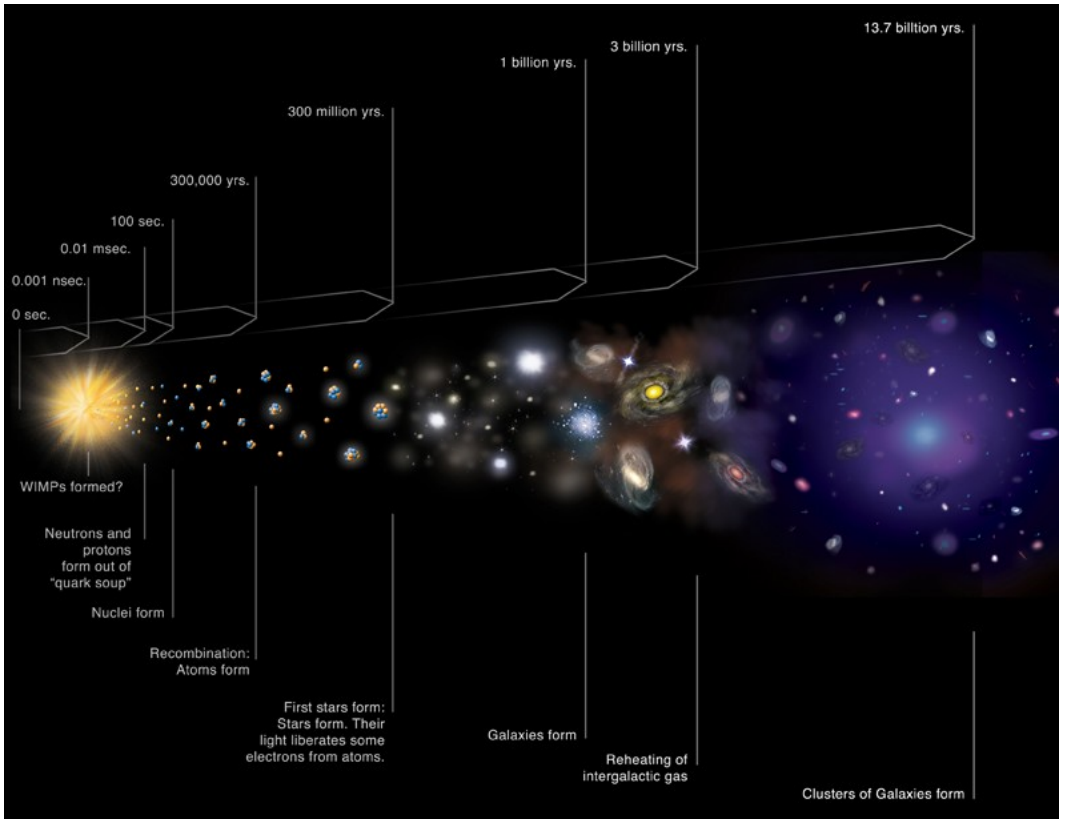
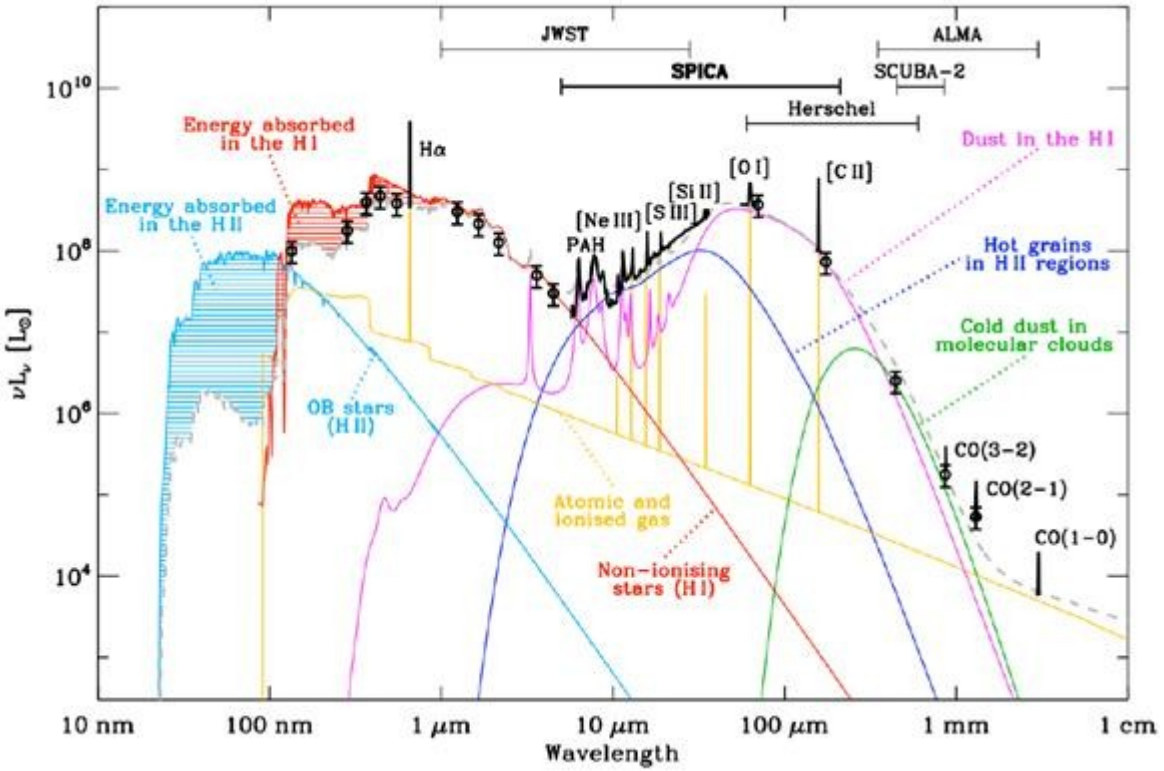
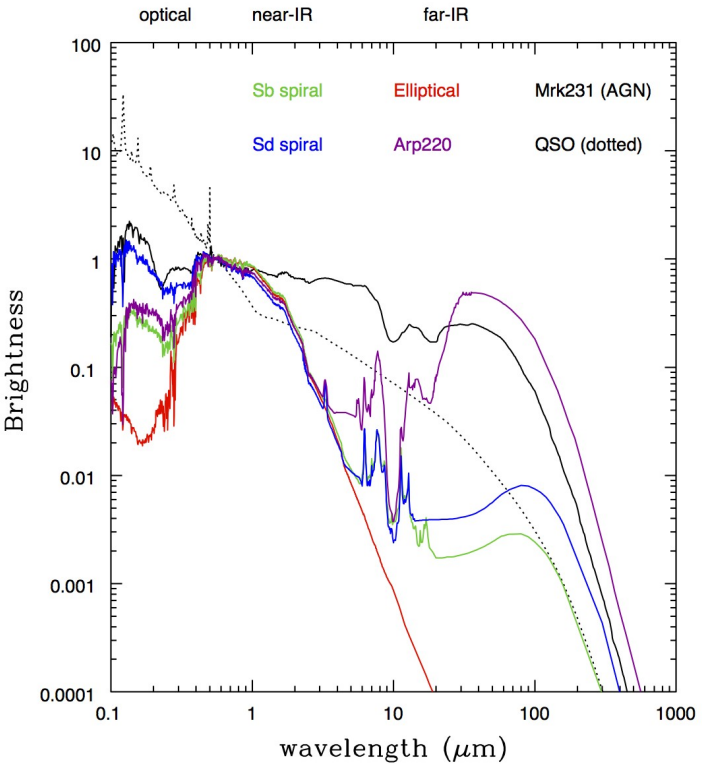
Galaxy formation (intro)



