The Large-scale Distribution of Cool Gas

Guangtun Ben Zhu (NASA/JHU)

The circumgalactic medium contains signatures of key processes in galaxy formation, such as gas accretion and outflow, and may account for the majority of baryons in the Universe. To probe gas in this environment, we measure the mean absorption induced by galaxy halos using all available quasar-galaxy pairs in the SDSS (of the order of several million). This method does not require the detection of individual absorber systems but is able to extract weak absorption signals below the noise of individual spectra. As a result, we can measure the radial distribution of gas with an unprecedented sensitivity, reaching rest equivalent width of 0.0001 Angstrom. We are able to measure Ca II absorption up to 200 kpc around galaxies and Mg II up to 20 Mpc. We also extract relationships between galaxy properties (stellar mass, SFR, orientation) and the amount of gas in their halos. On the large scale, the measured galaxy-gas correlation function reveals a clear transition from the 1-halo to 2-halo regime which we study quantitatively with a new dark matter-gas halo model. We also measure the velocity dispersion of cool gas clouds in the halo and interpret it in the cosmological context. I will further discuss the new constraints these results bring to the physics of gaseous halos.