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New neutrino mass bounds from Sloan Digital Sky Survey III Data Release 8 photometric luminous galaxies

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Abstract content

We present neutrino mass bounds using 900,000 luminous galaxies with photometric redshifts measured from Sloan Digital Sky Survey III Data Release Eight (SDSS DR8). The galaxies have photometric redshifts between z = 0.45 and z = 0.65, and cover 10,000 square degrees and thus probe a volume of 3hˆ(−3)Gpcˆ3, enabling tight constraints to be derived on the amount of dark matter in the form of massive neutrinos. A new bound on the sum of neutrino masses of 0.26 eV, at 95% confidence level (CL), is obtained after combining our sample of galaxies, which we call "CMASS", with WMAP 7 year Cosmic Microwave Background (CMB) data and the most recent measurement of the Hubble parameter from the Hubble Space Telescope (HST). This constraint is obtained with a conservative multipole range choice of $30 < l < 200$ in order to minimize non-linearities, and a free bias parameter in each of the four redshift bins. We study the impact of assuming this linear galaxy bias model using mock catalogs, and find that this model causes a small $(1 - 1.5\sigma)$ bias in the dark energy density. For this reason, we also quote neutrino bounds based on a conservative galaxy bias model containing additional, shot noise-like free parameters. In this conservative case, the neutrino mass bounds are significantly weakened, e.g. < 0.36 eV (95% confidence level) for WMAP+HST+CMASS (lmax = 200). We also study the dependence of the neutrino bound on multipole range (lmax = 150 vs lmax = 200) and on which combination of data sets is included as a prior. The addition of supernova and/or Baryon Acoustic Oscillation data does not significantly improve the neutrino mass bound once the HST prior is included. A companion paper (Ho et al. 2012) describes the construction of the angular power spectra in detail and derives constraints on a general cosmological model, including the dark energy equation of state w and the spatial curvature ΩK, while a second companion paper Seo et al. (2012) presents a measurement of the scale of baryon acoustic oscillations from the same data set. All three works are based on the catalog by Ross et al. (2011).

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