

SHARDS

and other multi-wavelength Cosmological Surveys in the Rainbow Database



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and the Rainbow Team



What do people need from a Cosmological Surveys database?

Raw/reduced data repository

- ➔ **“I need the best IRAC image (and catalog?) anybody has ever made (and tested) for the GOODS-N field. What should I do?”**
 - Look for a publication with a catalog.
 - Go to the *Spitzer* archive, download the data, and learn how to reduce them and how to make a catalog.
 - Look in an old webpage by GOODS.
 - Ask someone I know from the GOODS team and wait....
 - Use an updated (with many people’s effort) common (private/public) repository of deep-field data: Rainbow database.

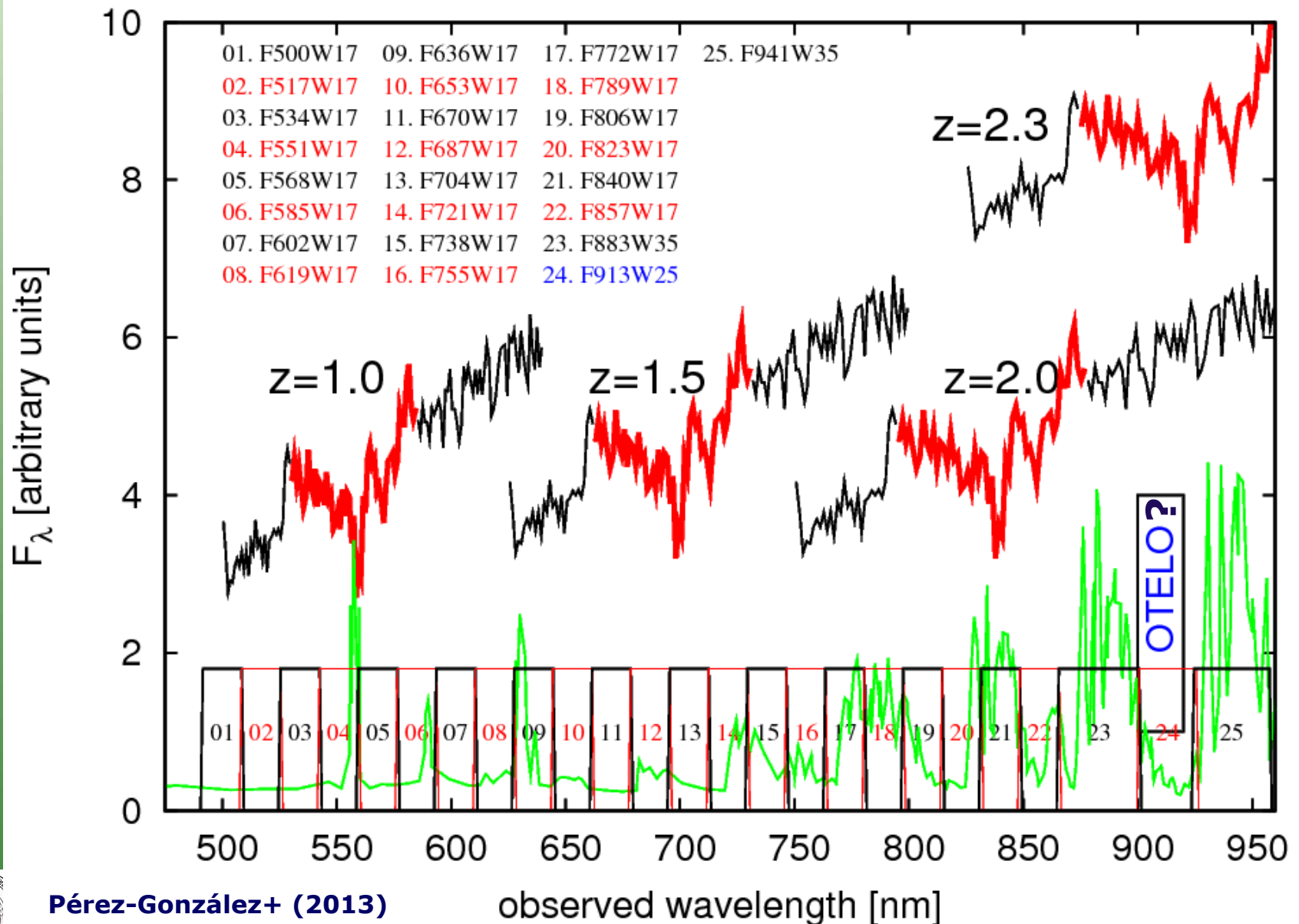
- ➔ **“Does SHARDS have a 400 nm image in GOODS-N?”**
 - Go to the *GTC* archive, search for the data, and learn how to reduce them, calibrate them and make a catalog.
 - Go to the outdated SHARDS webpage.
 - Use an updated (with many people’s effort) common (private/public) repository: the Rainbow database.

What do people need from a Cosmological Surveys database?

