

Comparing HII regions in M31 with the NGC 5128

A. Block, E. Peng



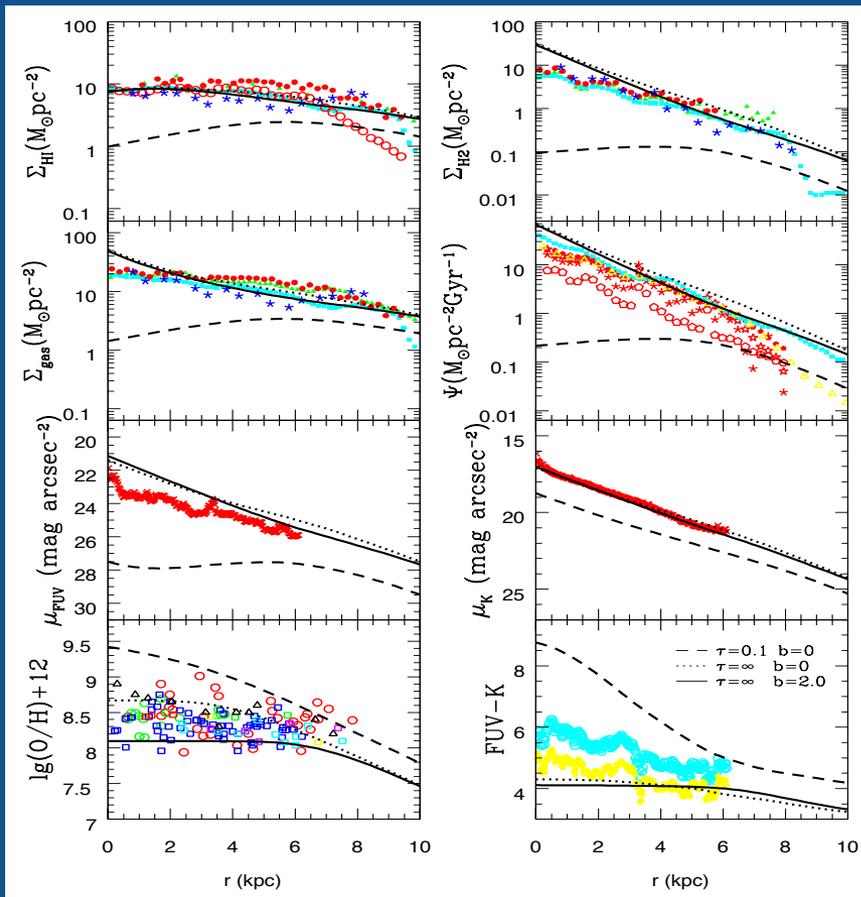
Pauline Barmby



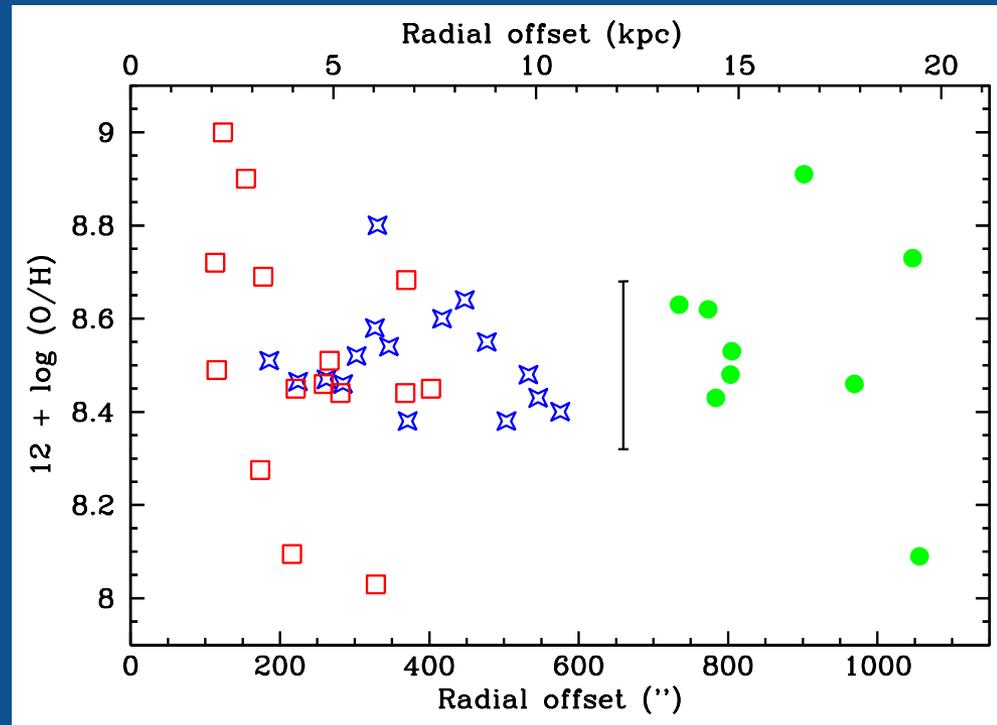
HII regions trace ionized gas,
recent star formation in galaxies



Metallicity gradients provide vital constraints on galactic chemical evolution models