~~Main idea: this is a well-known time slice of the Universe. We know that stars appeared earlier than galaxies.~~ Stellar population is different in different galaxies and it evolves in time. This makes different galaxies look different and early-type galaxies don't look like late-type galaxies that we see in the local Universe. In order to study it we need to study the evolution of the stellar popultation over cosmic time.

Why galaxies are different

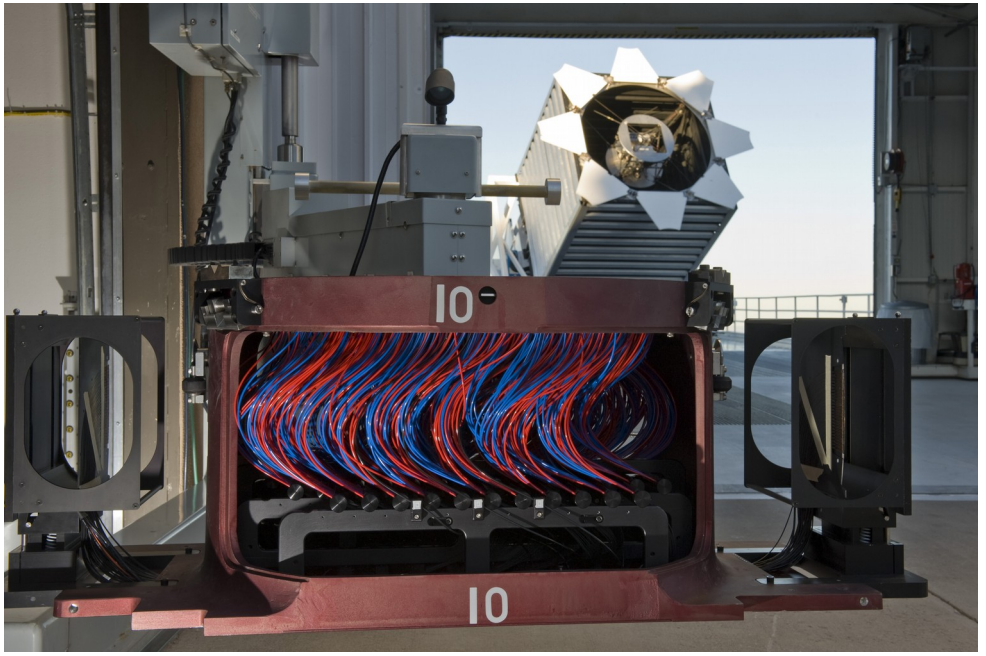


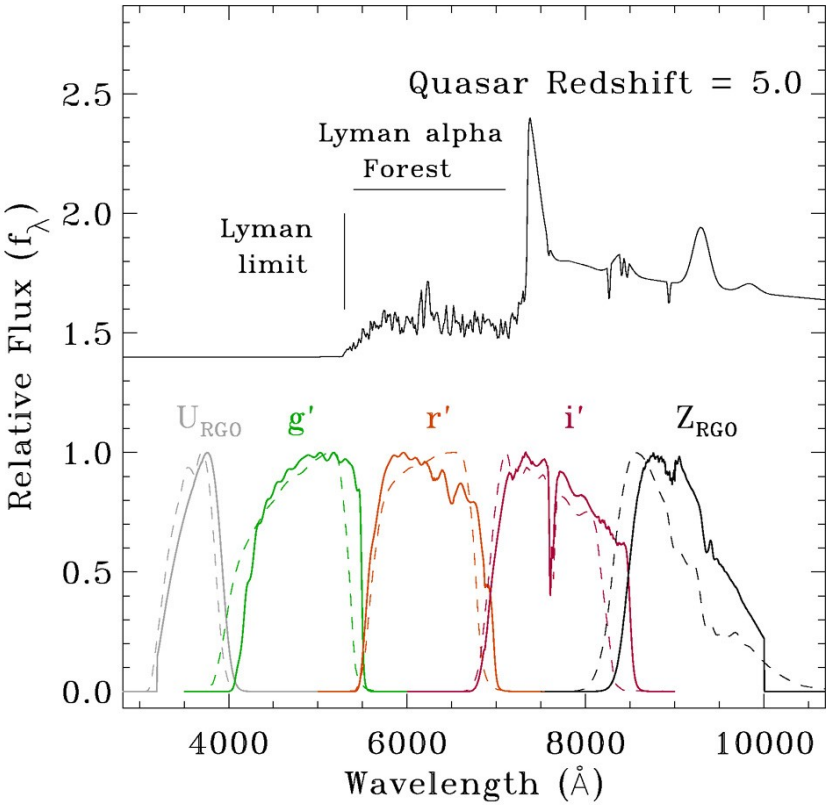


Different components of a galaxy invest specific part of the flux in different parts of EM spectra. We can find out what the galaxy «is made of» by looking at its spectrum.

~~Different telescopes work in different bands and~~ to find mass content of a galaxy we need to trace cool low mass stars that brings most of the stellar mass of the galaxy.

