Some thoughts on the bright side (the beginning) and the dark side of SDSS (my field, QSO absorption lines)

D. G. York, University of Chicago

Project definition for SDSS

- Scientists agreed on central goal: LSS
- Thus: redshifts of QSOs and galaxies
- How big? Need enough objects so that large samples of typical objects still exist after cuts are made
  - Boundary effects
  - Unexpected physical correlations
  - Etc.
  - Guess was 1 million redshifts

Defintion

- SO, needed 1% definition in systematics and photon stats at a magnitude faint enough to give 10^6 galaxies = ~17.5 (new imaging)
- Drift scan to minimize sky errors and overheads
- Fixes integration time at one minute.
- Aperture etc. must give survey in reasonable time (trade between operations cost and aperture costs)
- Scale must allow star/galaxy separation to faint limits.
- Magic numbers: f/5, 0.4 arcsec per pixel, 24 micron pixels, 2.5m aperture. Basically fixed by CCDs we could get.

Partnership

- Determined much of project (incl. software) procedures. Science interests paramount. (AT&T, NOAO, FNAL)
- Like minded scientists who would agree to open access within collaboration and public dispersal in timely fashion
- Public is “right” because
  - It forces everyone to do things right
  - It leads to more data getting looked at faster, a faster discovery of errors so they can be fixed before the project shuts down*
  - You cannot analyze all the data anyway: full value only when data are prepared for later use by others with different views.

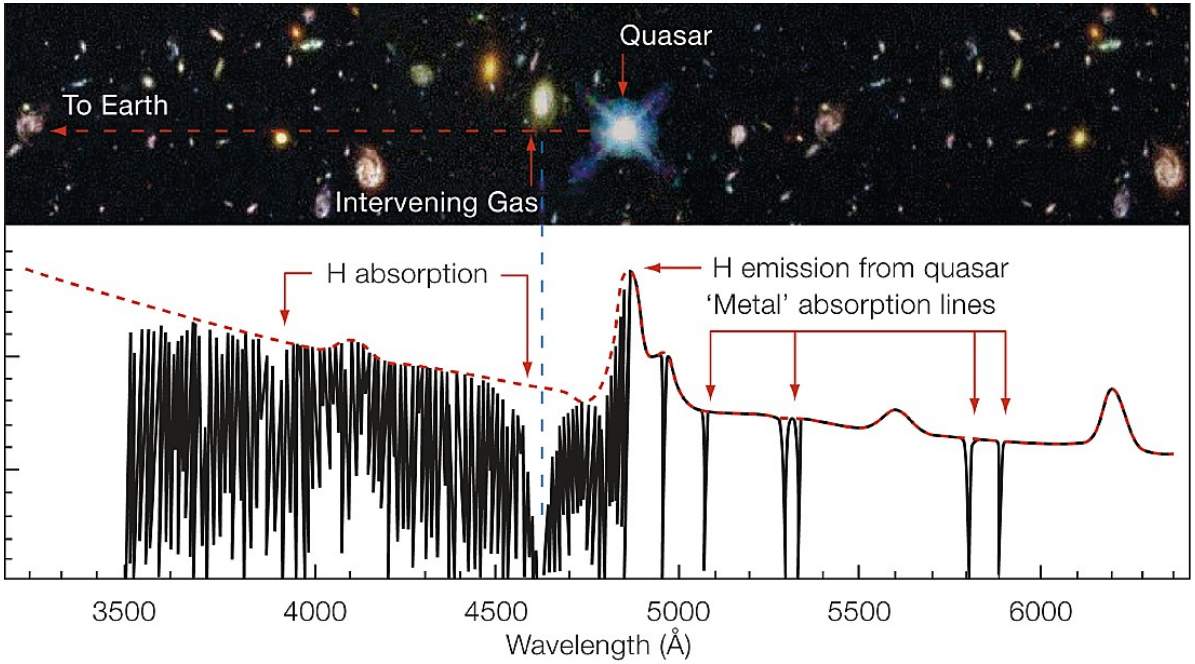
Functional goal

All of above reduces to one phrase that guided the project:

Create a public archive of 1 million galaxy spectra and their images

QSO limiting magnitude, star streams in the halo, mass metallicity relationship in LRGs, baryon oscillations, QSO absorption all came from the simple goal. Optimized for one thing, done very well.