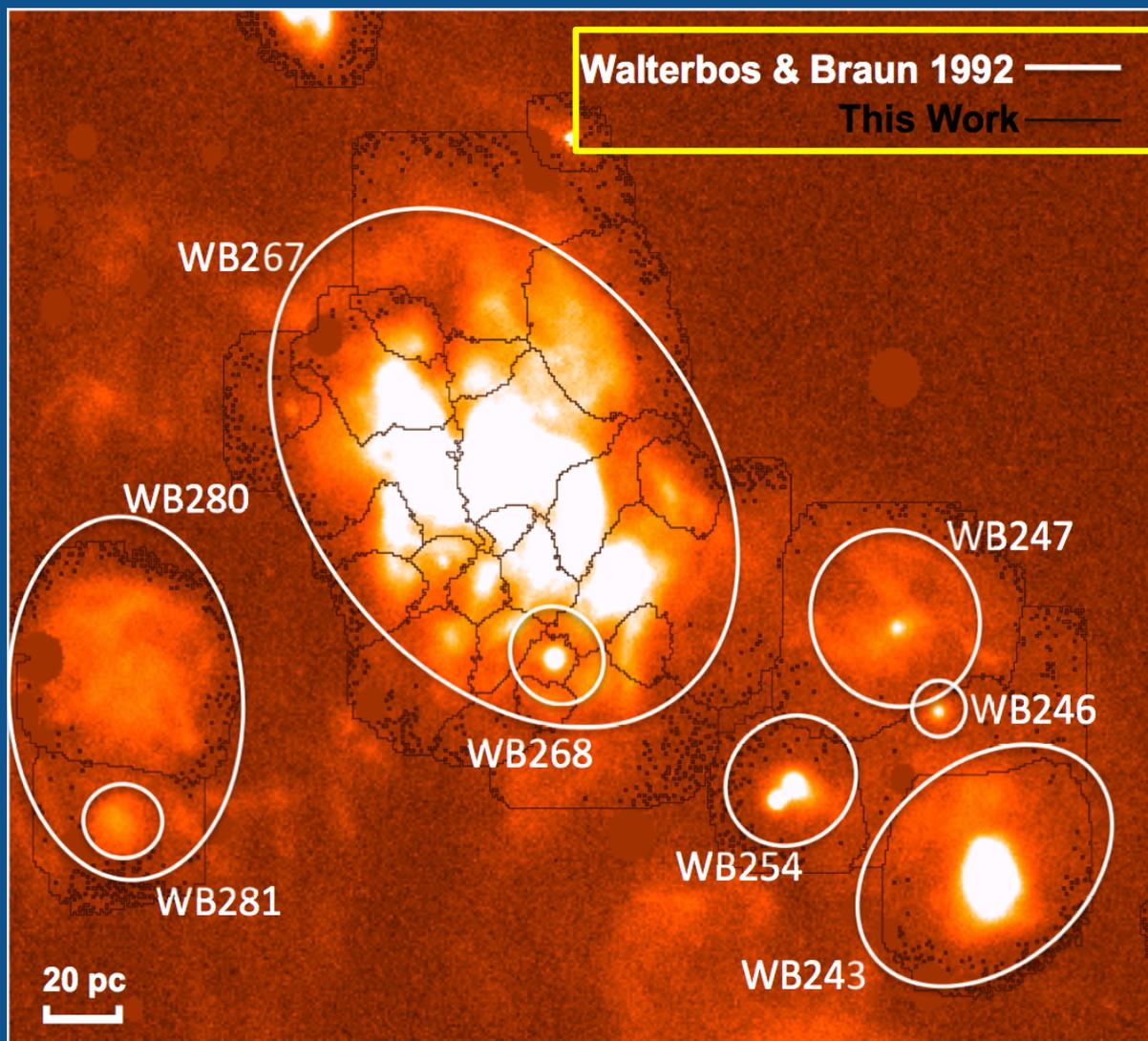


Kang et al 2012

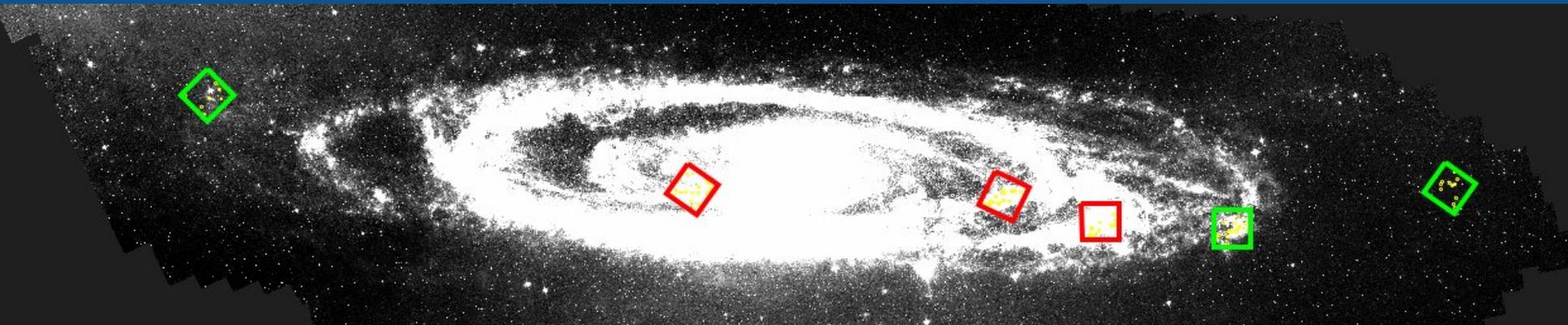
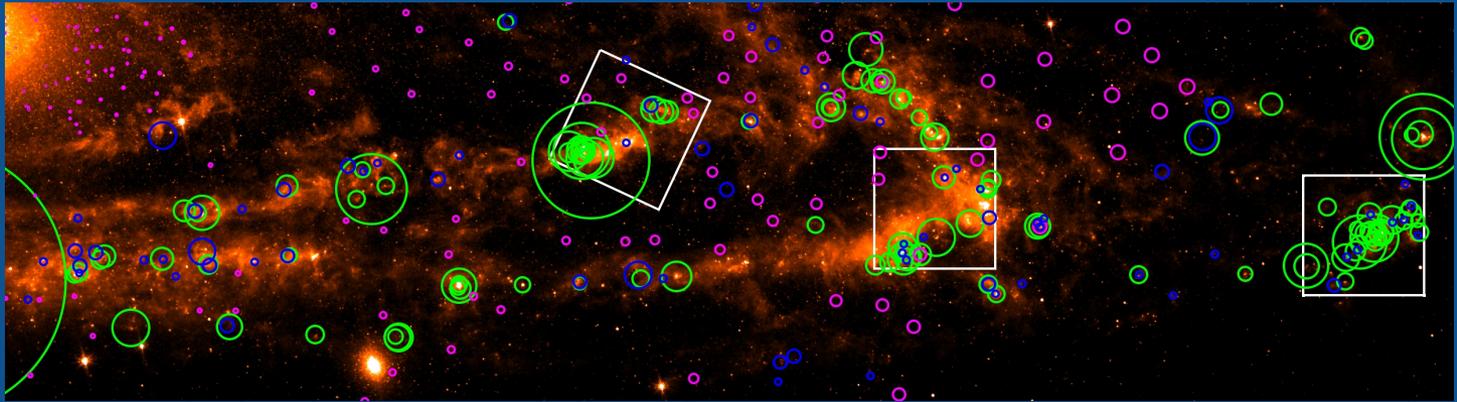


Walsh et al 2012

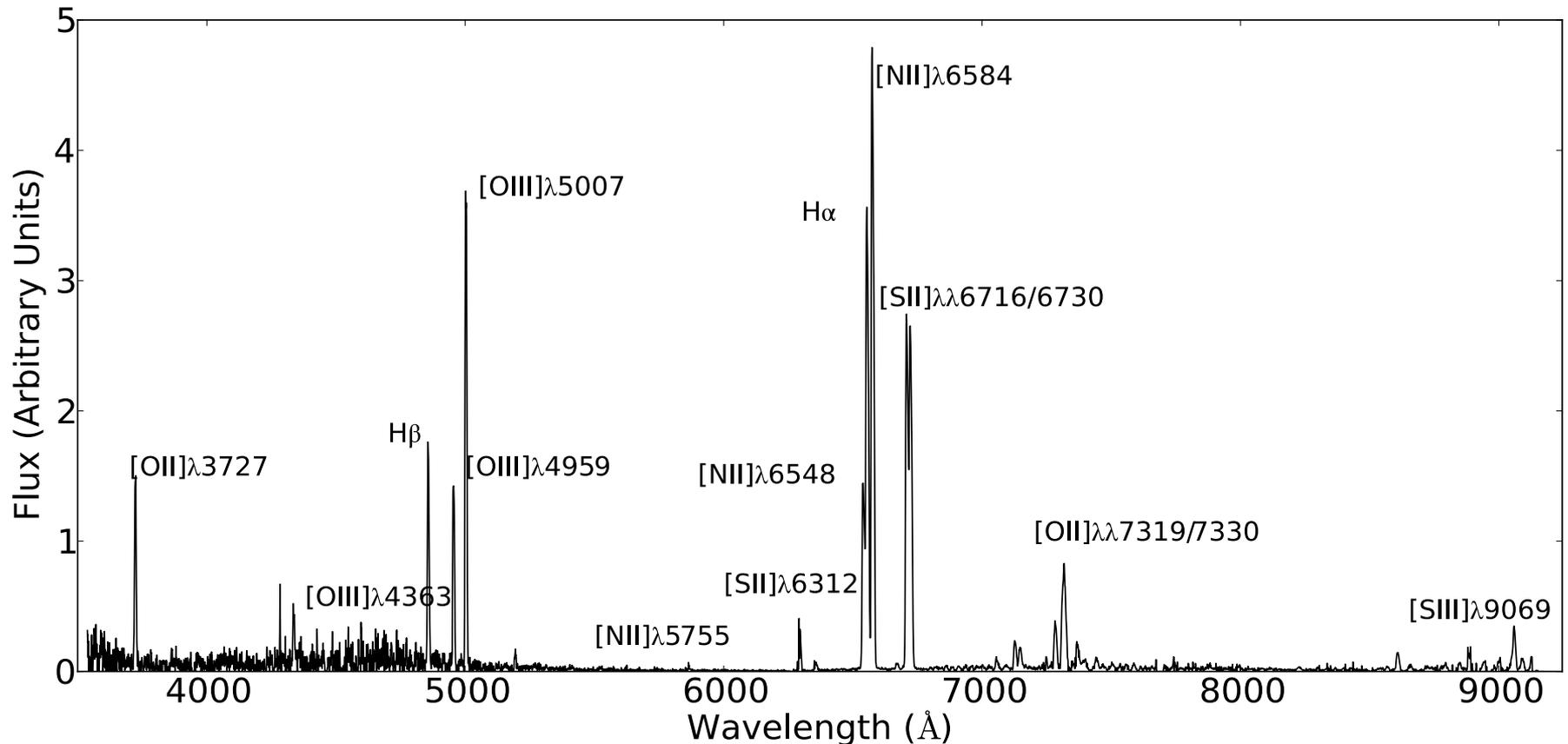
We mapped M31's HII regions for the first time with modern data