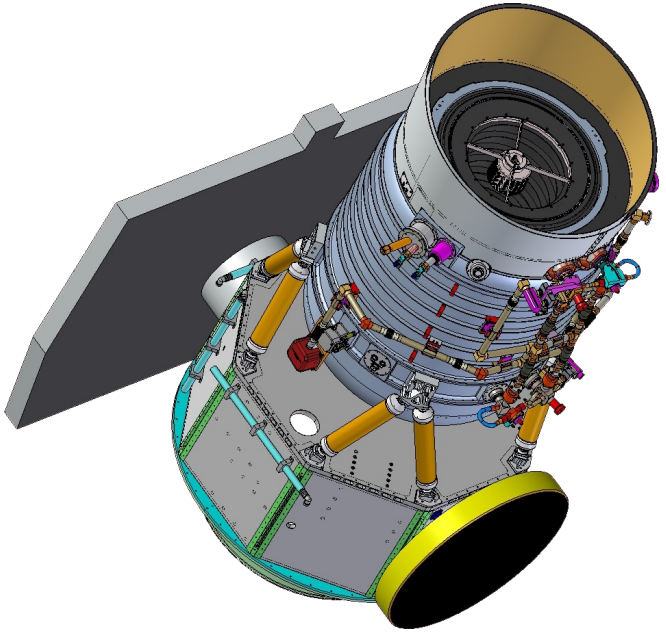
Telescopes for work: SDSS

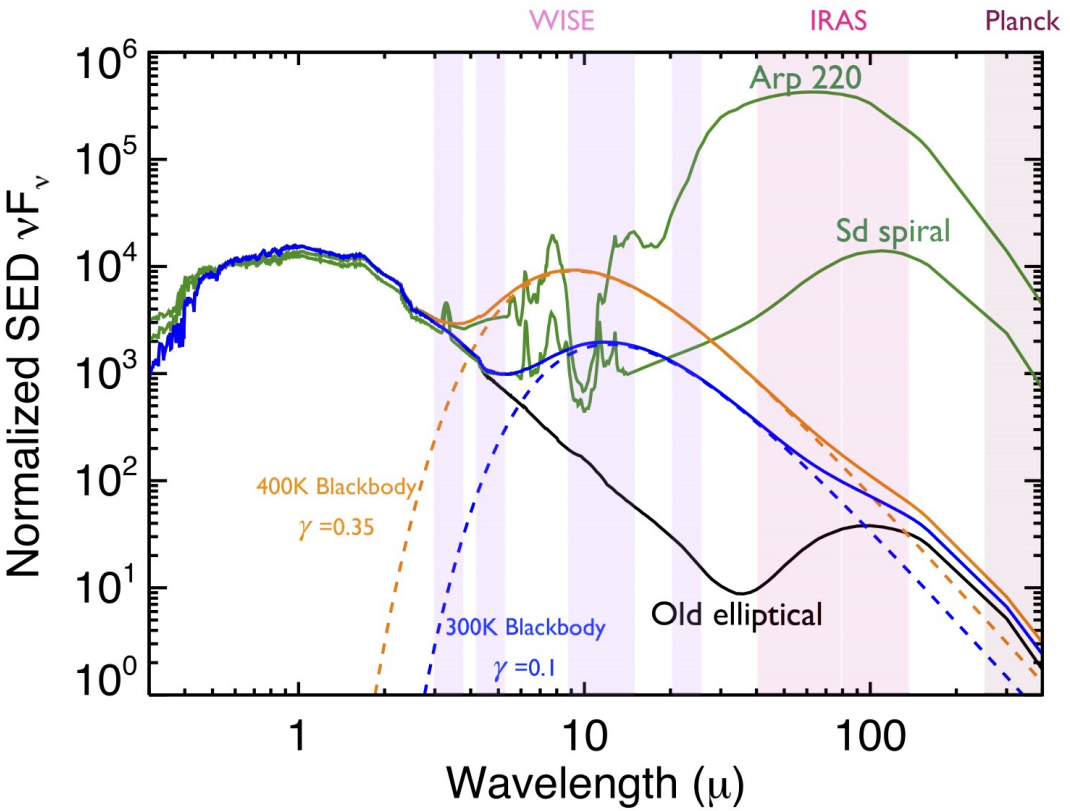




SDSS, it's main charcteristics (scans sky, fibers, 5 optical bands, relative small size). Mostly useful for «normal» galaxies up to z<0.4 but using different techniques (like dropouts) can detect high z galaxies (but needs confirmation from other telescopes).

