Recently there has been growing interest in observations of the high-redshift universe with the 21cm radiation of neutral hydrogen. The 21cm radiation traces the distribution of matter in the universe, and the signal can be used to constrain cosmological parameters. We explore the prospects for future observations of the 21cm signal from the epoch of reionization, and show the possibility of constraining neutrino mass, effective number of neutrino species and neutrino mass hierarchy.

We find that combining the CMB observations with future square kilometer arrays optimized for 21 cm line such as Omniscope can determine the neutrino mass hierarchy at 2σ. We also show that a more feasible combination of Planck + POLARBEAR and SKA can strongly improve errors of the bounds on the total neutrino mass and the effective number of neutrino species to be $\Delta \Sigma m_\nu \sim 0.12$ eV and $\Delta N_\nu \sim 0.38$ at 2σ [1].


Figure 1: Forecasts of 2σ errors on $r_\nu = (m_3 - m_1)/\Sigma m_\nu$ constrained by both the 21 cm and the CMB observations in case of the inverted hierarchy to be fiducial (left), and the normal hierarchy to be fiducial (right). The constrains are obtained by combining Omniscope with Planck + POLARBEAR (thick dashed lines), and Omniscope with CMBPol (thick solid lines), respectively. Allowed parameters on $r_\nu$ by neutrino oscillation experiments are plotted as two bands for the inverted and the normal hierarchies, respectively.