The Dark Side



Seeing Metal From Invisible Galaxies

ESO PR Photo 06/06 (15 February 2006)

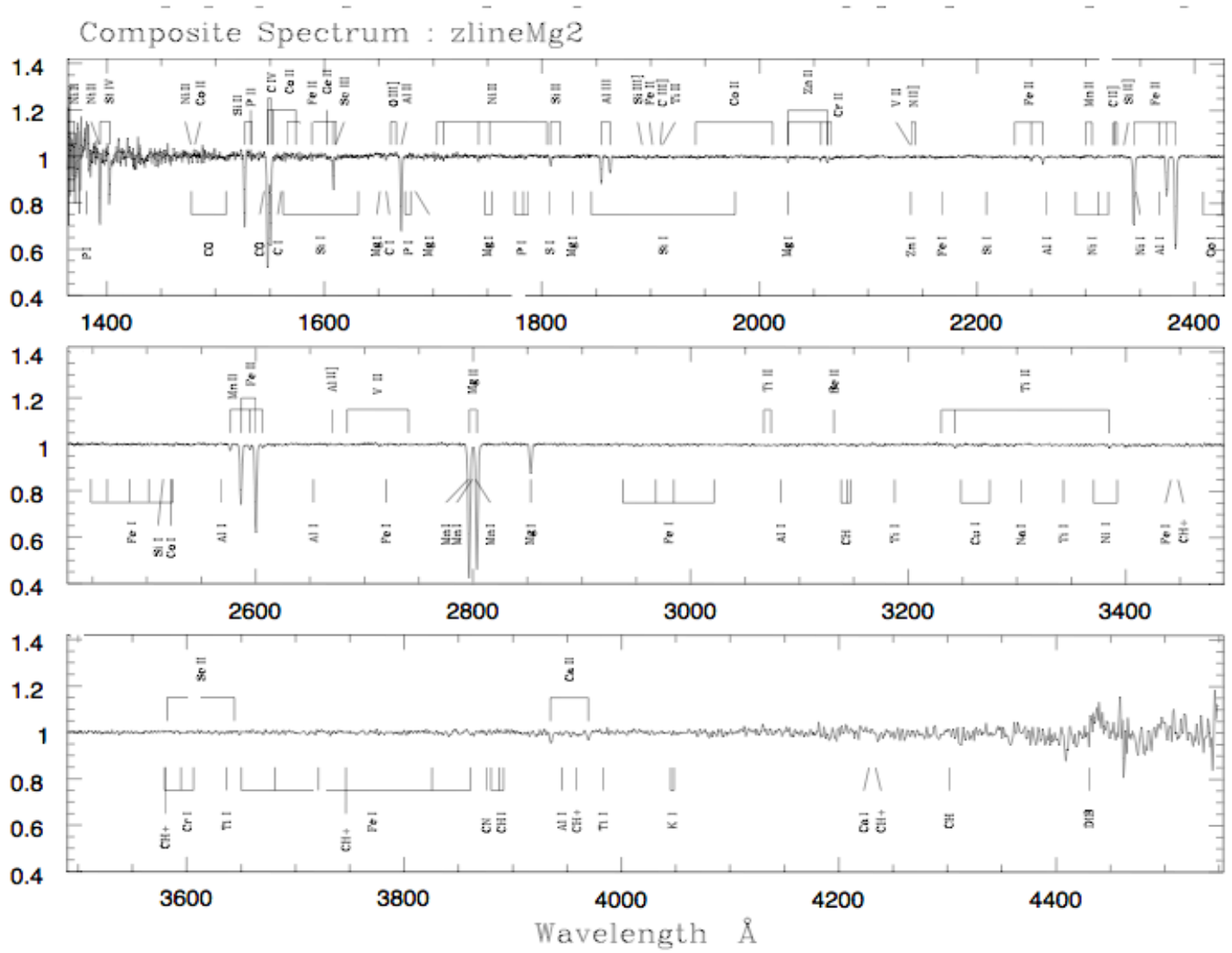
Origin of absorption lines in QSO spectra