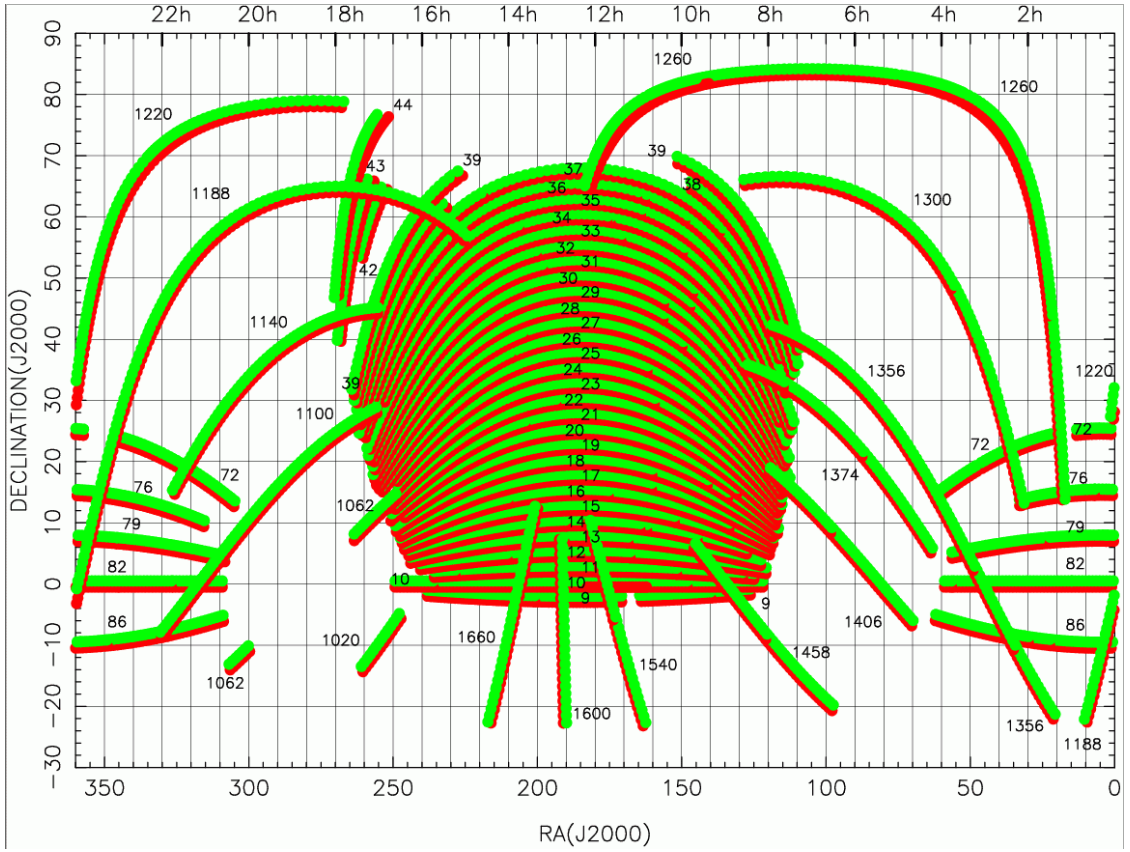
Telescopes for work: WISE

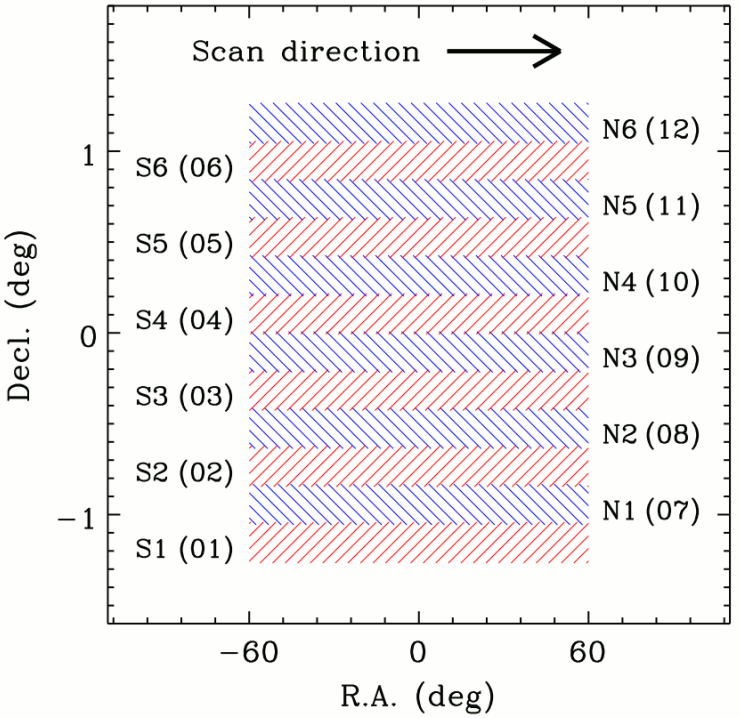




WISE, all-sky near-IR telescope with 4 bands with different sensitivity (third band is significantly larger and in turms of PSF and limiting flux is closer to w1 and w2). Telescope is used for detection and observations of intrinsically red objects — dusty galaxies, old galaxies, brown dwarfs, galaxies at high redshifts.

