

## High-redshift Lyman- $\alpha$ galaxies

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A strong Lyman- $\alpha$  line enables relatively easy detection of high redshift galaxies. Lyman- $\alpha$  galaxies are now known from  $z=3$  to 6.6. No evolution is discerned in the Lyman- $\alpha$  line luminosity function in this redshift range. This implies that the intergalactic medium at  $z=6$  is at least 50% ionized over more than 50% of the volume. Recent continuum detections of these galaxies from *HST*, MMT and *Spitzer* are now allowing us to address questions about the nature of these Lyman- $\alpha$  emitters, their stellar populations and ages. We find that by and large the Lyman- $\alpha$  galaxies are young galaxies dominated by stellar populations that are less than 25 Myr old.

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## Cosmic microwave background: probing the universe from $z = 6$ to 1100

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Observations of cosmic microwave background temperature and polarization fluctuations are sensitive to both physical conditions at recombination ( $z = 1100$ ) and physical process along the line of sight. I will discuss recent results from the Wilkinson Microwave Anisotropy Probe and planned ground and space-based observations. The talk will emphasize the role of CMB observations in determining the initial conditions for the growth of structure and as a probe of the physics of re-ionization.