Donald G. York--University of Chicago
Dan Vanden Berk--Penn State
Arlin Crotts--Columbia
Josh Frieman--FNAL/Univ. of Chicago
Guinevere Kauffmann--MPIA
Pat Hall--York University
Tim Heckman, Johns Hopkins University
Pushpa Khare--Utkal University (India)
Varsha Kulkarni--University of South Carolina
Jim Laurosesch--Univ. of Louisville
Matthew Lehnert--MPIA
Britt Lundgren--Univ. of Illinois (UIUC)
Brice Menard--IAS
Sandra Rao--Univ. of Pittsburgh
Gordon Richards--Johns Hopkins University
Don Schneider--Penn State
Mark Subbarao--Adler/Univ. of Chicago
David Turnshek--Univ. of Pittsburgh
Simon White--MPIA
Vivenne Wild, MPIA (now IAP)

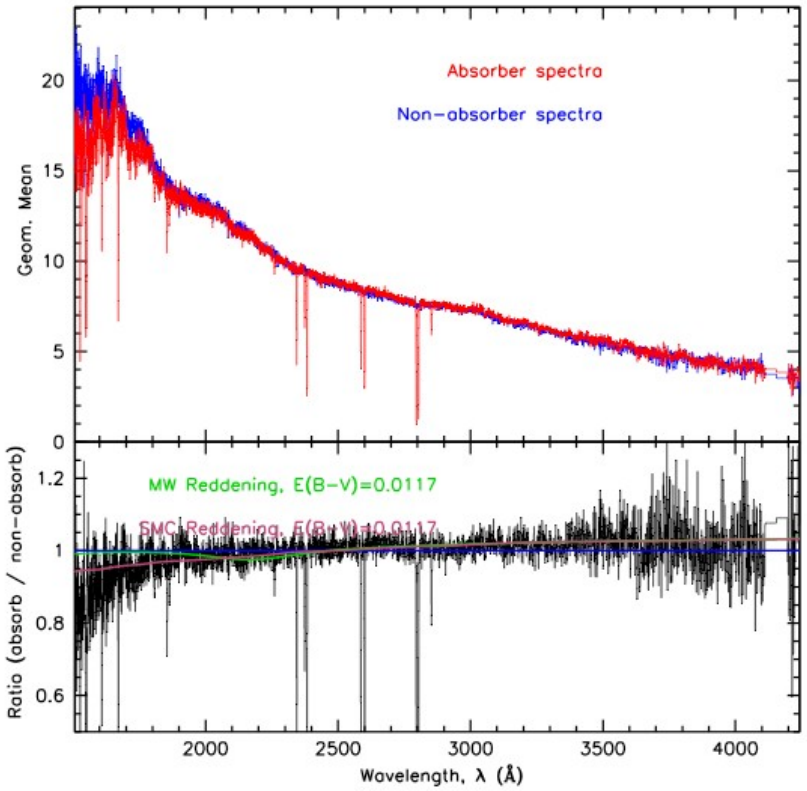
What are the absorbers?

" Lines of sight should pass through fair sample of galaxies
" Ellipticals should have high abundances and be common
    -- Where are they?
" Spirals: DLAs should be rare (clouds are small)
" Spirals: sub-DLAs should be common
    -- Where do the dwarfs come in? They should be common
" Intergalactic clouds without stars?
" High velocity clouds, tidally stripped gas from accretion of galaxies
" Role of ejected gas from QSOs
" Do absorbers trace history of element formation?