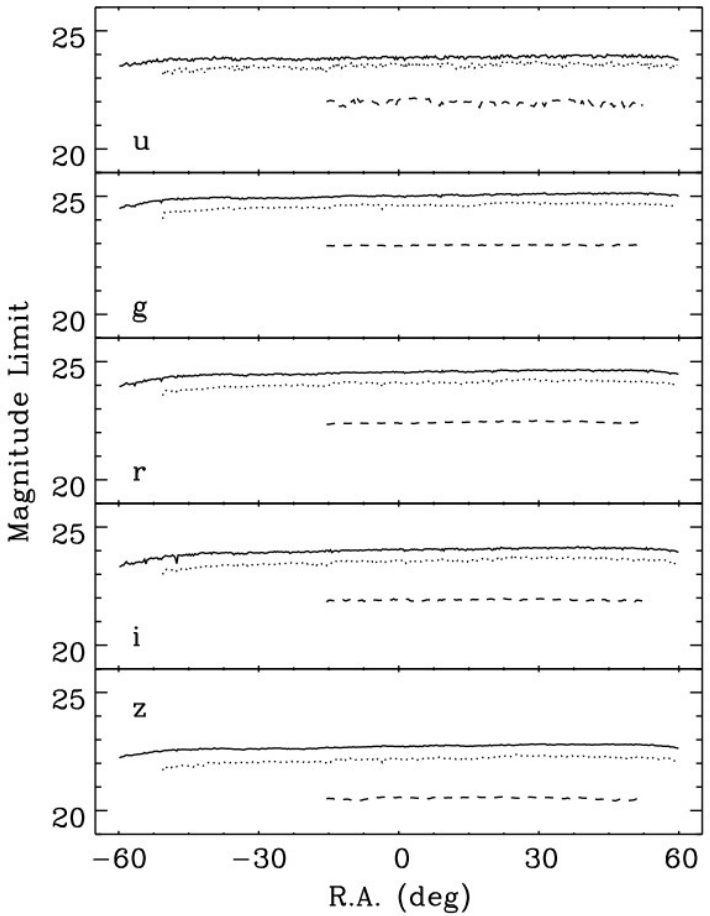
Our field - Stripe 82

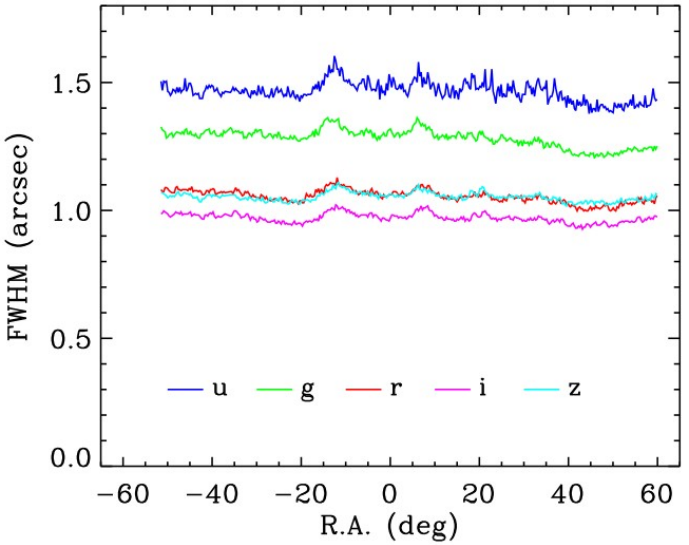


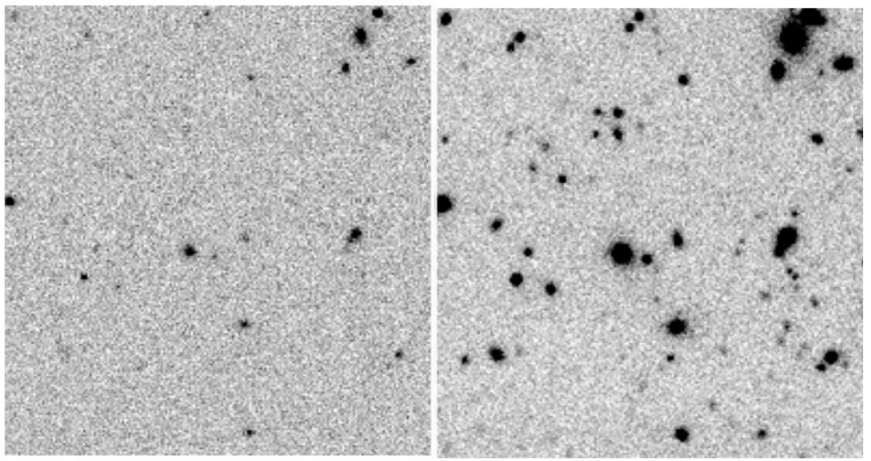


Stripe 82 (can be seen in the middle-right part) is a region of the sky close to selectial aquator that was repetedly scanned by SDSS for 70-90 times (comparing to single pass for ~~the~~ most of the rest of areas). 12 stripes with different psf, usually worse closer to the edges.

