# How are Lyα absorbers distributed around galaxies?

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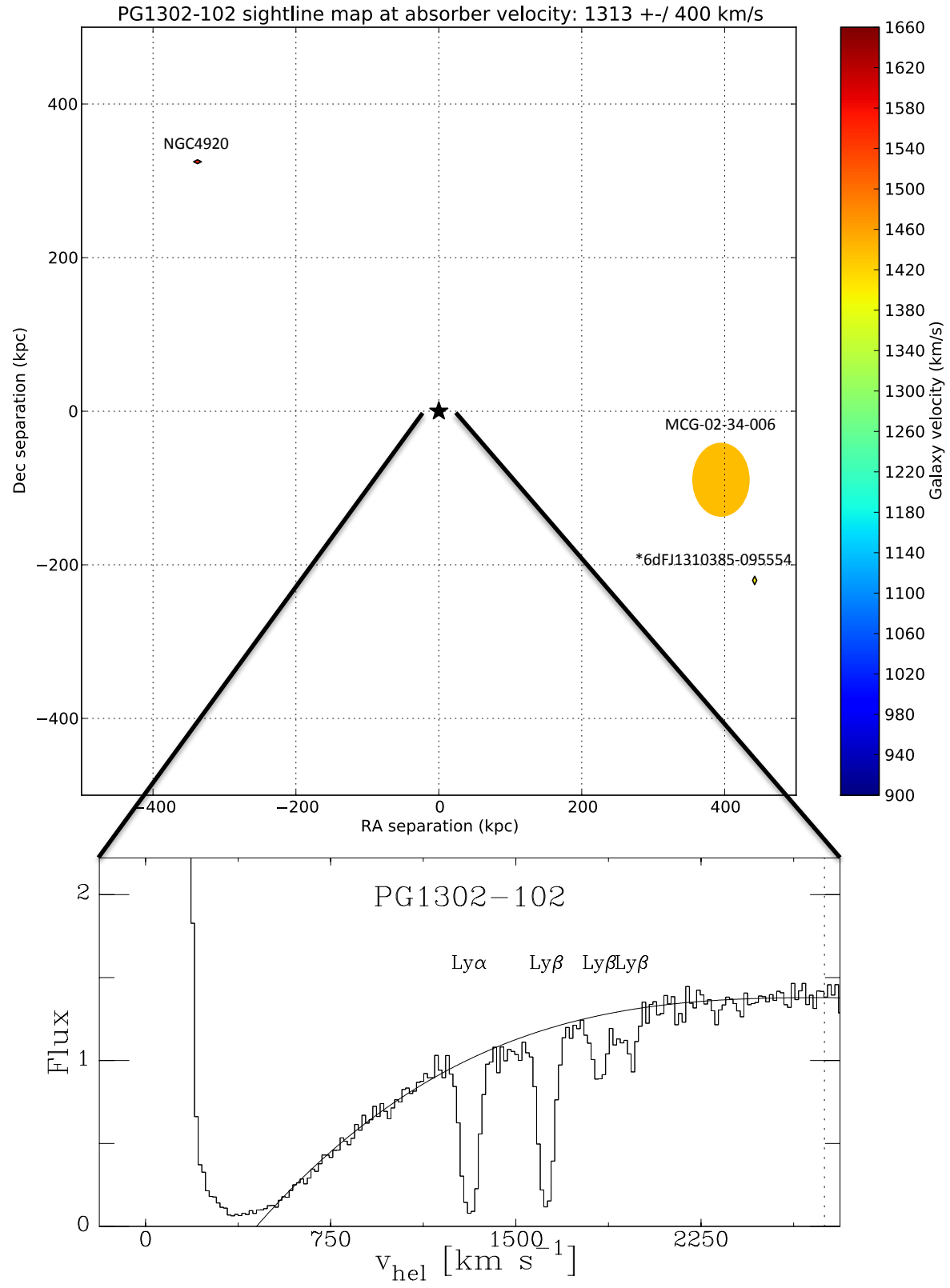
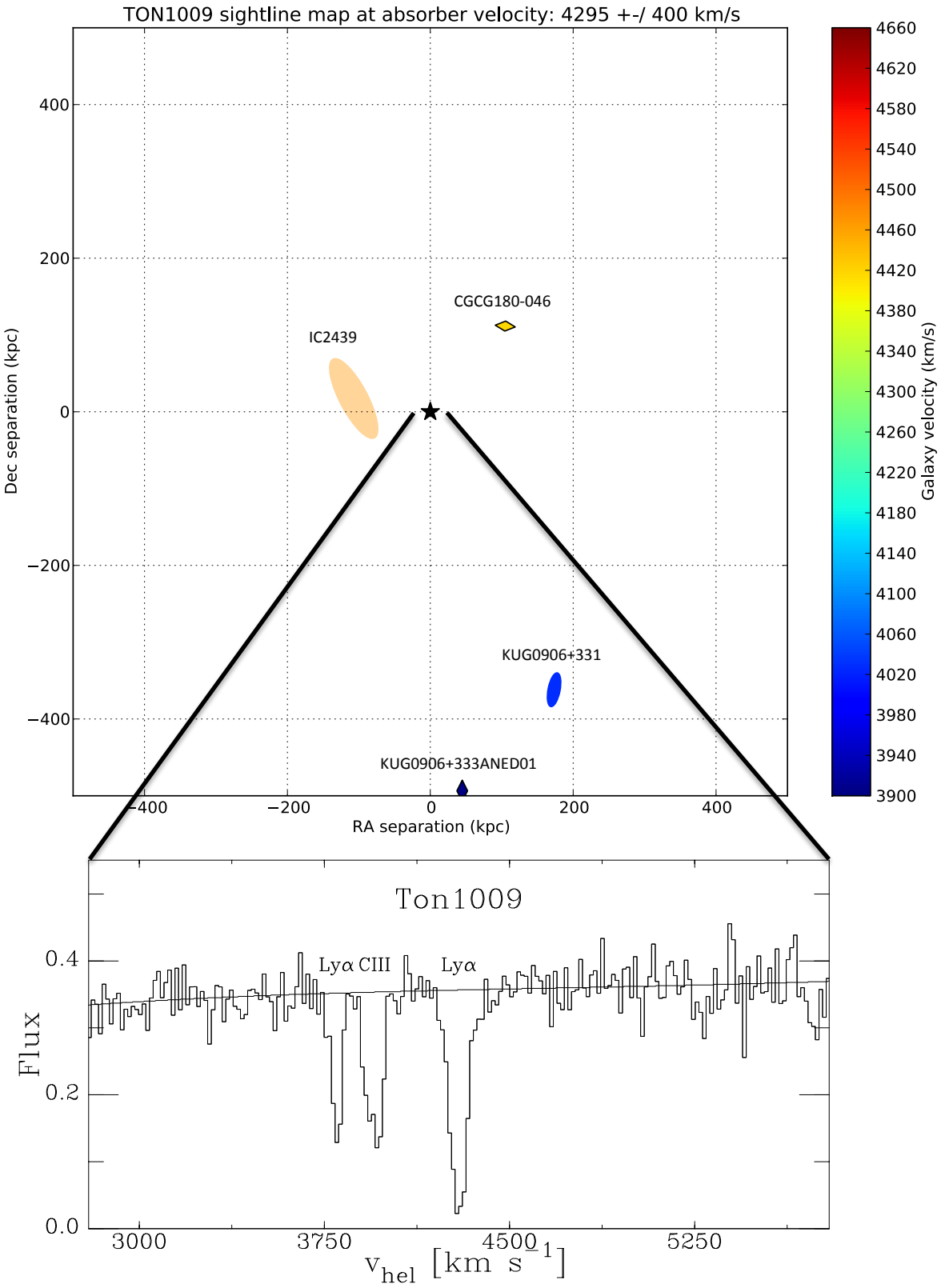
**Abstract:**