Advanced products estimation and repository

- ➔ **“I want to do a statistical analysis of star-forming galaxies at $z \sim 1$, no AGN. I need X-rays/UV/optical/IRAC/MIPS/Herschel for everything in UDS/COSMOS/EGS/.... What should I do?”**
 - Look for a publication with such catalog.
 - Build all the catalogs from scratch and merge them on my own.
 - Reinvent the wheel.
 - Lose hope.
 - Use an updated (with many people’s effort) common repository.
- ➔ **“I want to know the redshift of this guy here”.**
- ➔ **“I want to access the CANDELS data for this source. What fields did they have? Which are public already?”**
- ➔ **“I want a stellar mass estimate for this other galaxy”.**
- ➔ **“I want the best MIPS/Herschel based SFRs for my sample.”**
- ➔ **“I need an easy way to show/share with other people my data and my redshift/mass/... estimations”.**

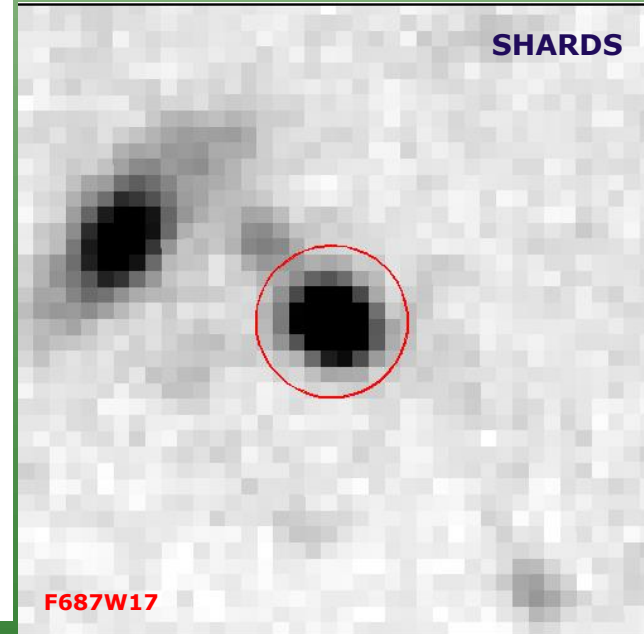
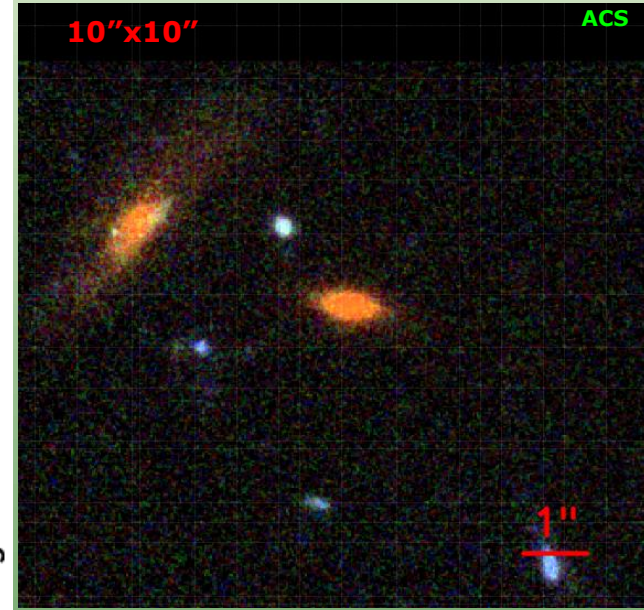
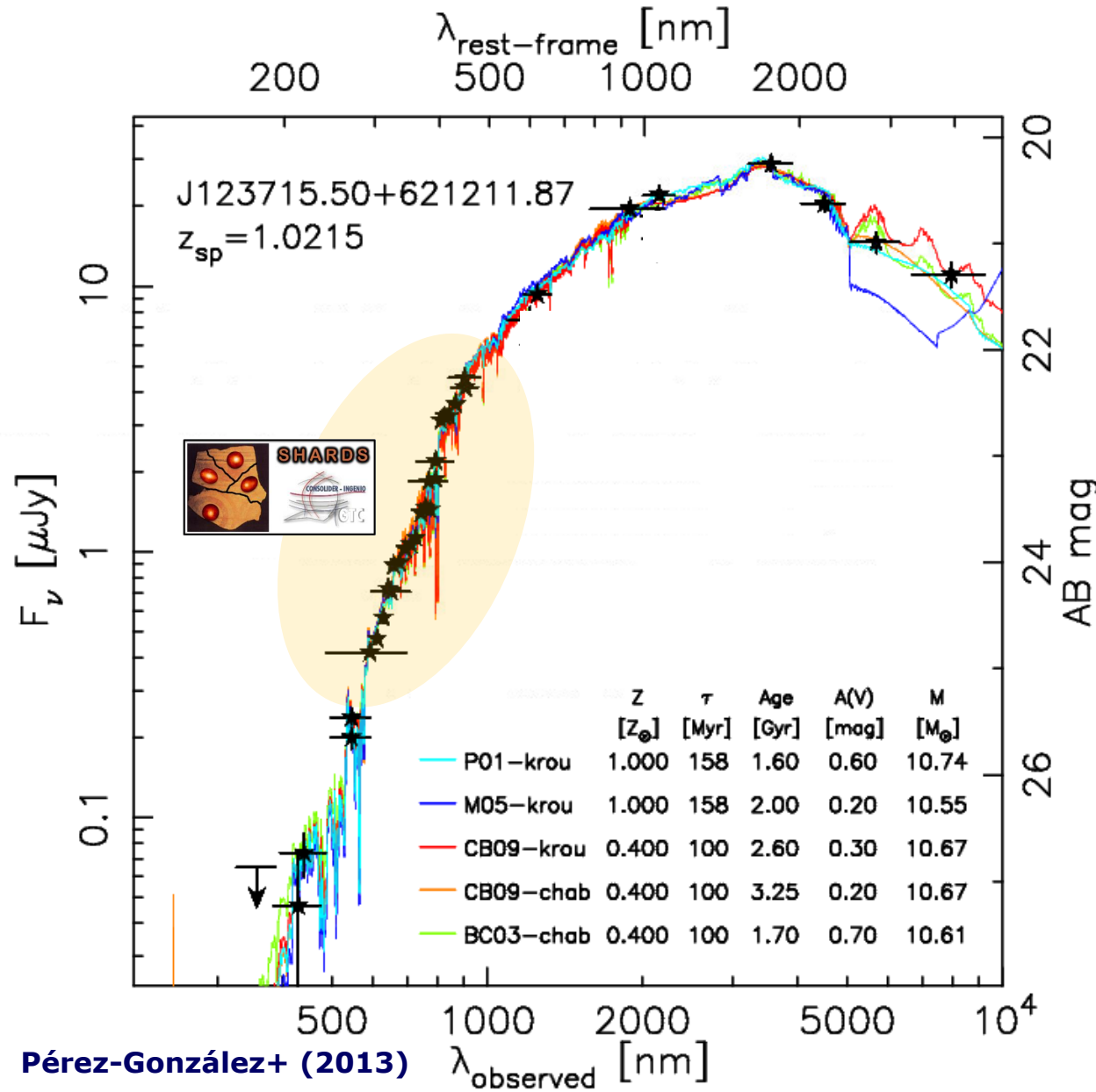
Cosmological surveys do have a lot of data now!!