SDSS co-adds

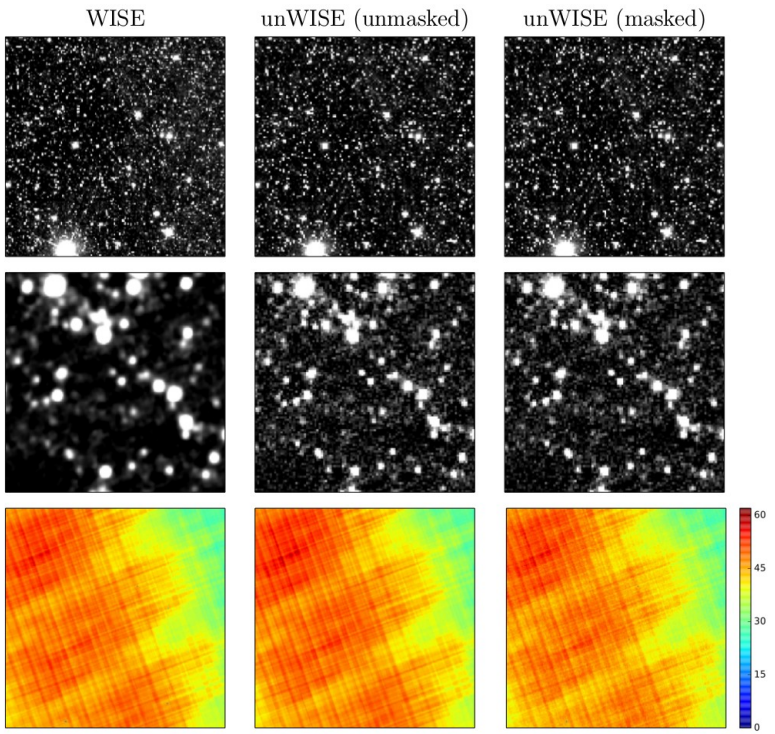


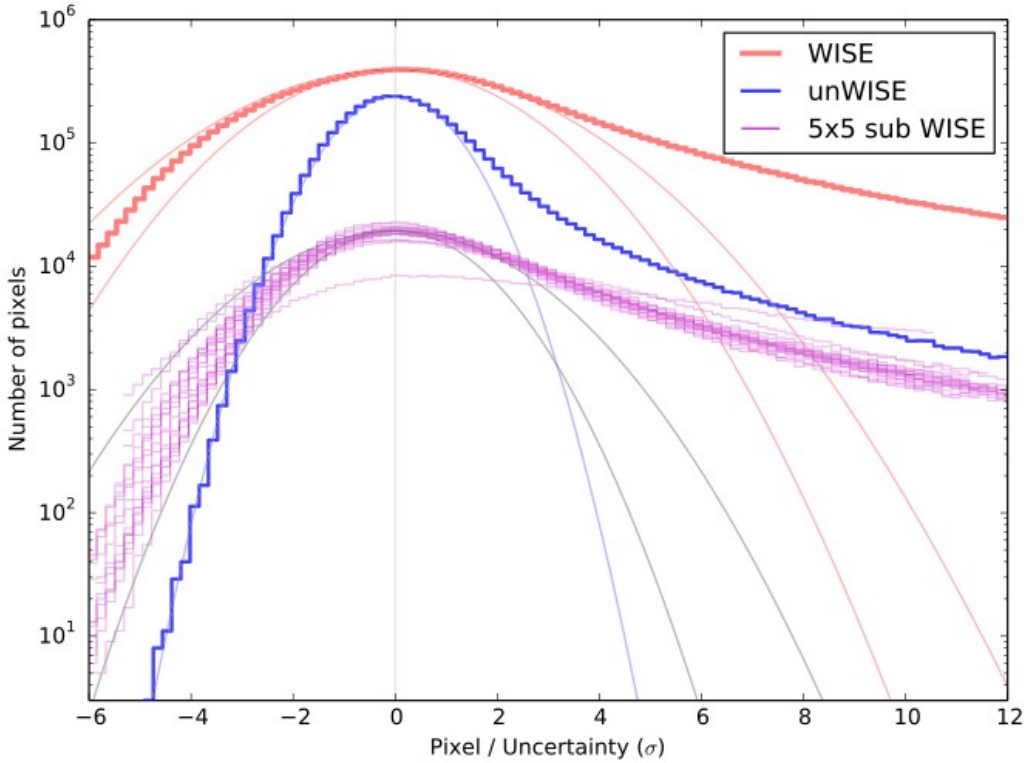




Jiang's co-added images increased limiting mag to 1-2 mag deeper than single pass images. He took only images with the best seeing so his FWHM is also very increased. Those images explain our choice of i-band as a high-resolution image for the next steps.

Not WISE - unWISE





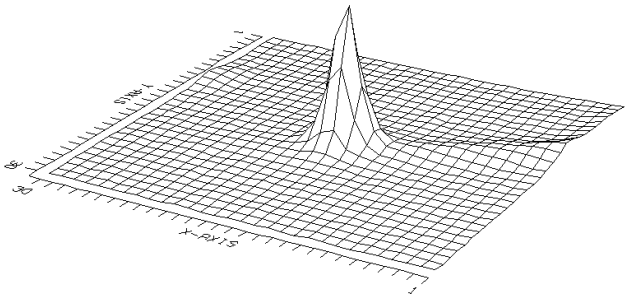
Lang's co-adds with restored WISE pixel scale (2.75 instead of 1.375). This has led to the decrease in the sky variance and unWISE ratio of pixel/per-pixel uncertainty is now close to the unit Gaussian (plus source tail from real sources)

Our work starts here

To do «template fitting» we need to change pixel scale of high-res images and change the reference pixel value so that SDSS and WISE images of so different sizes are totally alligned.

(I will put here SDSS image on top of the WISE image to compare sizes)

We performed our own photometry