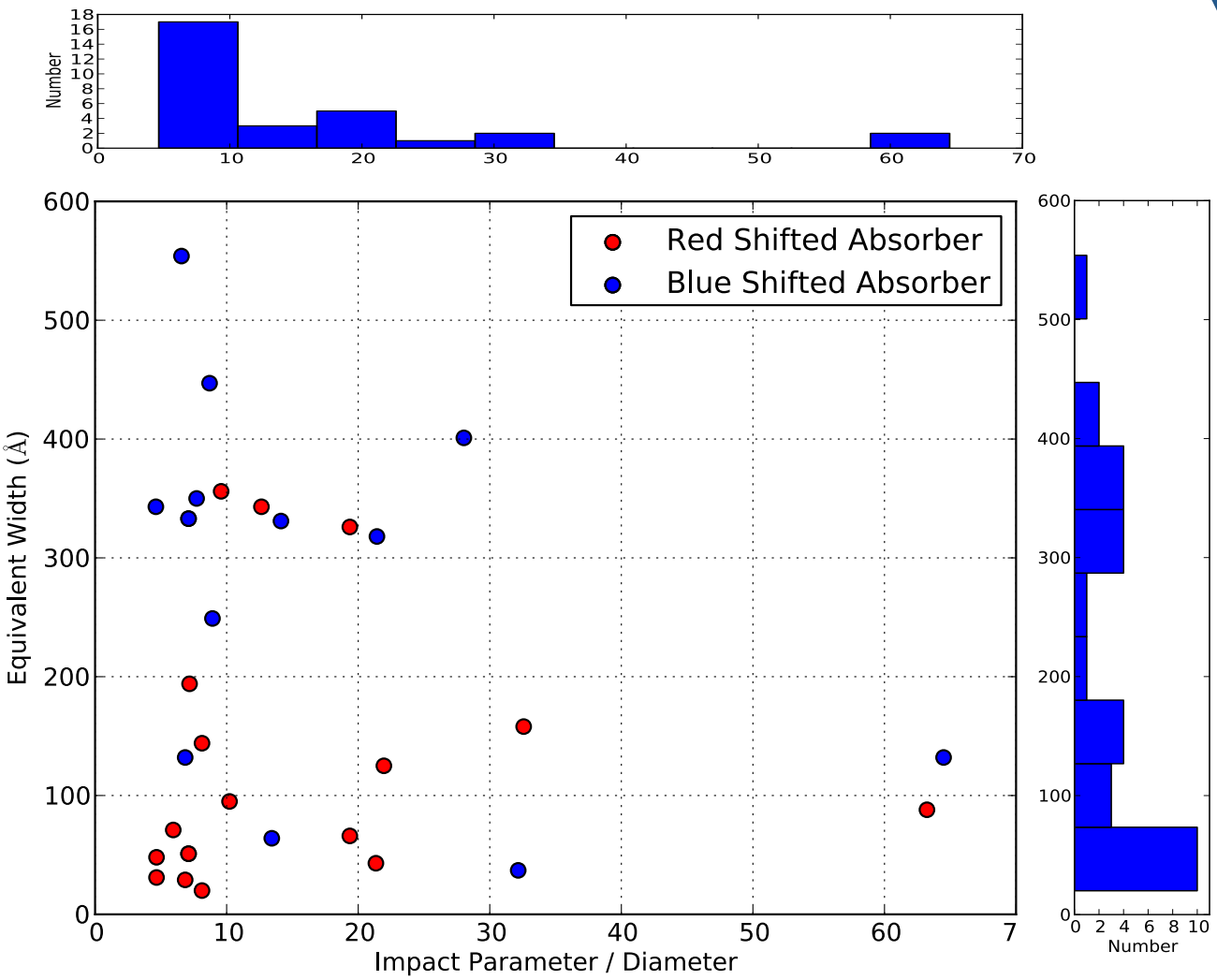
Understanding the distribution of gas around galaxies provides key insights to the mechanisms of accretion and feedback, and are necessary to create a cohesive theory of galaxy evolution. We are conducting a large survey of Lyα absorbers as a function of galaxy environment in the nearby universe (cz <= 10,000 km/s) using archival QSO spectra from the Cosmic Origins Spectrograph (COS) on HST. There are currently over 250 QSO sightlines available, and we present preliminary results from an initial sample of 20 target sightlines chosen for their proximity to large, well studied galaxies.