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More promising to build on solid foundations



Our solution to this problem...

Rainbow

Database



<http://rainbowx.fis.ucm.es>



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What's that Rainbow database about?

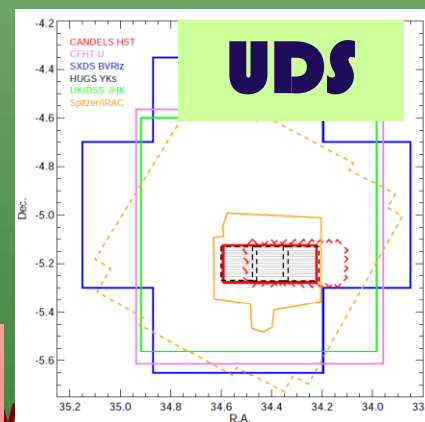
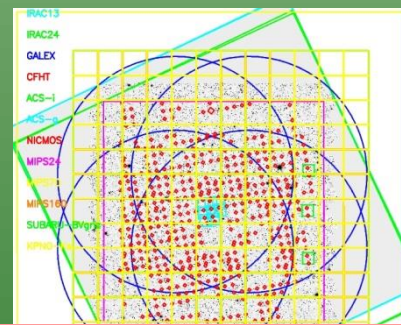
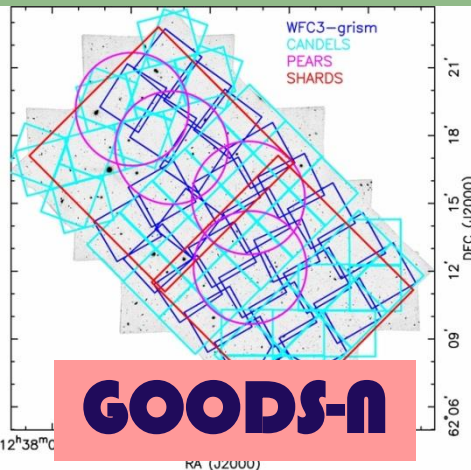
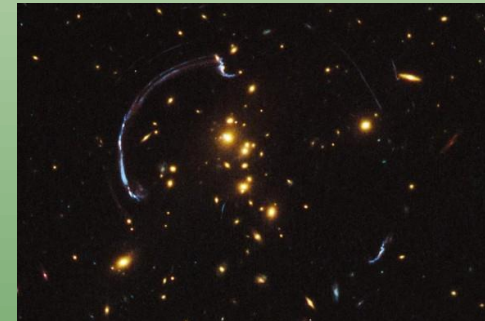
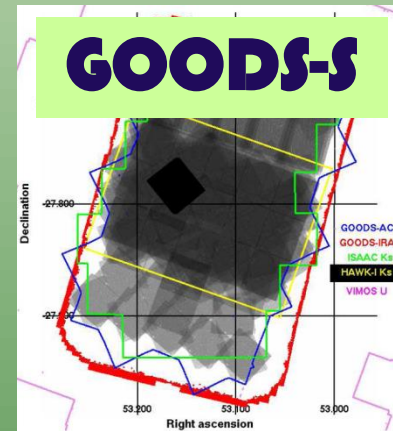
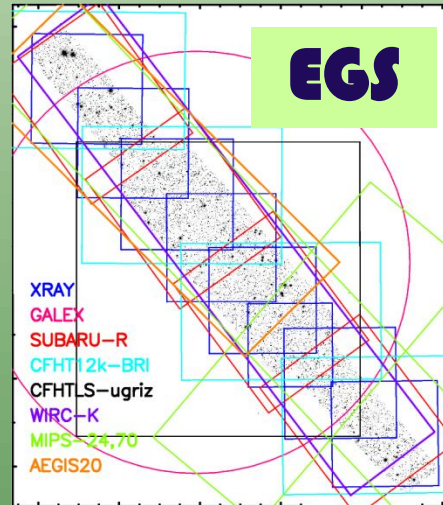
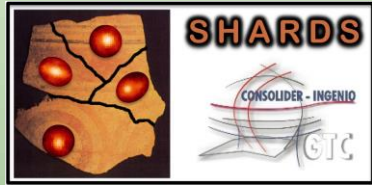
The Rainbow database is a MySQL-based database compiling data from our group at UCM/UofA/UCSC, collaborators, and the community:

- single-band ultra-deep (26-28 AB) photometry for hundreds of bands in main fields: GOODS-N/S, UDS, EGS, COSMOS, CANDELS, HLS, HFF.
- merged photometric catalogs from X-rays to radio wavelengths. Special algorithms (**expertise!**) have been developed and adopted to merge data from different surveys, instruments, resolutions, papers,...
- Elaborated data products: redshifts, stellar masses, SFRs, morphology, extinctions, ages,...
- **Not only catalogs, all images** (FITS files for imaging and spectroscopic data –if available–) **are also in the database.**

The Rainbow database, technically, is:

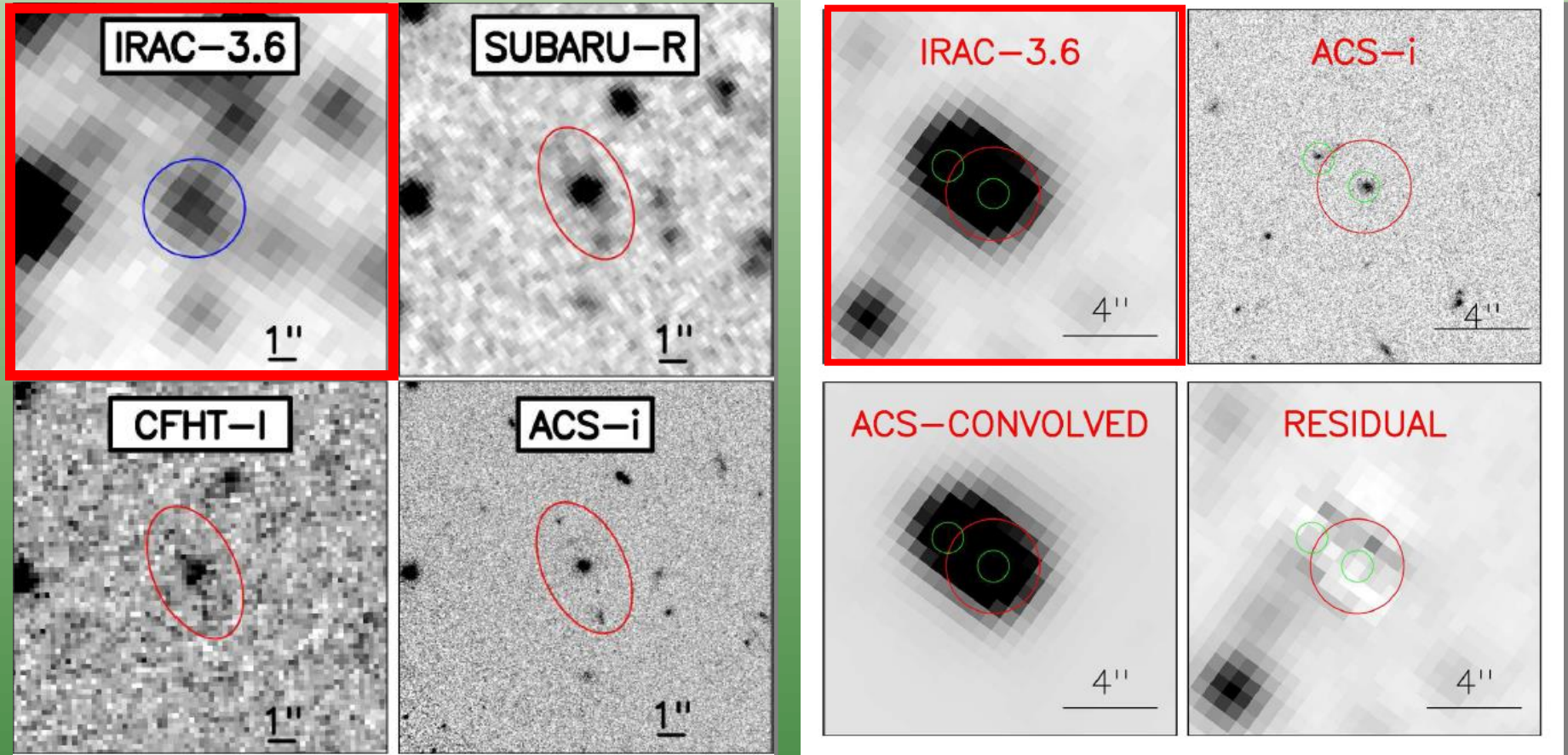
- MySQL database and Apache server in Scientific Linux 6.5 computers.
- Main server is in Madrid. Public and private mirrors in Madrid (4), Tucson (AZ) and Santa Cruz (CA).
- Servers have 20-30 Tb disk capacity each (60-90% used).
- The database includes a battery of c++/python/IDL programs organized in a (**offline**) **pipeline** to build (reduce, calibrate) merged catalogs (measuring/literature) and produce advanced products.
- The database includes a battery of c++/python/php/html/java **offline and online interfaces** to navigate through the MySQL database.
- The database includes private and public data and access.