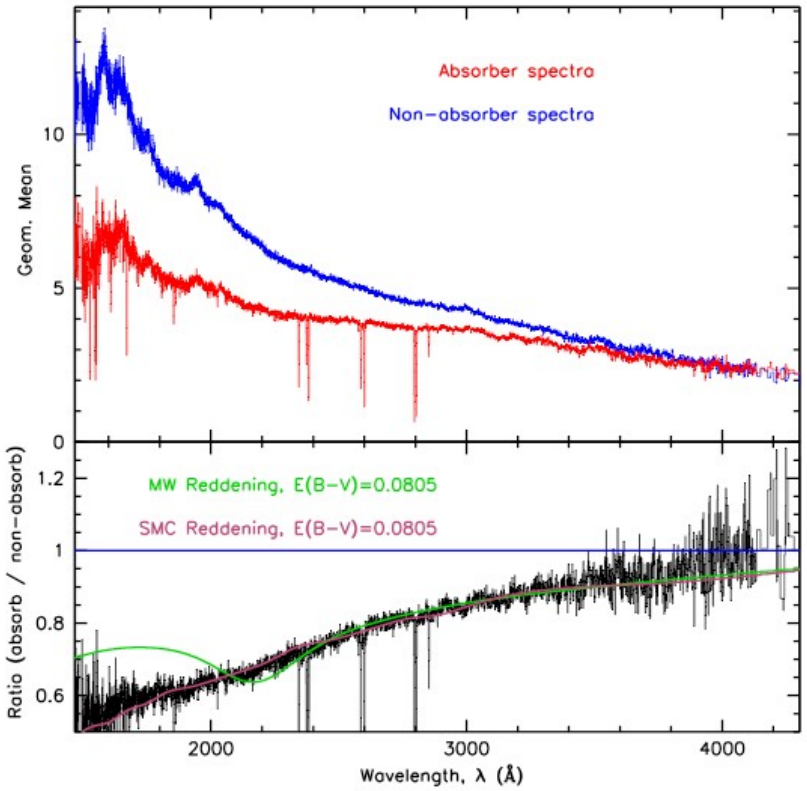
Composite of 809 spectra



Low extinction