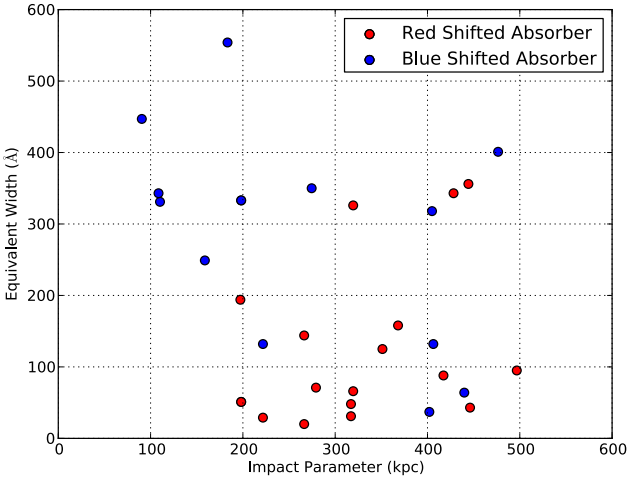



**Above:** Detected absorption at v = 1313 km/s in PG1302-102 sightline with corresponding map of absorber environment. **Top:** All galaxies within 400 km/s of absorber and 500 kpc in physical impact parameter are included. Inclination, position angle and size of galaxies is illustrated by ellipse major/minor axis, orientation, and size (x6). Spiral type galaxies are solid ellipses, elliptical type are transparent, and unknowns are diamonds.



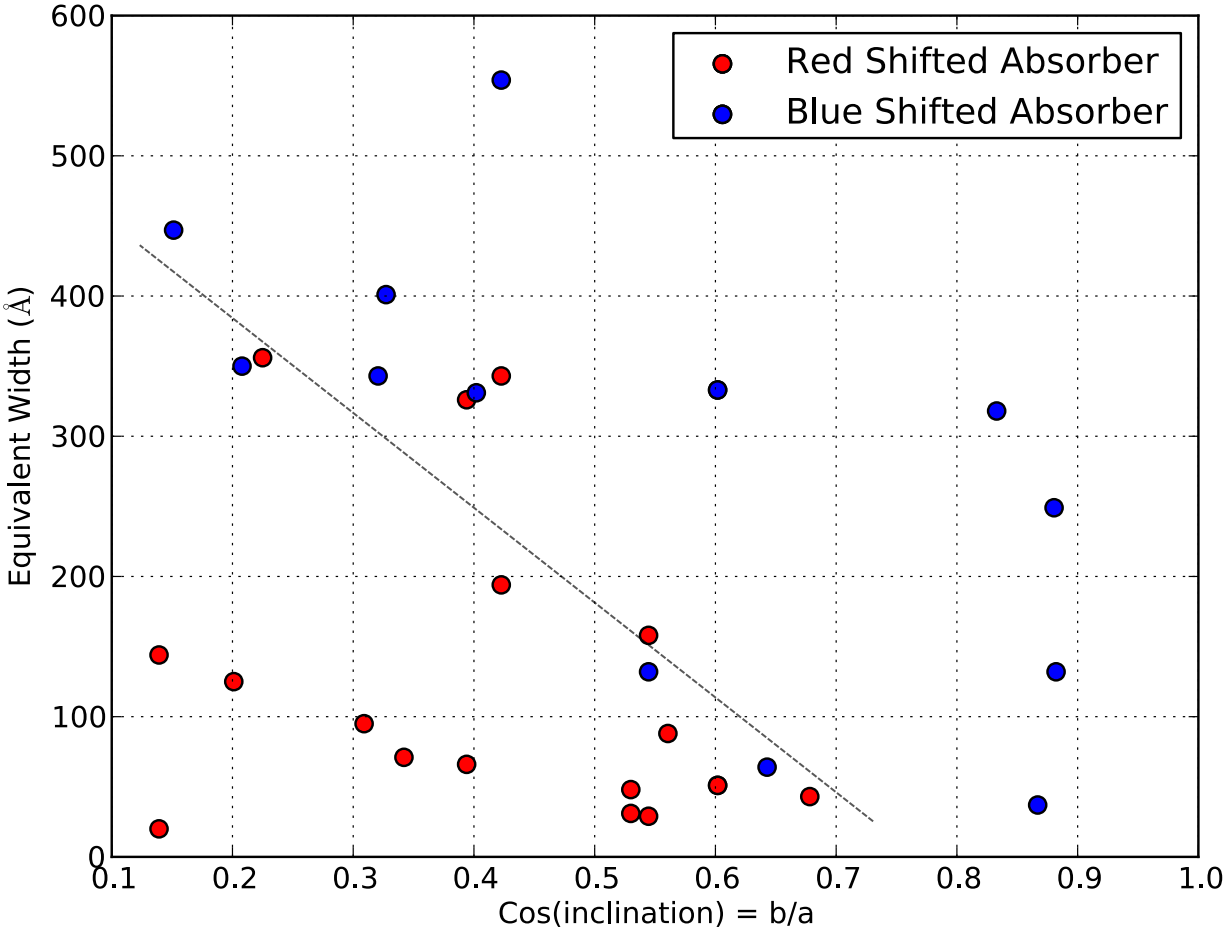

**Above:** Detected absorption at v = 4295 km/s in TON1009 sightline with corresponding map of absorber environment. **Top:** All galaxies within 400 km/s of absorber and 500 kpc in physical impact parameter are included. Inclination, position angle and size of galaxies is illustrated by ellipse major/minor axis, orientation, and size (x6). Spiral type galaxies are solid ellipses, elliptical type are transparent, and unknowns are diamonds.

