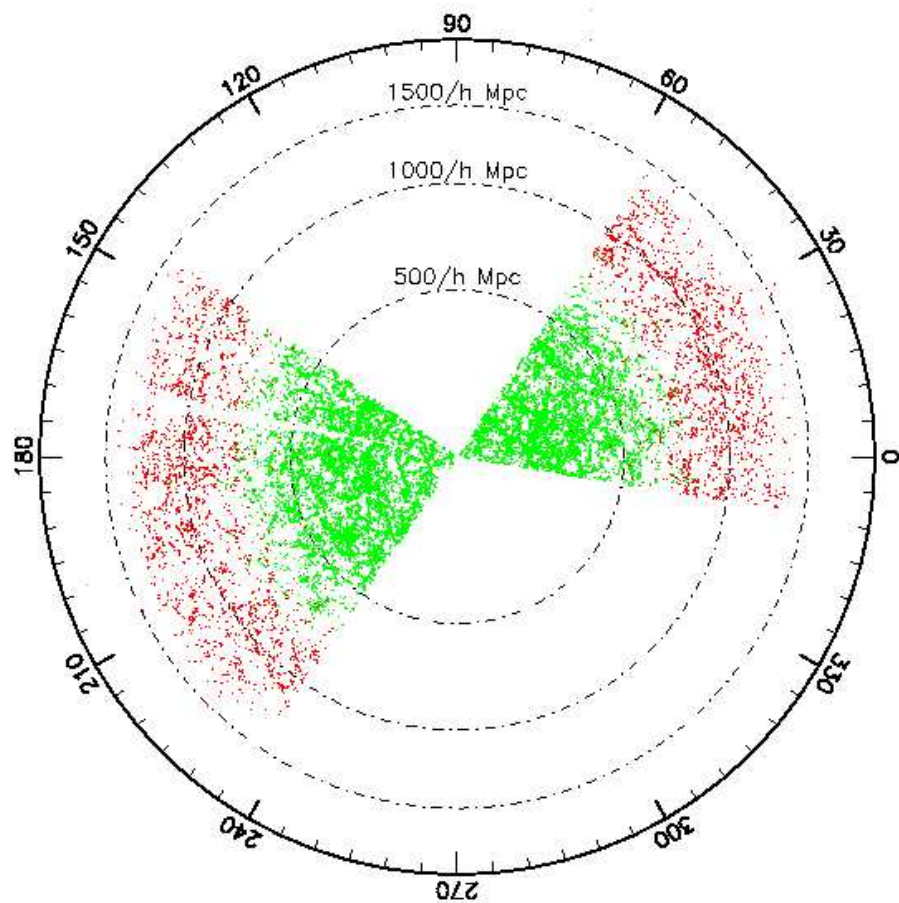




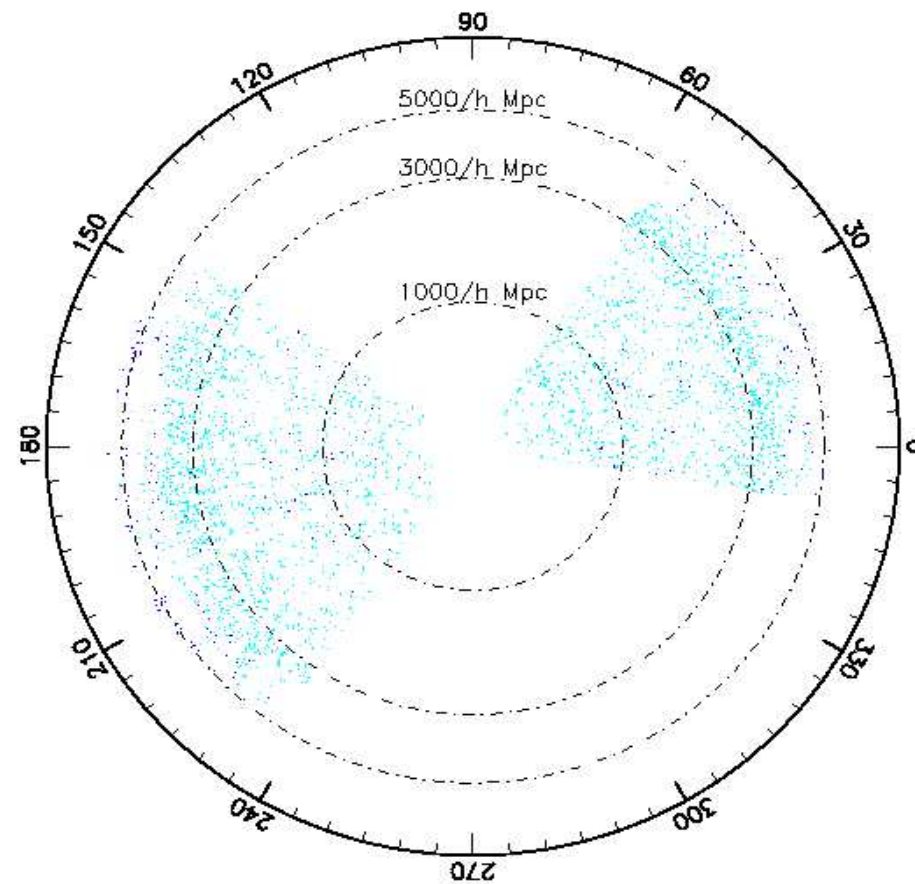
# Deep galaxy surveys



Las Campanas, mid-90's



Galaxies



Quasars

SDSS, recent