What can I find in Rainbow?: fields...



What can I find in Rainbow?: flavors...

IRAC selected



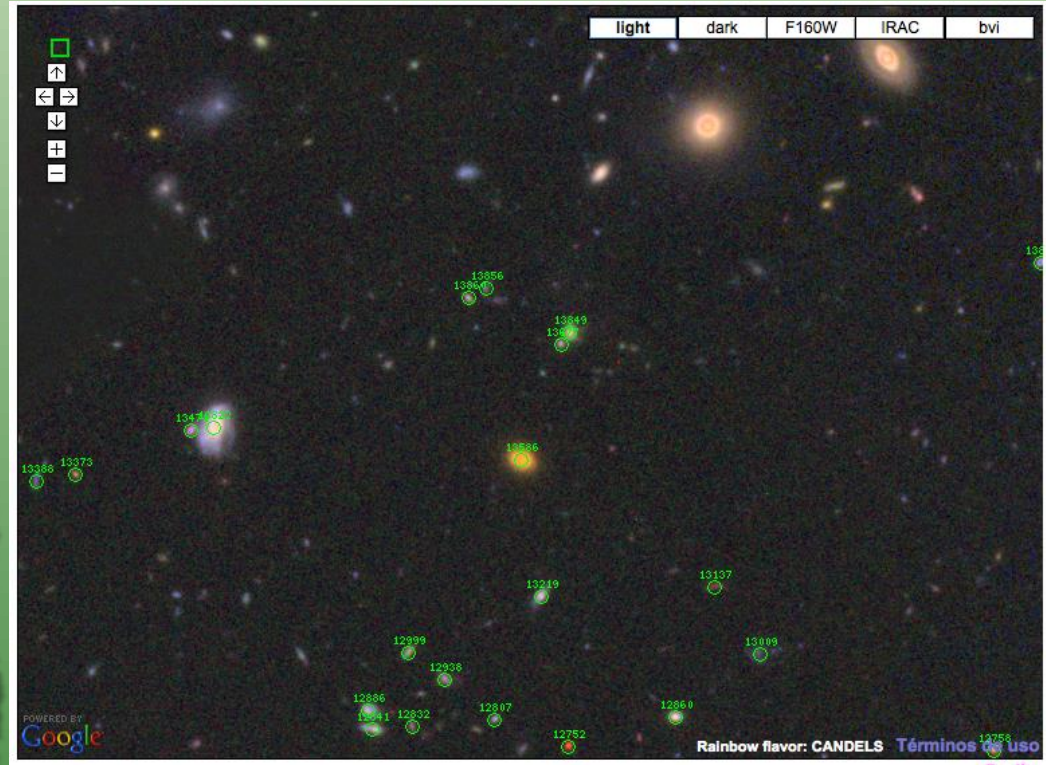
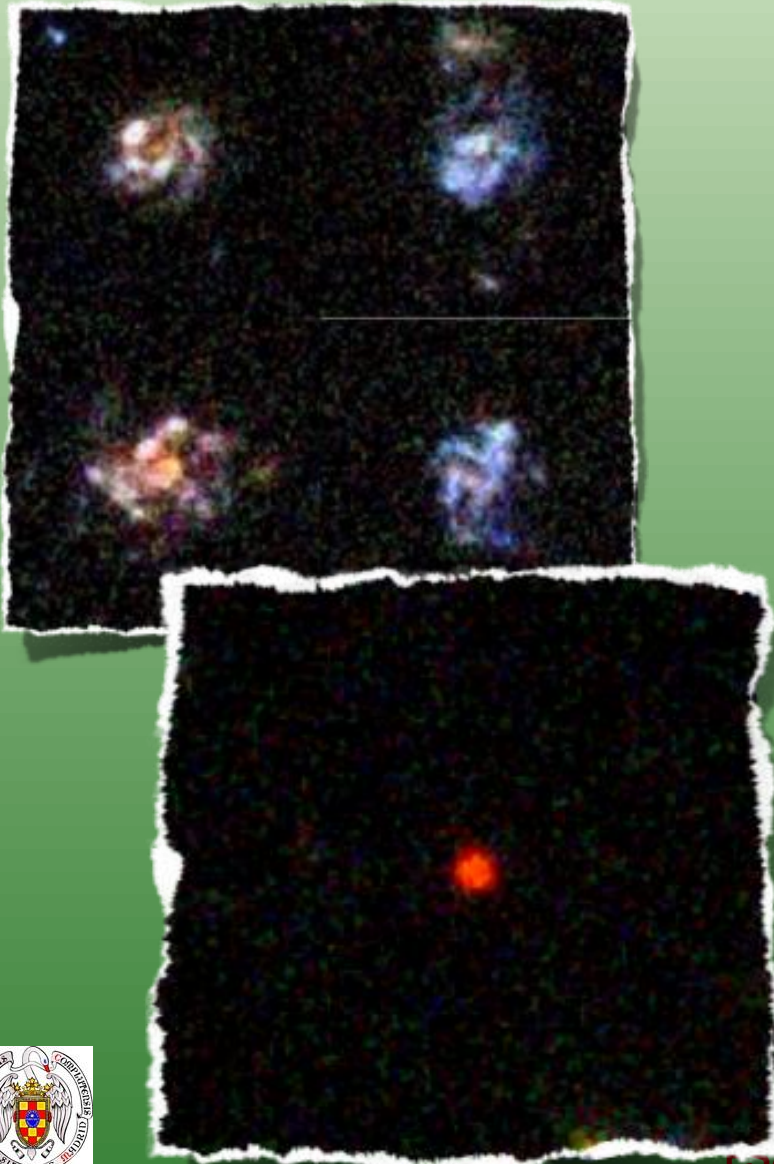
Barro+ (2011ab)