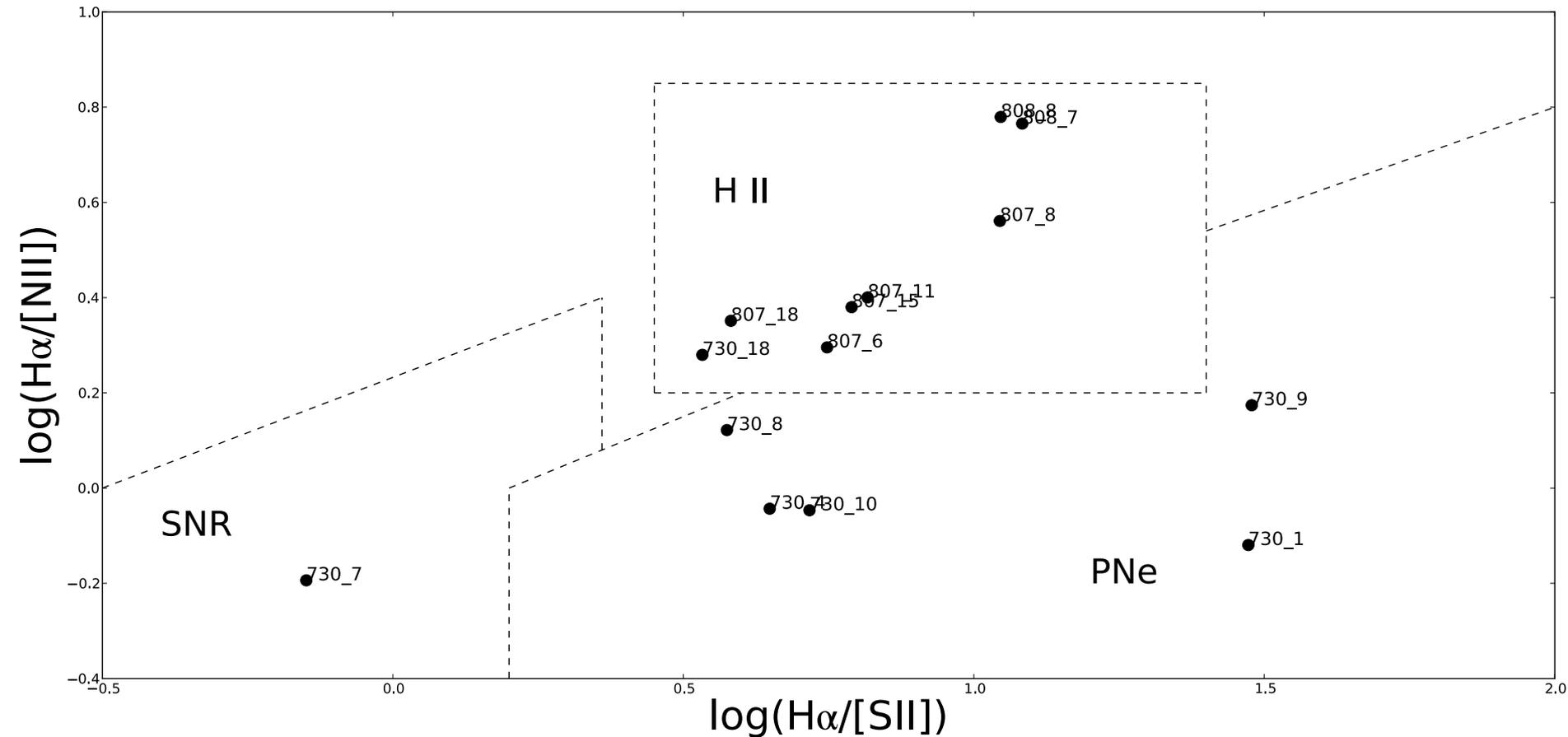
This yielded astrometry sufficient for
GMOS-N multi-slit observations



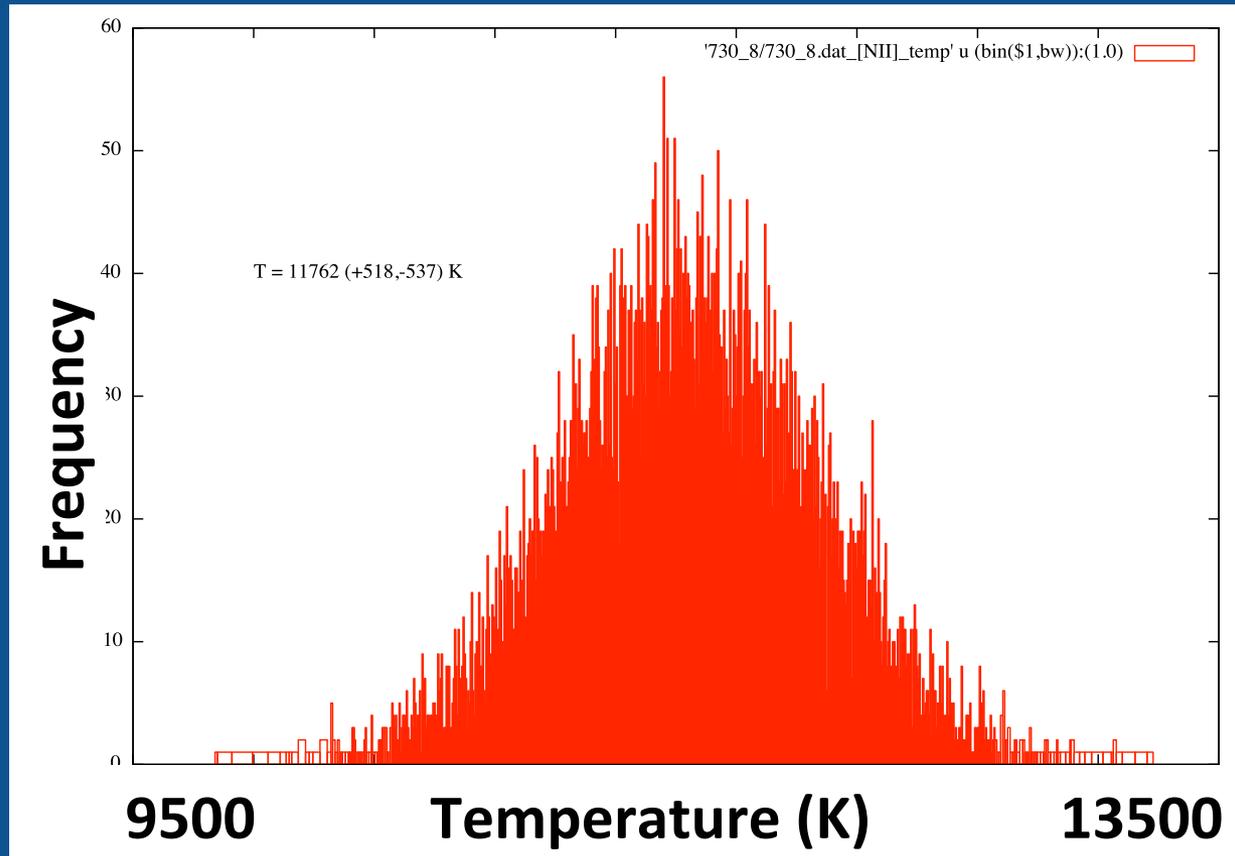
We detect auroral lines & can measure T_e directly



