

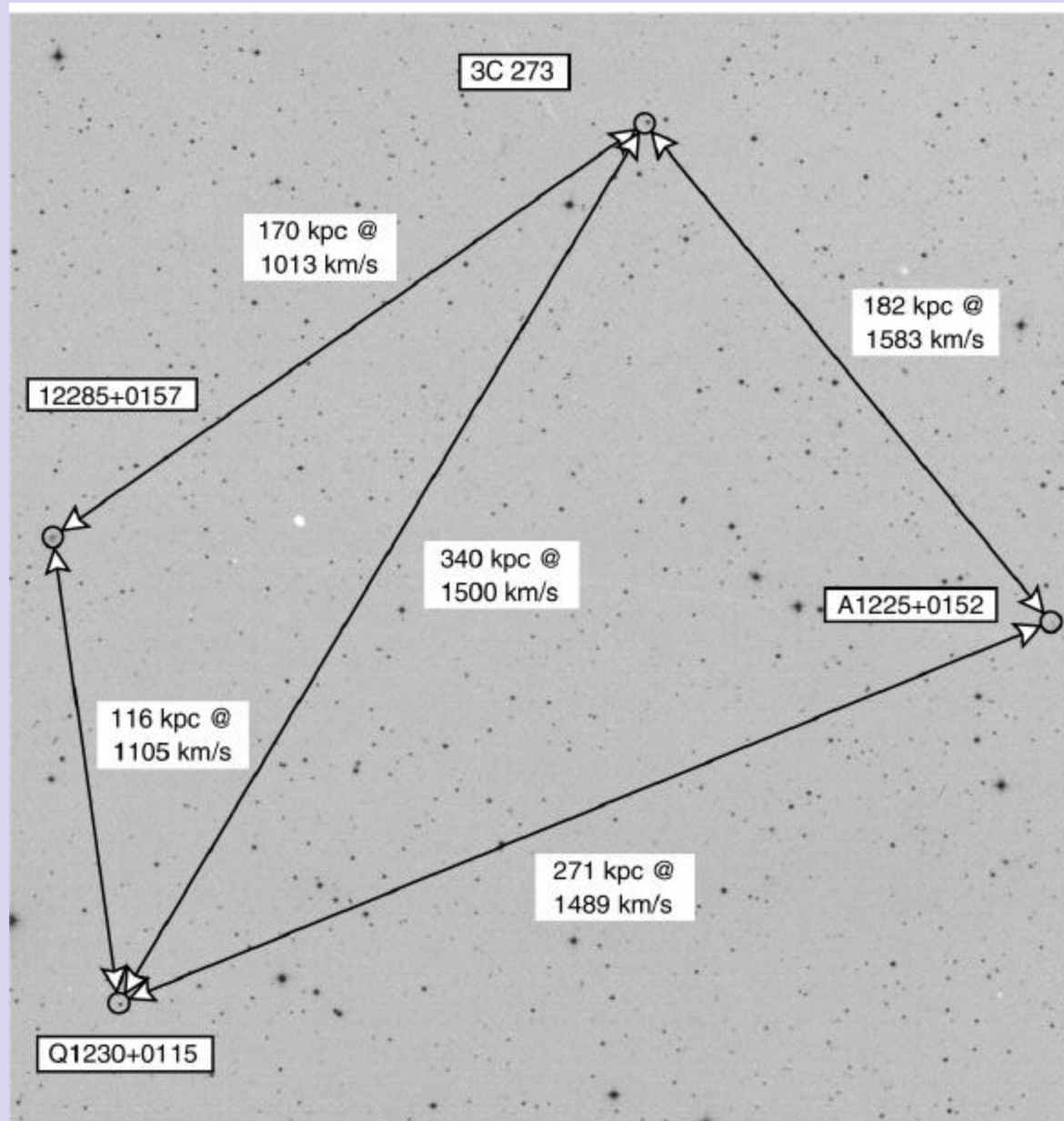


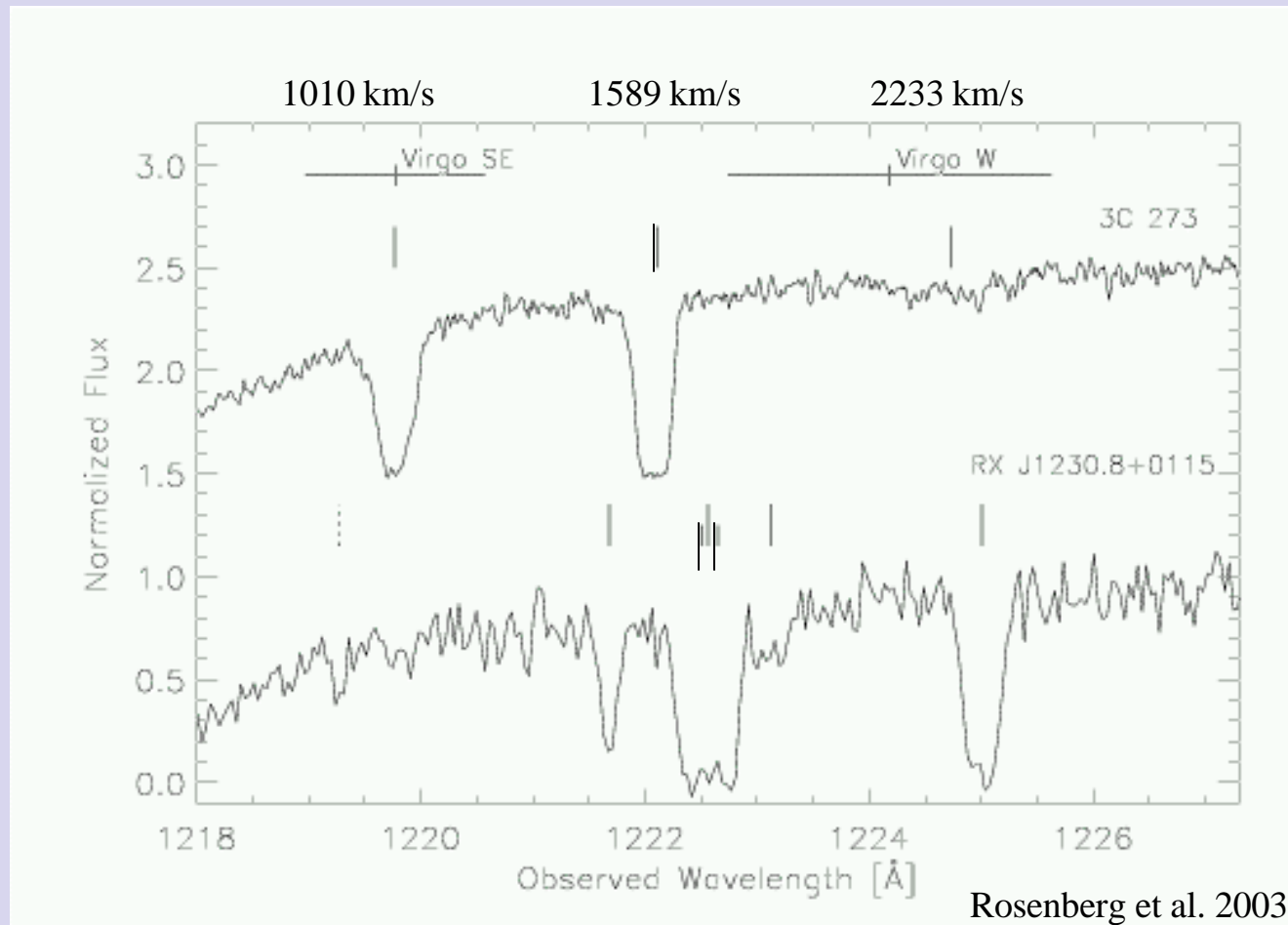
**Studying Galaxies and Everything in Between:  
A Discussion of Research and Teaching**

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# An Intriguing Example of Galaxy/IGM Interaction