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What can I find in Rainbow?: flavors...

F160W selected



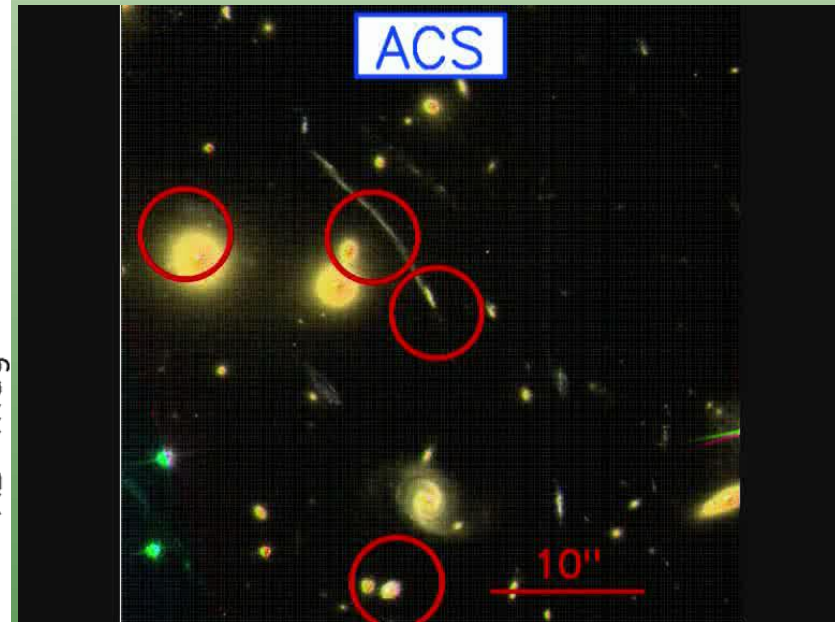
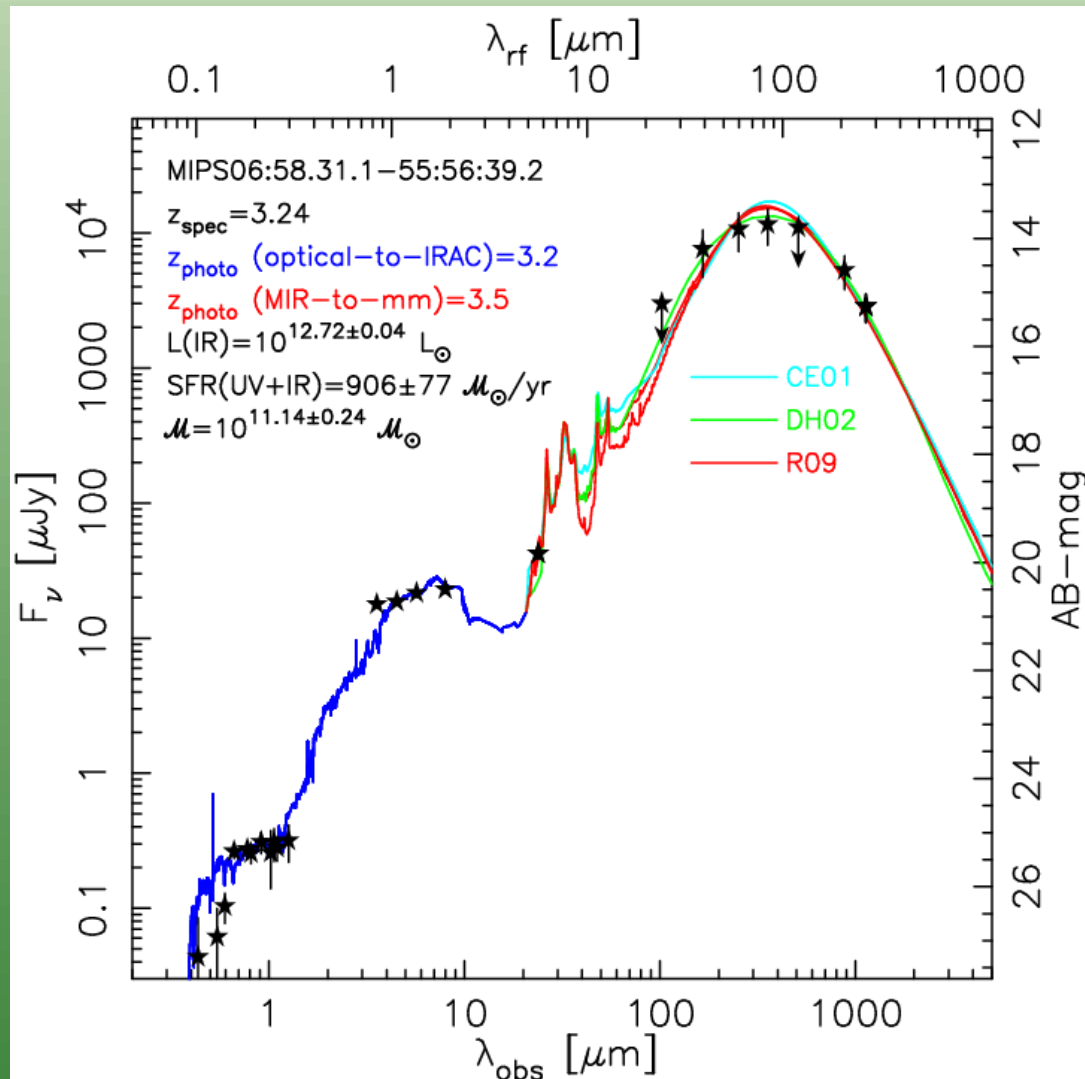
Barro+ (2013)