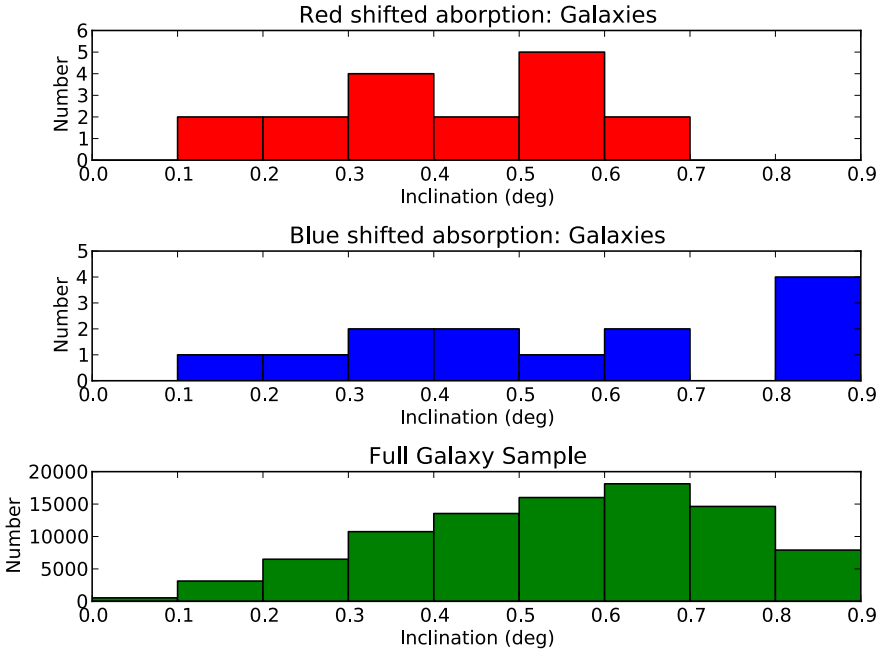



**Above:** The equivalent width of absorbers is plotted against the impact parameter to each associated galaxy, normalized by the galaxy size. Marginal histograms show the distributions of impact parameters and equivalent widths. Weakly absorbing systems occur at all impact parameters, however the average equivalent width clearly increases with decreasing impact parameter.

**Above, left:** Equivalent width plotted against impact parameter, not normalized by galaxy size. No significant correlation is seen, suggesting the expected correlation between galaxy size and the abundance of circumgalactic gas.




**Above:** Equivalent width plotted as a function of minor/major axis ratio. 22/30 absorbers appear to be associated with small axis ratio galaxies (b/a < 0.6). This translates to 84% of absorbing systems occur near a galaxy with >50° inclination angle. We also notice a dichotomy between gas that is red vs blue shifted compared to the velocity of the associated galaxy (dashed black line). Average above line is $W$ = 284 Å, average below is $W$ = 129 Å.

**Above (left):** Distributions of galaxy inclinations. Red depicts galaxies nearby redshifted absorption, blue depicts galaxies nearby blue shifted absorption, and green for all nearby galaxies (cz < 10000 km/s)

# Conclusions:

- We measure 90 Lyα absorbing systems in 20 QSO sightlines in the redshift range of 0–0.033 (cz = 0–10,000 km/s). 34% of absorbers can unambiguously be paired with a galaxy within 500 kpc and 400 km/s, and 42% reside nearby more than one galaxy.

- Lyα equivalent width *(W)* increases with decreasing impact parameter (normalized by galaxy size).

- 84% of galaxies associated with Lyα absorption are highly inclined (>50°).

- Red shifted absorbers (with respect to the associated galaxies) tend toward lower *W*.
  - Average *W(redshifted)* = 129Å
  - Average *W(blueshifted)* = 284Å

- Preference for Lyα absorption along major axis – 67% of associated galaxies have azimuth angles <50°.