X35a Cosmological-Scale HI Distribution Around Galaxies and AGN Probed with Massive Spectroscopic Data

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We present 3-dimensional (3D) neutral hydrogen (HI) tomographic maps of cosmological-scale HI distributions at $z = 2 - 3$ over a total of 838 deg^2 in two blank fields that are traced by Lyα forest absorptions of 12,000 background SDSS quasars at $z = 2.08 - 3.68$ Using the 3D HI tomographic maps, we investigate the average cosmological-scale ($\gtrsim$ 10 cMpc) HI radial profiles and two-direction profiles of the line-of-sight (LoS) and transverse (TS) directions around galaxies and AGN at $z = 2-3$ identified by the Hobby Eberly Telescope Dark Energy eXperiment (HETDEX) and SDSS surveys, respectively. We find that the peak of the HI radial profile around the galaxies is lower than the one around AGN, suggesting that the dark-matter halo of AGN is more massive on average than the one of galaxies. We also find that the LoS profile of AGN is comparable with the theoretical prediction, and that the LoS profile is narrower than the TS profile, indicating the Kaiser effect. Moreover, there exists a weak HI absorption region in the LoS-profile at $\gtrsim$ 20 cMpc, which can be explained by the theoretical model with the combination of the radiation effect and the velocity gradient due to the matter infall. Although there is no significant dependence of AGN types (type 1 vs. type 2) on the HI profiles beyond the errors, we find that the peaks of the radial profiles anti-correlate with AGN luminosities, which suggest that quasars' ionization effects are stronger than the HI mass differences.