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What can I find in Rainbow?: flavors...

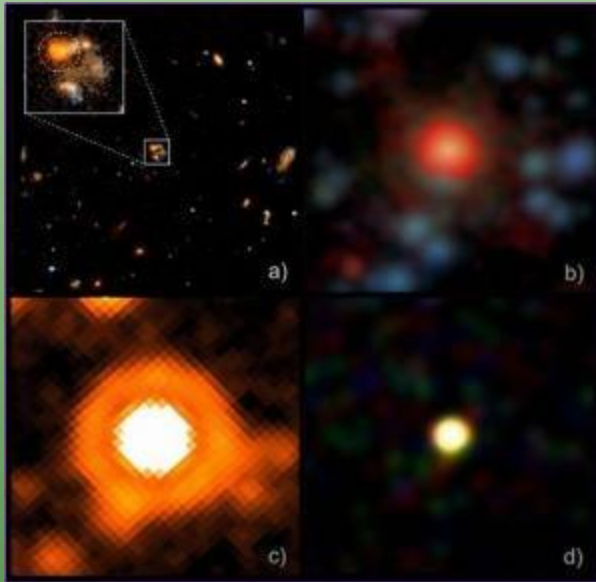
MIR/FIR selected



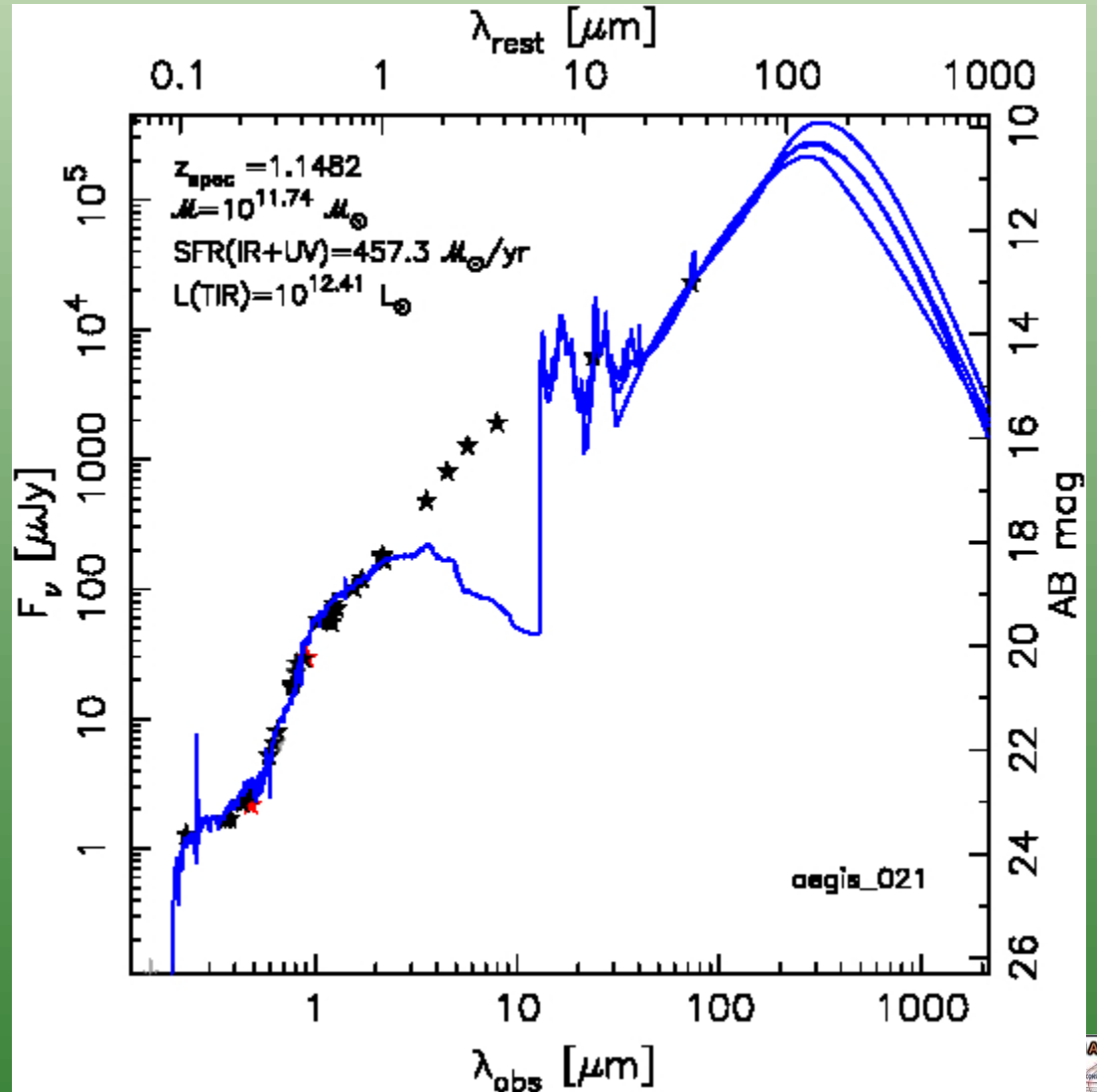
Egami+ (2010), Rawle+ (2010),
Rex+ (2010), P-G+ (2010)

What can I find in Rainbow?: flavors...

X-ray selected



NASA Press Release 2007



What can I find in Rainbow?: data...



IRAC/H

.....

Image N

Catalog N

SEDs:
rainbow, TFIT

Multi- λ IRAC catalog

photo-z's, masses:
our own and from literature

SFRs: UV and IR

Synth-colors

stellarity

Morphology

Other: X-ray, lines,...

UV-to-NIR SED fitting

MIR/FIR SED fitting

Fluxes from SED modelling

Star/galaxy separation

Multi- λ IRAC/H selected catalog with full physical characterization (several estimations using different methods/models/sources)



Rainbow Demo: raw data, quicklook

Firefox | Select your galaxy in any rainbow DB | + | https://rainbow.fis.ucm.es/Rainbow_slicer_public/ | Google

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Rainbow Slicer

Choose field and filters

Select field (database) Select Filters
No database selected

Dataset footprints for selected Rainbow field

Database: Not selected
Coordinates: ---

DATA ACCESS

N-BAND QUICKLOOK

RA (J2000.0)
DEC (J2000.0)
Stamp size

N-SOURCE QUICKLOOK

Filter
RA (J2000.0)
DEC (J2000.0)

Stamp size

RAINBOW SKY MAP



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Rainbow Demo: advanced data products