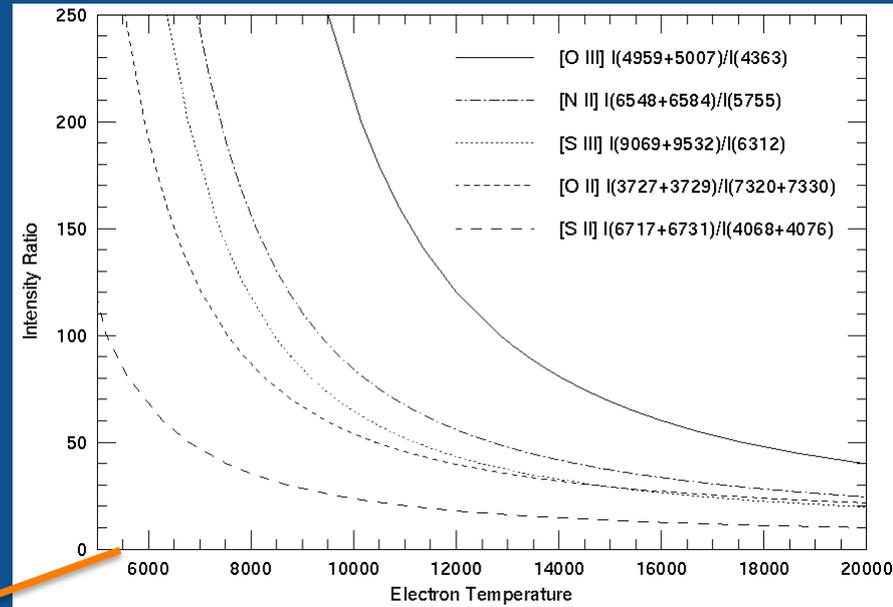
We can clearly distinguish between emission-line object classes



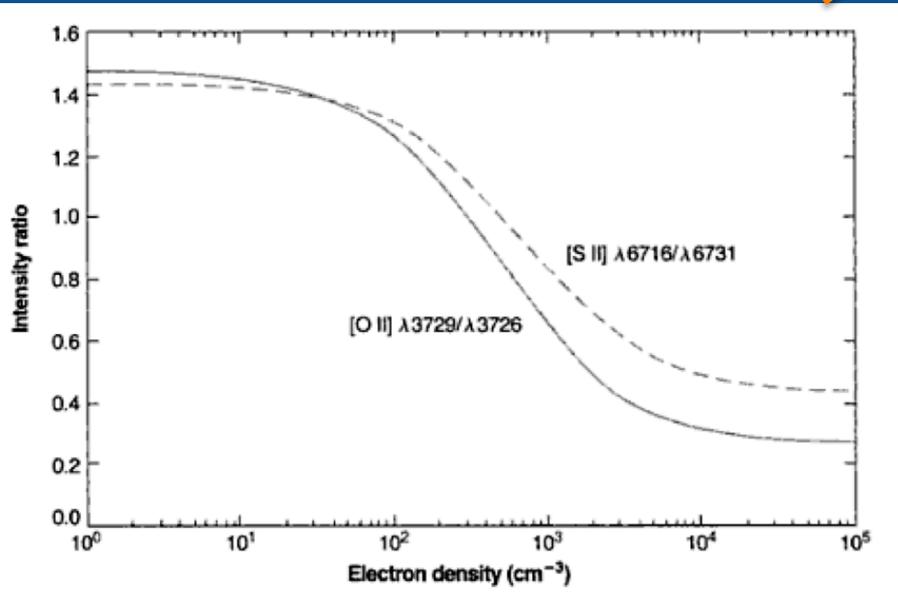
The Nebular Empirical Analysis Tool (NEAT) provides derived quantities *and their PDFs*



$$\frac{O}{H} = \frac{O^+}{H^+} + \frac{O^{++}}{H^+}$$

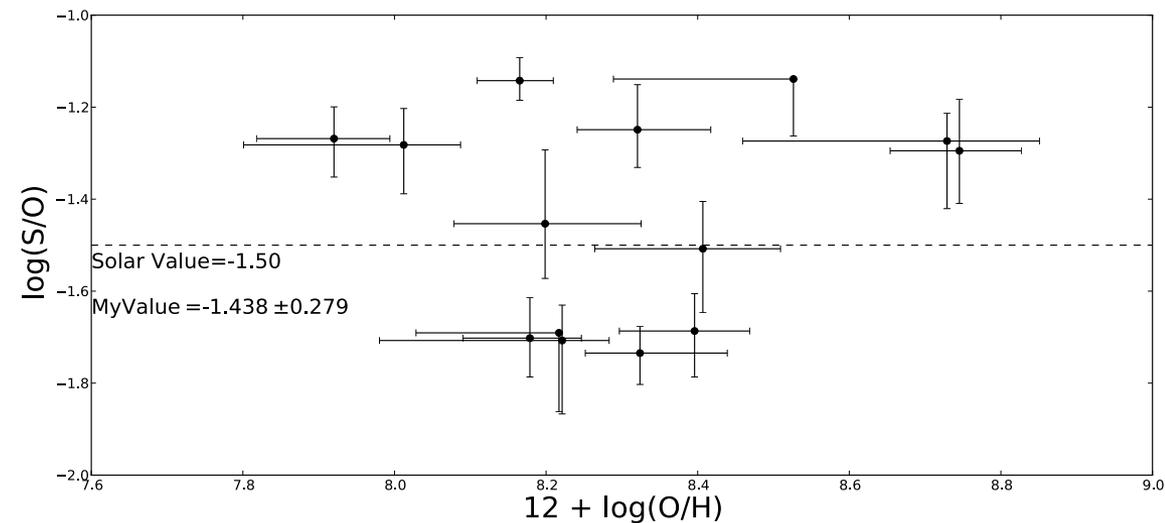
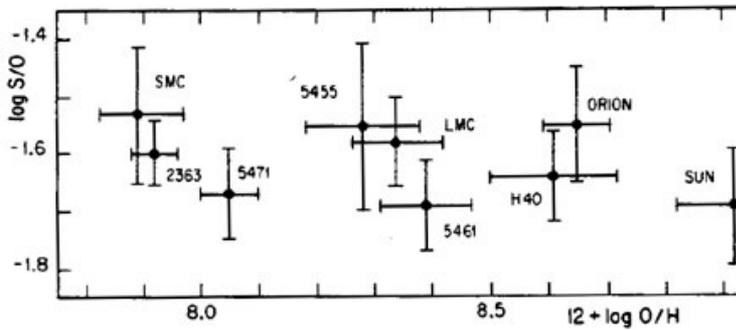
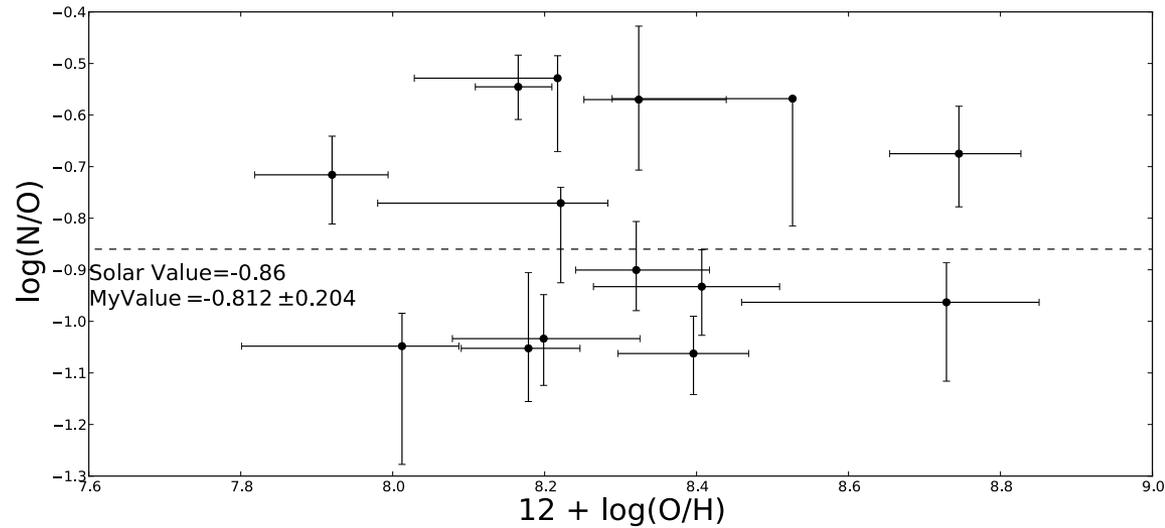
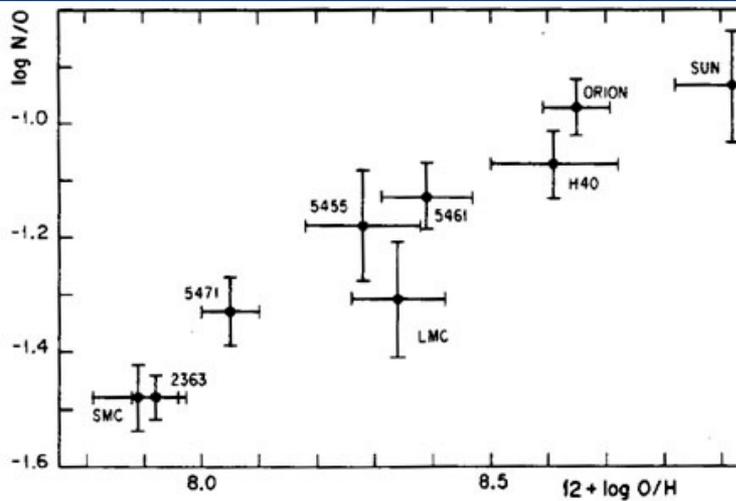