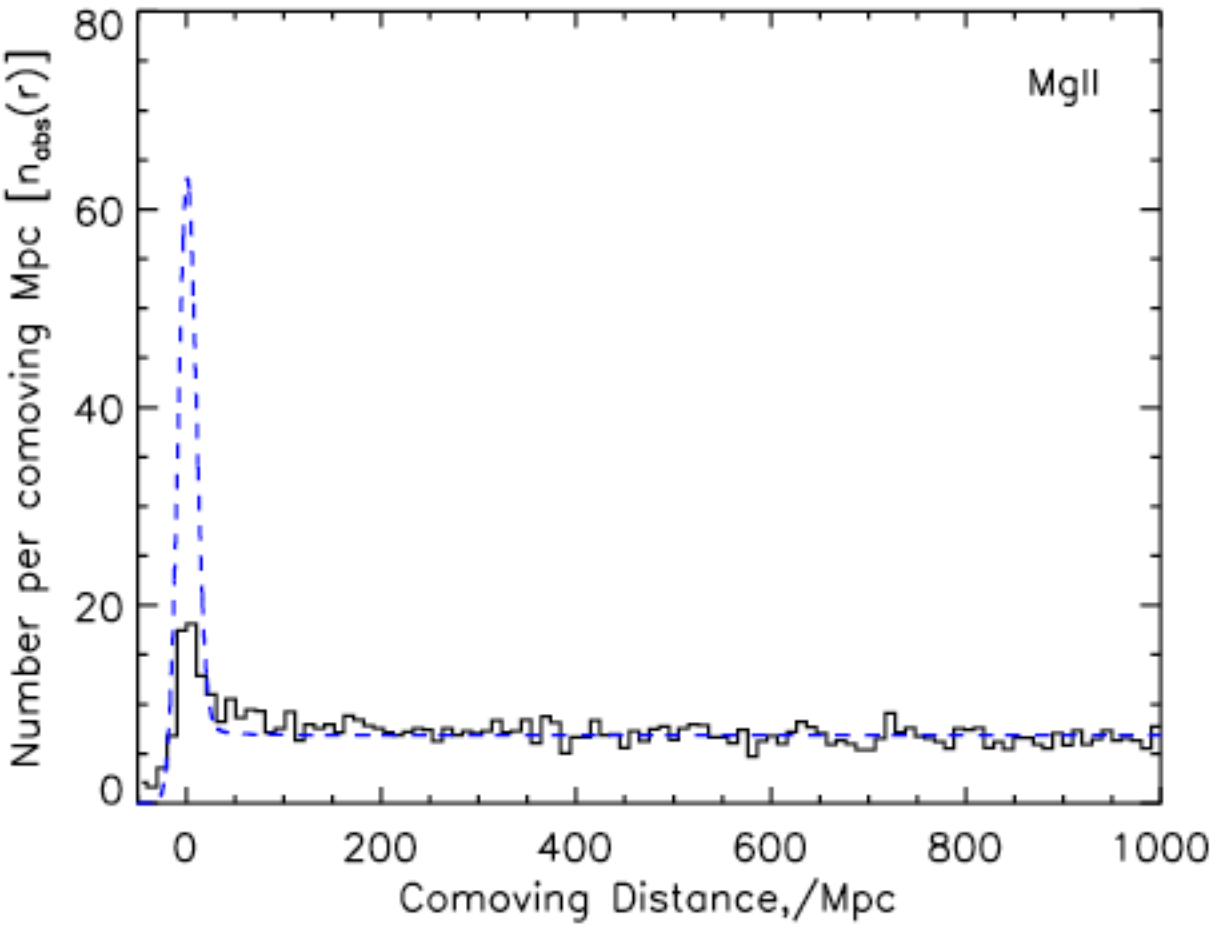


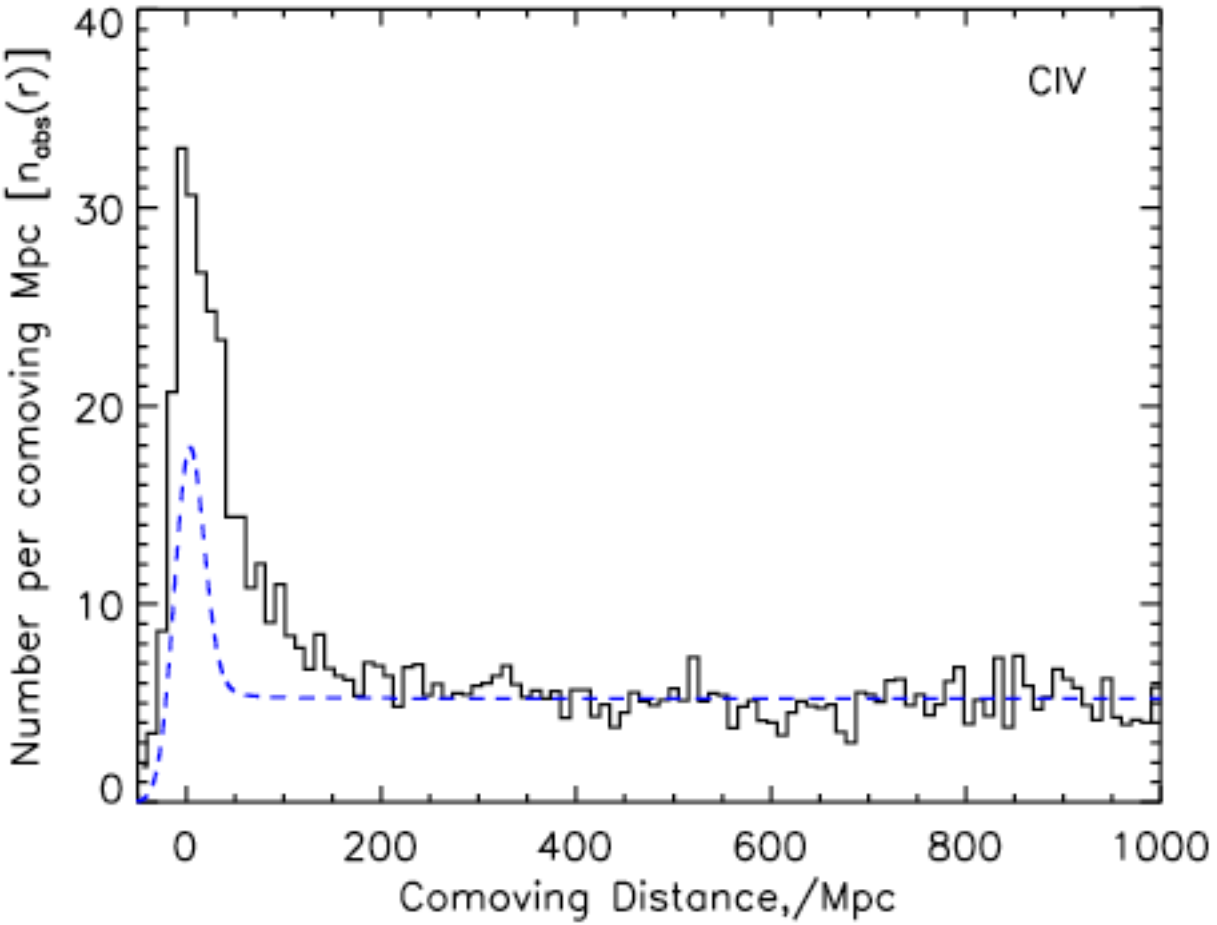
Strong Mg II, high E(B-V)