RX J1230+0115:  $\log N_{\text{HI}} \sim 16-17$

3C 273:  $\log N_{\text{HI}} = 15.85$ ,  $Z=0.06Z_{\odot}$

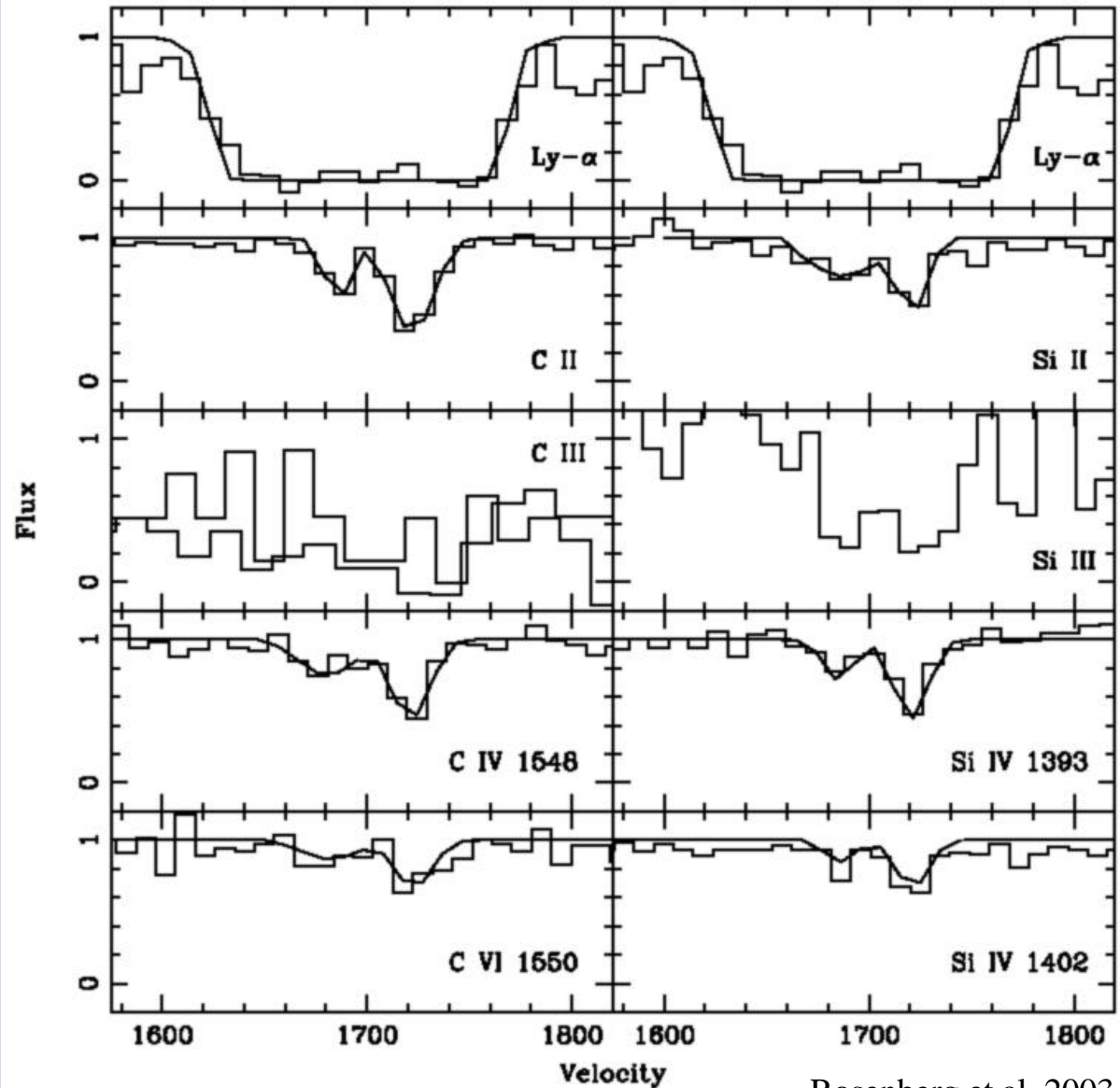
Excellent pair-wise association between the sightlines – coincidences indicate absorber radii of  $100-250h_{70}^{-1}$  kpc (higher redshift  $\sim 350$  kpc)