NEAT



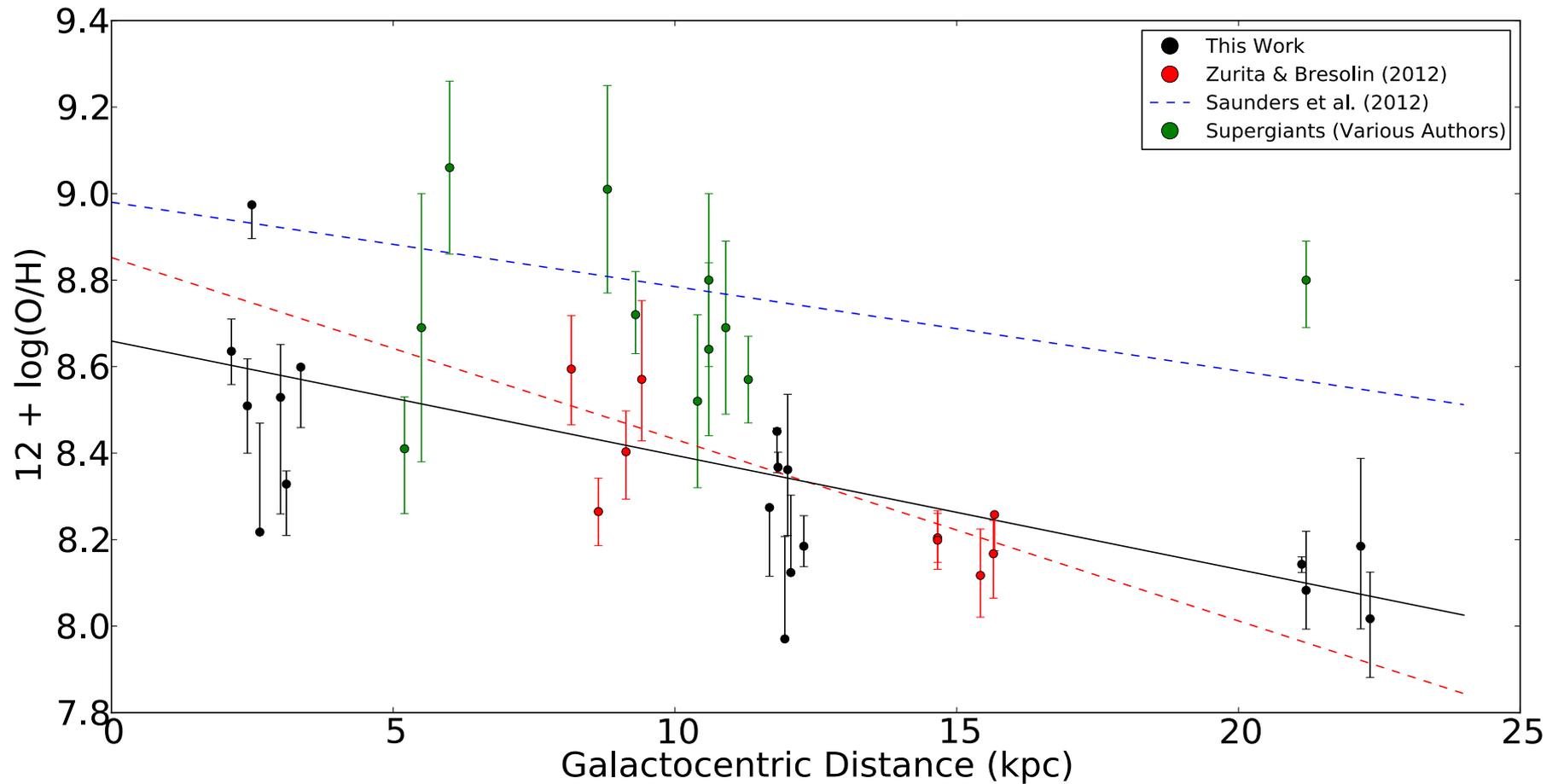
$$\frac{O^{++}}{H^+} = \frac{[OIII]\lambda 5007 / H_{\beta}}{j_{[OIII]}(T_e, n) / j_{H\beta}(T_e)}$$

Puzzlingly, [N/O] doesn't correlate with [O/H]