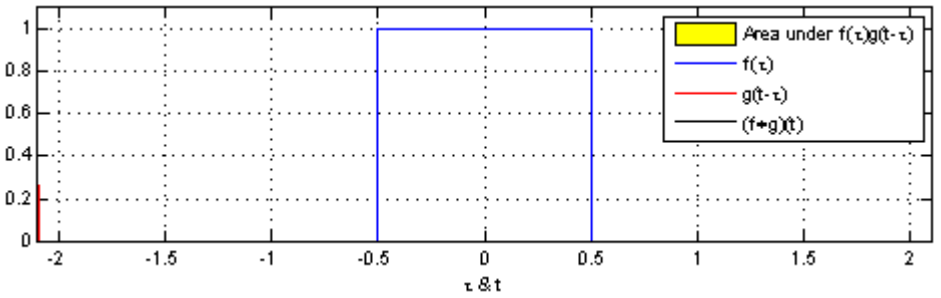


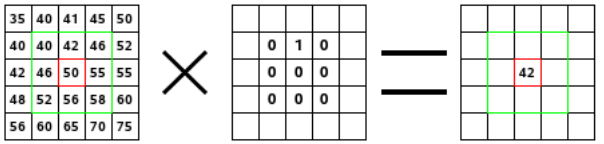
Jiang's catalogs on co-adds miss a certain number of sources that we would like to use in our work, so we constructed our own catalog with the folowing parameters:

in total we obtained more than 22 million sources.

I will show here one of SDSS image with region files for detected sources, PSF selection criteria and couple of bad, non point-like sources.

PSF kernel





In order to do «template fitting» we need to construct the kernel K such that PSF_lores = K * PSF_hires

On this slide I will show 2 different PSFs and a resulting kernel

Residual images

I am showing here residual images from Tphot — one as a full WISE image with small part being «cleaned» and second one — zoomed in cutout

Residual images (zoomed in)

Colors and magnitudes of our sample

Here I present i-w1 vs i-w2 and mag_auto vs magerr_auto of the catalog produced by tphot to show colors and limiting magnitude of our sample