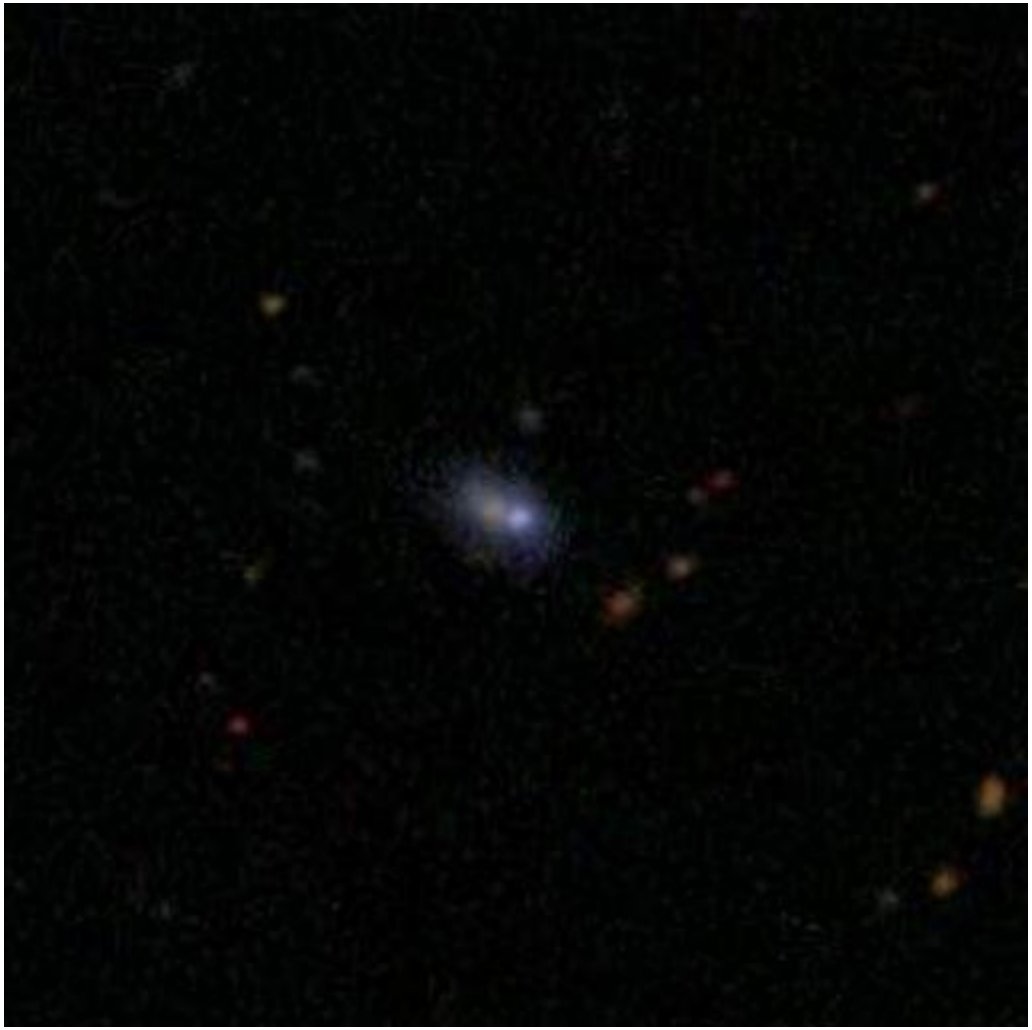
Outflows?? From QSOs

Wild et al. 2008




CIV
Number per comoving Mpc [$n_{abs}(r)$]
Comoving Distance,/Mpc
0
10
20
30
40
0
200
400
600
800
1000

QSO (background) near galaxy (foreground)



Galaxy,J1042, z=0.03;
QSO z=2.66

- The very hard work paid off for almost everyone, personally.
- My thanks to the hundreds of people willing to set aside large parts of their lives.
- And to our sponsors and board-level leadership, who made it possible.
- And to the UC leadership who supported our participation in the project.