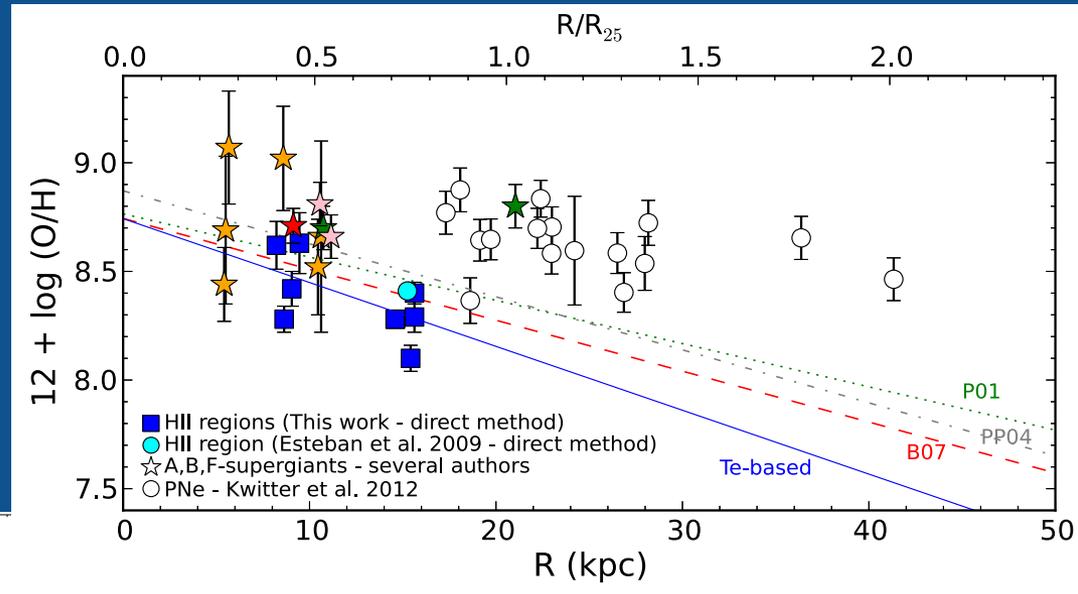
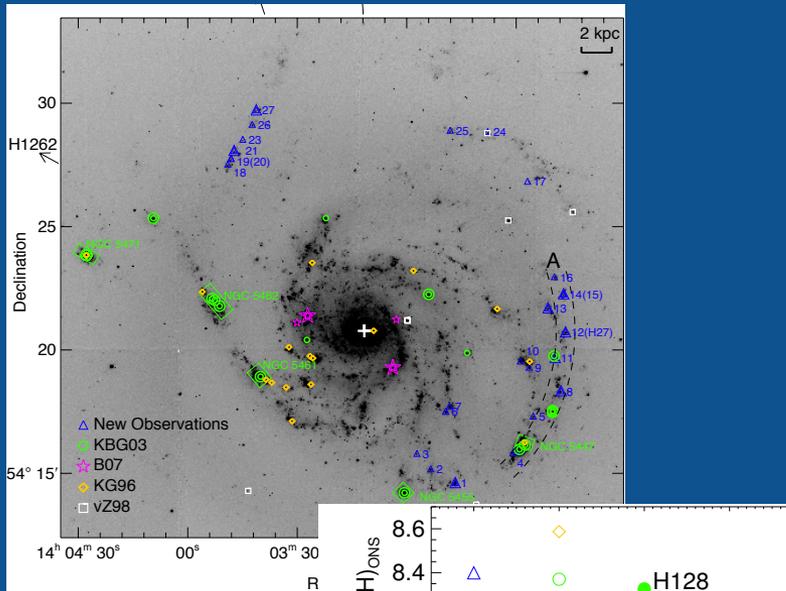


Torres-Peimbert et al. 89

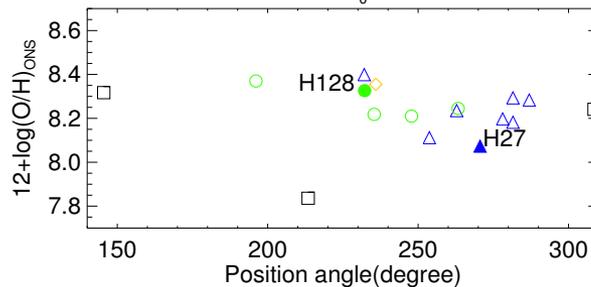
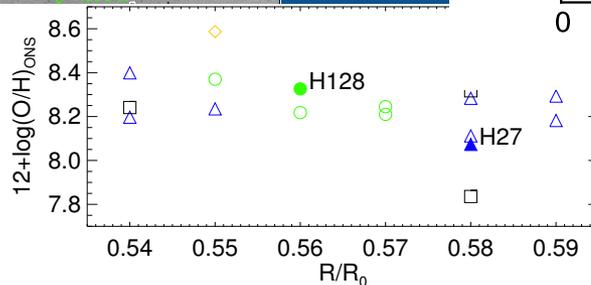
Our abundances trace a wide radial range, consistent with recent work



Remaining questions: intrinsic scatter, azimuthal variations, offsets

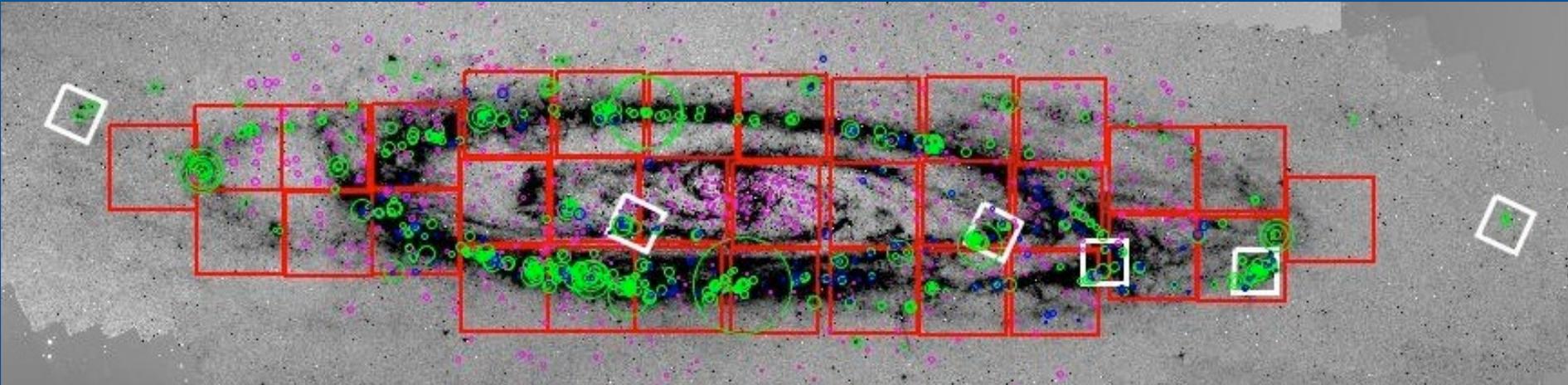


Li et al. 13



Zurita & Bresolin 12

SITELLE: all M31, all the time



SITELLE (11')

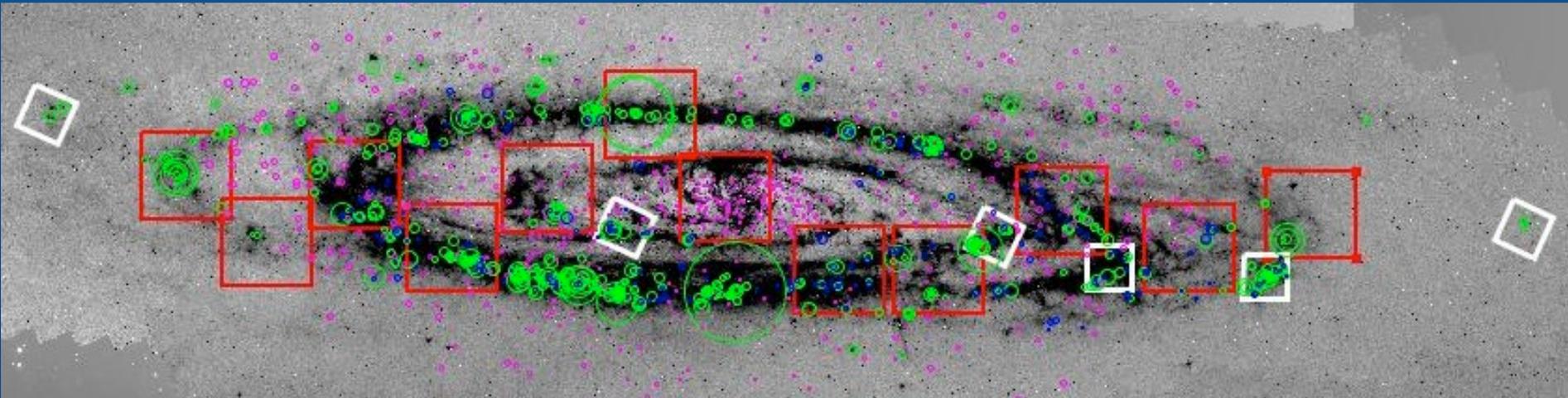
HII regions

GMOS (5')

PNe

SNR

..or perhaps...



