Co-evolution of galaxies and their dark matter haloes from weak lensing

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Abstract

Galaxy-galaxy weak lensing is a direct probe of the mean matter distribution around galaxies. The depth and sky coverage of the CFHT Legacy Survey yield statistically significant galaxy halo mass measurements over a much wider range of stellar masses and redshifts ($0.2 < z < 0.8$) than previous weak lensing studies. We find, for the first time from weak lensing alone, evidence for significant evolution in the stellar-to-halo mass ratio (SHMR): the peak ratio falls as a function of cosmic time, and shifts to lower stellar mass haloes. These evolutionary trends are dominated by red galaxies, and are consistent with a model in which the stellar mass above which star formation is quenched "downsizes" with cosmic time. In contrast, the SHMR of blue, star-forming galaxies is well fit by a power law that does not evolve with time. This suggests that blue galaxies form stars at a rate that is balanced with their dark matter accretion in such a way that they evolve *along* the SHMR. This can be used to constrain the mean star formation rate of the galaxy population over cosmic time.