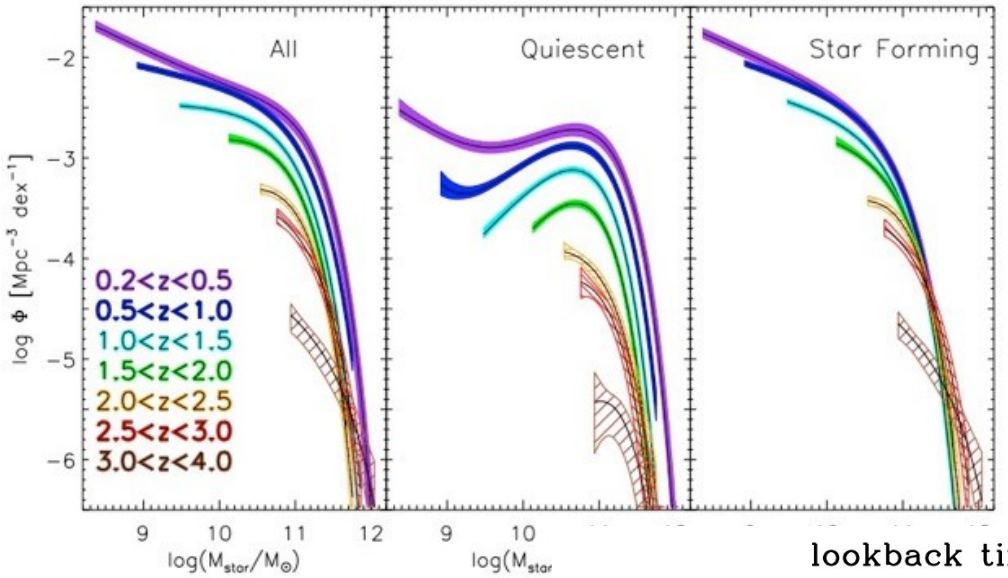
SED

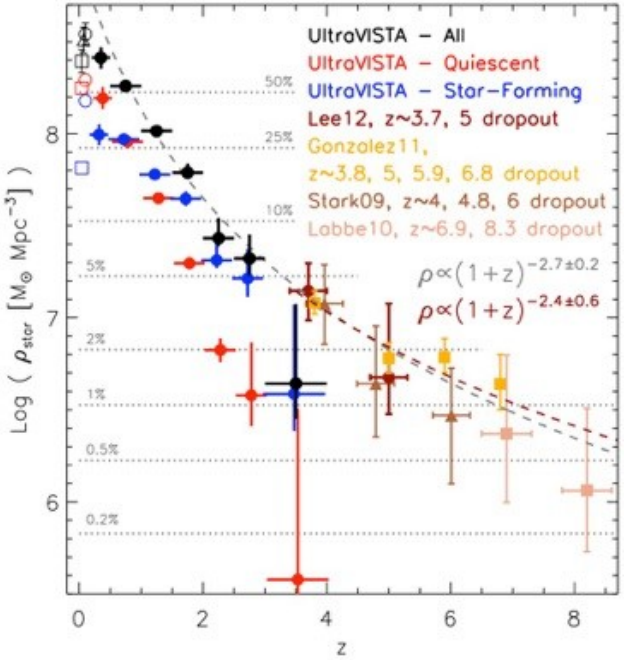
On this slide there there will be 1 constructed SED with Jiang's data for u,g,r,i,z and our data for i, w1,w2 and matched spectra, also parameters of this galaxy will be shown

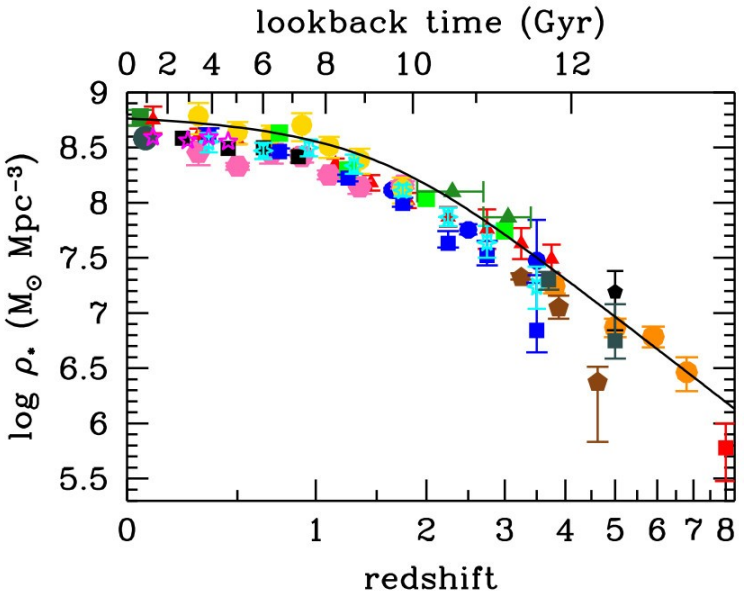
Mass and redshift histogram from HyperZ

If I have time to run Hyperz several times I will show mass histograam and redshift histogram for a small region of Stripe 82 an mention that those sources will be matched with origianl catalog to correct for magnitudes and gind potential spectroscopic redshifts.

Mass Function, GSMD







Mass functions from literature, Press-Shechter formalism. Upper-right image — from Muzzin for Ultravista, for high-z galaxies. Bottom image — From Madau & Dickinson, 2014.

Dropouts. images

Tphot residuals with bright sources in w1 and w2 and no detection in SDSS

Dropouts. SED

I will show matched spectra for the dropout sources for which I run hyperz and the plot of the oldest possible dropout galaxies that I showed you on the droup meeting.

Conclusions, Future work.