# Metal Lines Show Enrichment of the Absorbers

Two components seen in RX J1230.8+0115 system

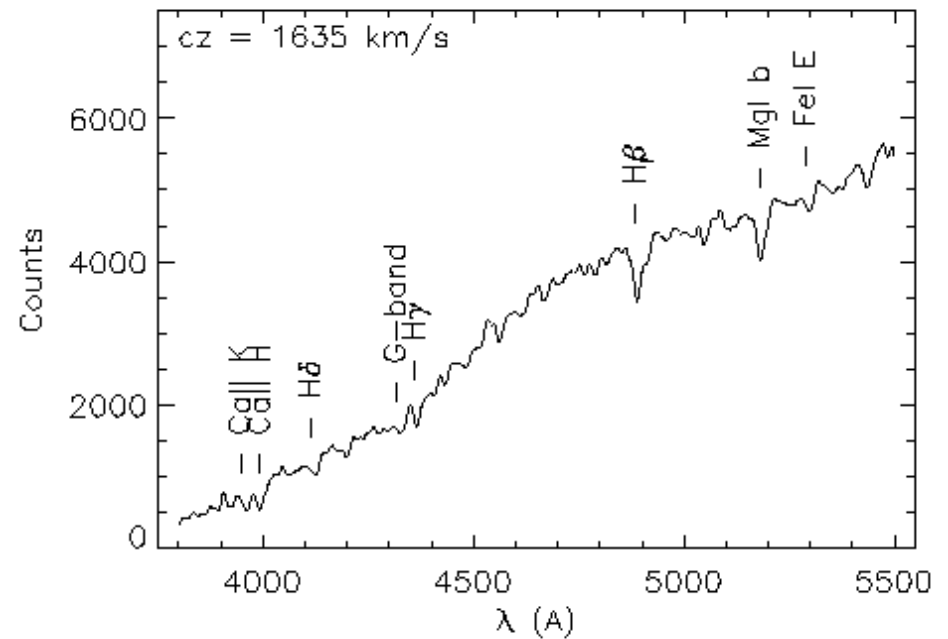
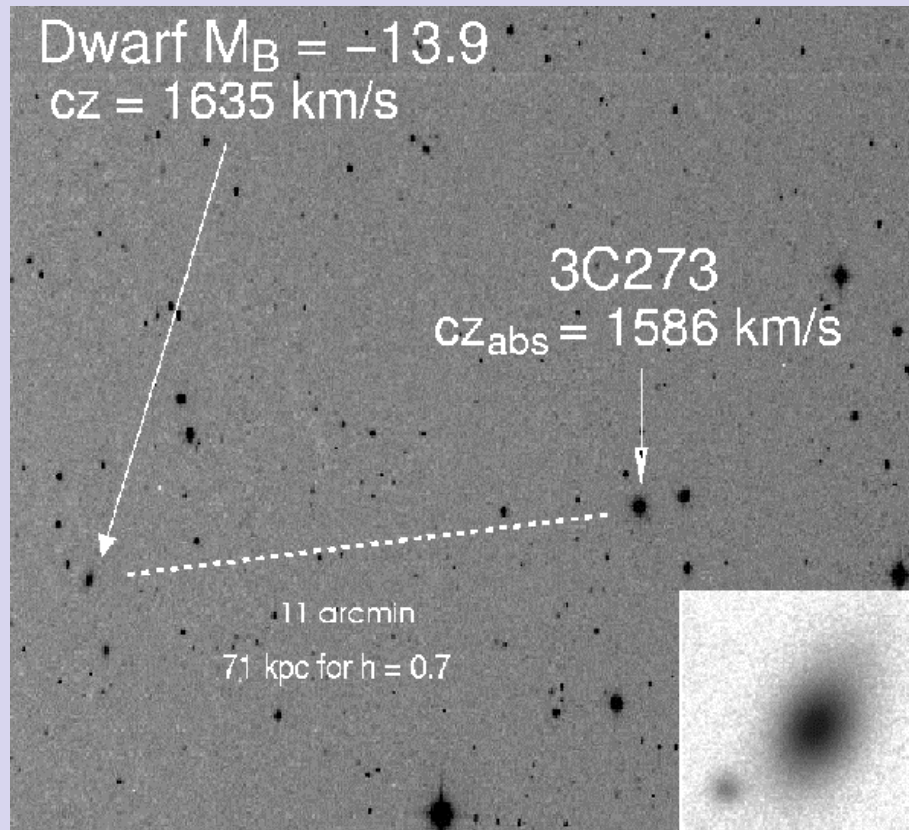
Strong metal lines in RX J1230.8+0115 - Ly- $\alpha$  and metal line strength consistent with  $Z \sim 0.06Z_{\odot}$  as in 3C 273 sight line. LOS depth = 10-30 kpc

3C 273 metallicity =  $0.06Z_{\odot}$  Tripp et al. (2002). LOS depth = 70 pc



# The Nearby Dwarf Starburst

71 kpc from 3C 273 sight line which has similar metallicity and possible Si/C overabundance (sn type-II enrichment). Time scale for fading starburst (2-3 Gyr) appropriate for outflow during SF epoch.



## Summary

- Absorber associations indicate large sizes for correlated structures.
- Line-of-sight depths indicate that these are probably correlated but not contiguous structures.
- Differently ionized clouds have different size characteristics.
- Similar systems have been identified in galaxy groups (Shull et al) or as weak MgII absorbers (Charlton et al)
- Post-starburst galaxy near 3C273 may indicate importance of dwarf galaxies in expelling metal enriched material.
- No galaxy found within 270 kpc of the RX J1230.8+0115 absorber.

## Science Explorers

<http://www.colorado.edu/ScienceDiscovery/teachers/sciex.html>

<http://casa.colorado.edu/~jrosenbe/teaching.html>

- Professional development for grades 5-8 science teachers
- Three workshops following a single theme each year
- Materials and curriculum developed for each workshop
- Concentrates on hands-on material
- Teachers plus 5 students work through pieces of each curriculum in day long workshops
- Material designed to be taken back to the classroom
- Programs run at urban and rural sites throughout Colorado



# Curriculum Topics

## How do we know:

The temperature of a star?

The composition of a star?

The distance to a star?

The velocity of a galaxy?

The distance to a galaxy?

## Building a Doppler ball