Wavelength range: 370-950 nm would be nice

Spectral resolution: $R \sim 2000$

Flux (faint lines in bright regions): 10^{-16} erg/cm²/s

With fantastic SITELLE data comes the need for better tools

INTERNATIONAL VIRTUAL OBSERVATORY ALLIANCE



Welcome to the **astropy** documentation! **astropy** is a community-driven package intended to core functionality and some common tools needed for performing astronomy and astrophysics with

User Documentation

Astropy at a glance

- Overview
- Installation
- Getting Started with Astropy
- What's New in Astropy 0.3

Core data structures and transformations

- Constants ([astropy.constants](#))
- Units ([astropy.units](#))
- N-dimensional datasets ([astropy.nddata](#))
- Data Tables ([astropy.table](#))
- Time and Dates ([astropy.time](#))
- Astronomical Coordinate Systems ([astropy.coordinates](#))
- World Coordinate System ([astropy.wcs](#))
- Models And Fitting ([astropy.modeling](#))

Connecting up: Files and I/O

- Unified file read/write interface
- FITS File handling ([astropy.io.fits](#))
- ASCII Tables ([astropy.io.ascii](#))
- VOTable XML handling ([astropy.io.votable](#))
- Miscellaneous Input/Output ([astropy.io.misc](#))

Astronomy computations and utilities

- Cosmological Calculations ([astropy.cosmology](#))
- Astrostatistics Tools ([astropy.stats](#))
- Virtual Observatory Access ([astropy.vo](#))

Nuts and bolts of Astropy

- Configuration system ([astropy.config](#))
- I/O Registry ([astropy.io.registry](#))

VO Applications for Astronomers

In this section, scientists can find available VO-compatible applications for their immediate use to do science. The level of maturity of the applications depends on a high degree on the level of maturity of the corresponding IVOA protocols and standards.. As a consequence of the flexibility of the standards, several of the applications might overlap in functionality. **The IVOA does not manage or guarantee these services/tools.**



Applications (In alphabetical order)

- Aladin
- AppLauncher
- Cross Comparison Tool
- CDS Xmatch Service
- Data Discovery Tool
- Filter Profile Service
- Iris
- Montage
- Octet
- SkyView
- Specvi
- SPLAT
- TAOL

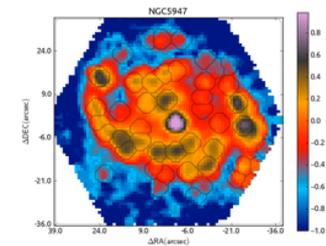
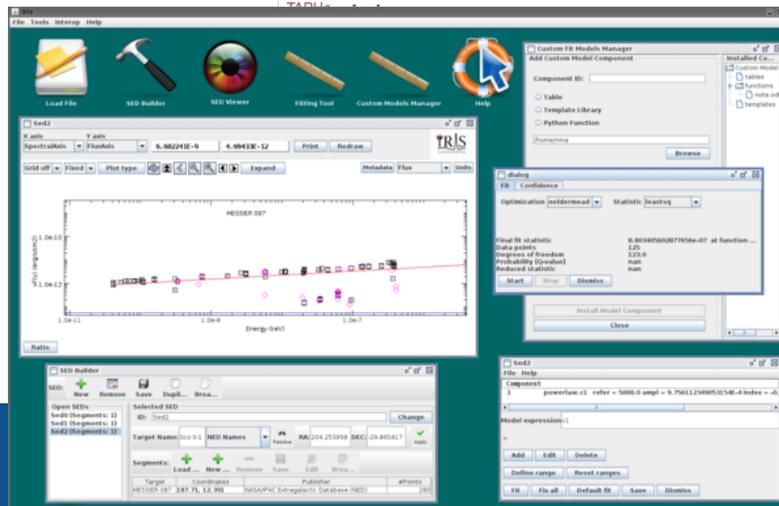
Functionality

- Search for Images:** Aladin, Datascope, SkyView, VODesktop, Data Discovery Tool
- Search for Spectra:** Aladin, Datascope, SPLAT, Specview, VOServices, VOSpec, Data Discovery Tool
- Search for Catalogues:** Aladin, Datascope, TOPCAT, VODesktop, Data Discovery Tool

VO-compliant Tools & Services

- DS9: Image visualisation
- GOSSIP: SED fitting
- VirGO: Search for Images and Spectra
- IRAF: Image Reduction & Analysis
- World Wide Telescope
- Gaia - Graphical Astronomy and Image Analysis

HII explorer, a tool for detecting HII regions in IFS datacubes.

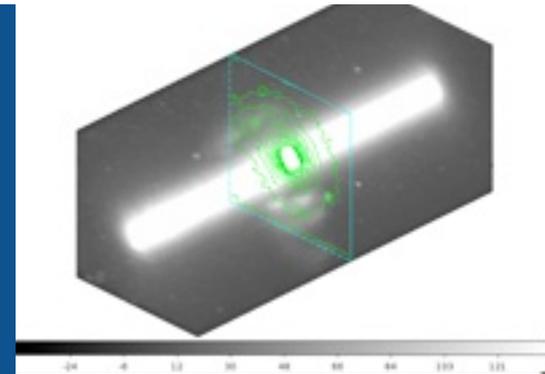
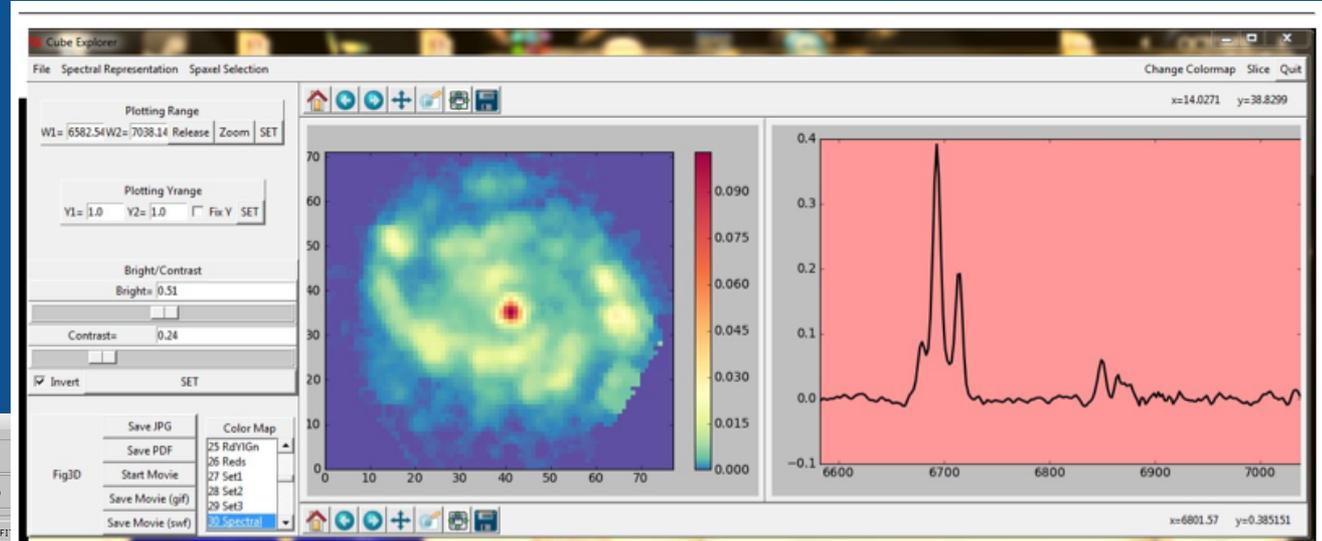
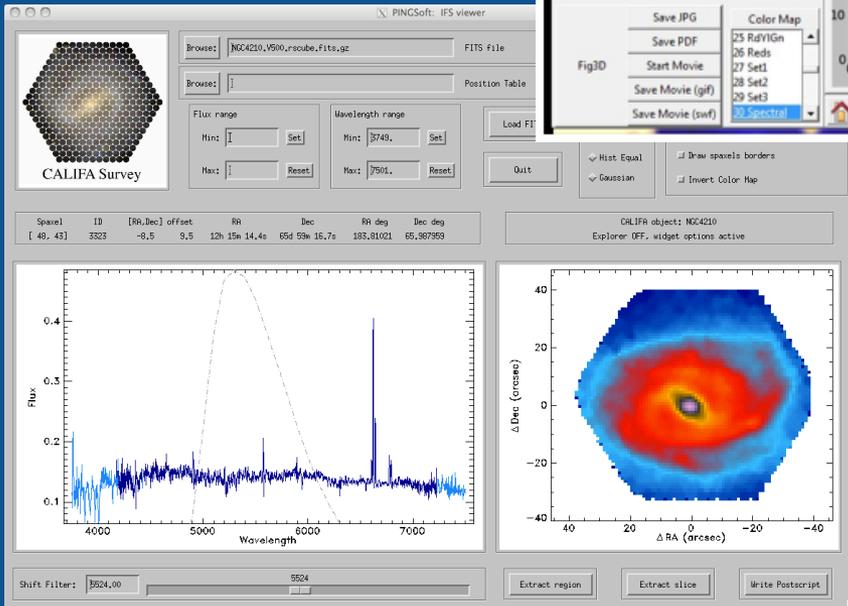


the integrated spectra of HII regions from IFS datacubes.