Firefox Select your galaxy in any rainbow.DB Select your galaxy in any rainbow.DB

https://rainbowx.fis.ucm.es/Rainbow_navigator_public/

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Rainbow Navigator

Choose field and selection band

Select field (database) ? Selection Band ?
No database selected

Dataset footprints for selected Rainbow catalog

BUILD YOUR SAMPLE ?

Sample selection interface

SEARCH (BY COORDS) ?

RA (J2000.0)
DEC (J2000.0)
Search radius 2.
Query database

SEARCH (BY NAME) ?

Galaxy ID
Query database

CLICKABLE MAP ?

Central RA 00:00:00.00
DEC +00:00:00.00
Map size 2
 Mark sources



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And next? What would we need from SVO?

- ➔ Online **utilities/interfaces** for evaluation or project feasibility purposes (all linked to Rainbow), for example:
 - On-the-fly queryable (linked to data sheets) plotting (upgrade from <http://filtergraph.vanderbilt.edu/rainbow?d=GOOD-S>).
 - Quick (and dirty?) online imaging and spectroscopy measurement utilities (photometry, emission-lines,...).
 - Basic online SED-template comparison.
 - On-the-fly pipeline to build whole datasheet for given sky position.
 - Upload user data (catalogs and images): **cloud projects**.
 - Online PSF fitting.
- ➔ Also for SVO?: desktop access utilities, direct MySQL access, **outreach utilities**, **citizen science**, crowdcrafting (Rainbow Zoo, Rainbow Segmentation, ...)

