

X39a Field Variation in LAE-IGM HI Correlation at $z \approx 2$ Mapped by Subaru/HSC

Yongming Liang (SOKENDAI/NAOJ), Nobunari Kashikawa (Tokyo), Zheng Cai (Tsinghua), Xiaohui Fan (Steward), J. Xavier Prochaska (UCO/Lick), Kazuhiro Shimasaku (Tokyo), Masayuki Tanaka (NAOJ), other collaborators in HSC Project 399.

The correlation between neutral hydrogen (HI) in the intergalactic medium (IGM) and galaxies now attracts great interest. We have found a positive Ly α emitter (LAE) - IGM HI correlation based on a 5.4 deg² narrowband survey targeting IGM HI overdense regions (Liang et al., 2021). Compared with simulations, this relation provides us with an instructive probe to unveil pristine HI gas assembly and galaxy formation. Meanwhile, a specific field with significant SDSS/BOSS quasar overdensity also addresses the possible existence of field variation. Therefore, we extend the study to the latest $z = 2.2$ LAE catalog surveyed over the areas of ~ 20 deg² from the Subaru HSC-SSP (Ono et al., 2021) and additional HSC fields with the grouping quasars. With the larger sample, we derive the relations of the Ly α forest fluctuation as a function of LAE overdensity in various environments and find the slope of the relation is flatter in both general fields and quasar fields, being consistent with model predictions. However, the clustering strengths in the power-law fit for cross-correlation functions between LAEs and LoSs with high effective optical depth are comparable in all environments. The results suggest the LAE overdensity-IGM HI relation is steeper in regions with denser HI. Nevertheless, the gravitational potential of underlying halos still plays the dominant role in regulating the LAE-IGM HI correlation, while AGN feedback or exceeding HI may have secondary effects.