Figure 1: (a) H II regions are peaky/isolated structures with a strong emission and the average ionized gas emission across the size of about a hundred or a few hundreds of parsecs (e.g. 1: Oey et al. 2003), which corresponds to a typical projected

Visualization & 1D extraction is a start

IFSView (Python)



PINGSoft (IDL)

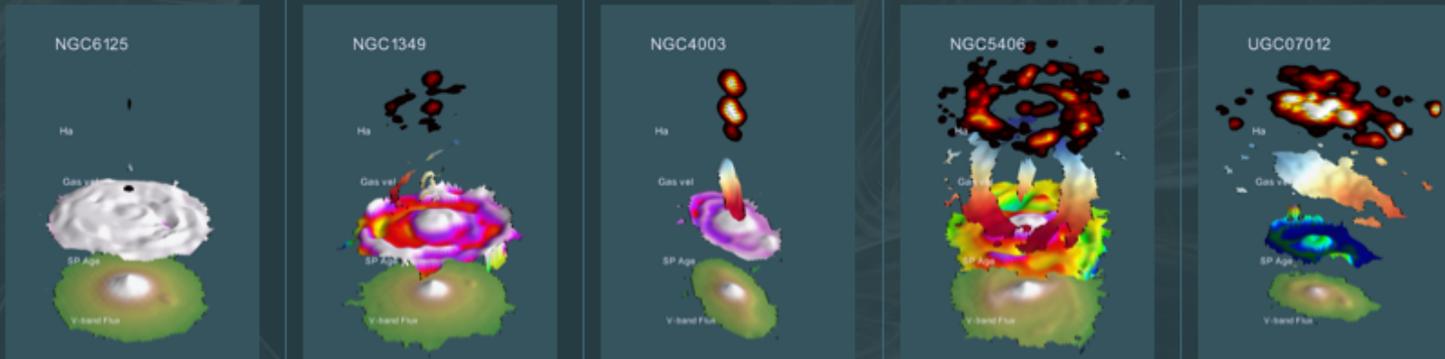
ds9 (C)

Other surveys have some great tools already

CALIFA 1st DATA RELEASE



SDSS,
90" x 90"



H α 3D
H α gas vel
Stellar age
V light

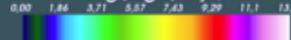
Flux 10⁻¹⁶ erg/s/cm/arcsec²/Å



velocity km/s



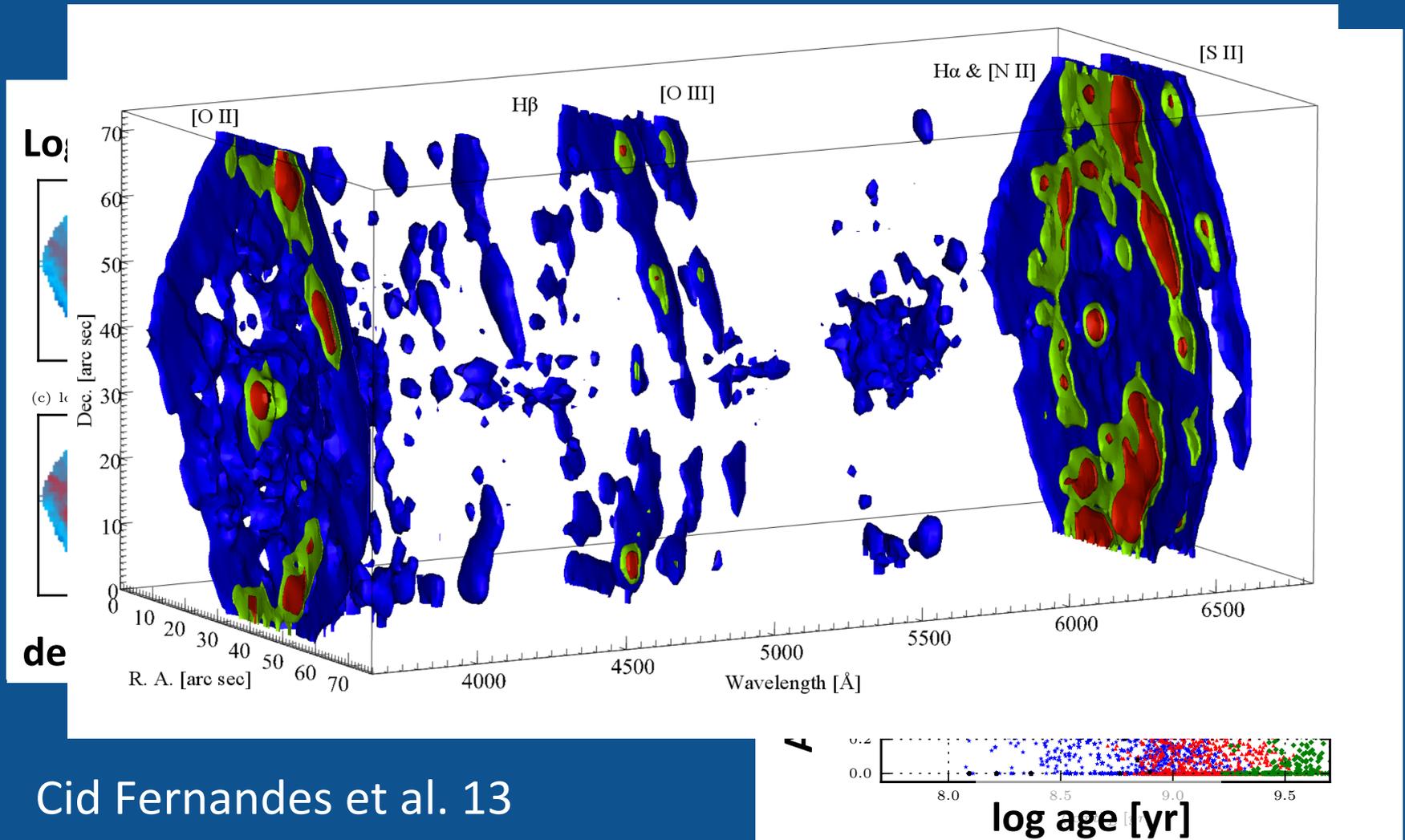
log(Age/Gyr)



Flux 10⁻¹⁶ erg/s/cm/arcsec²

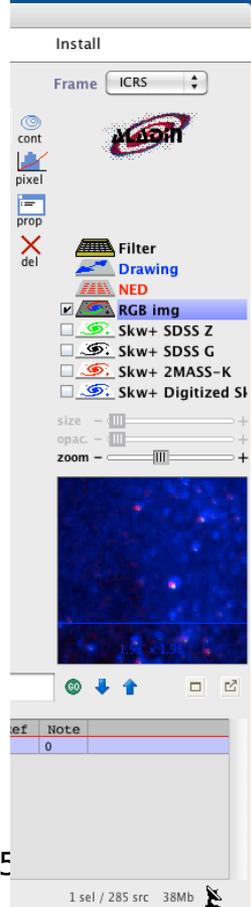
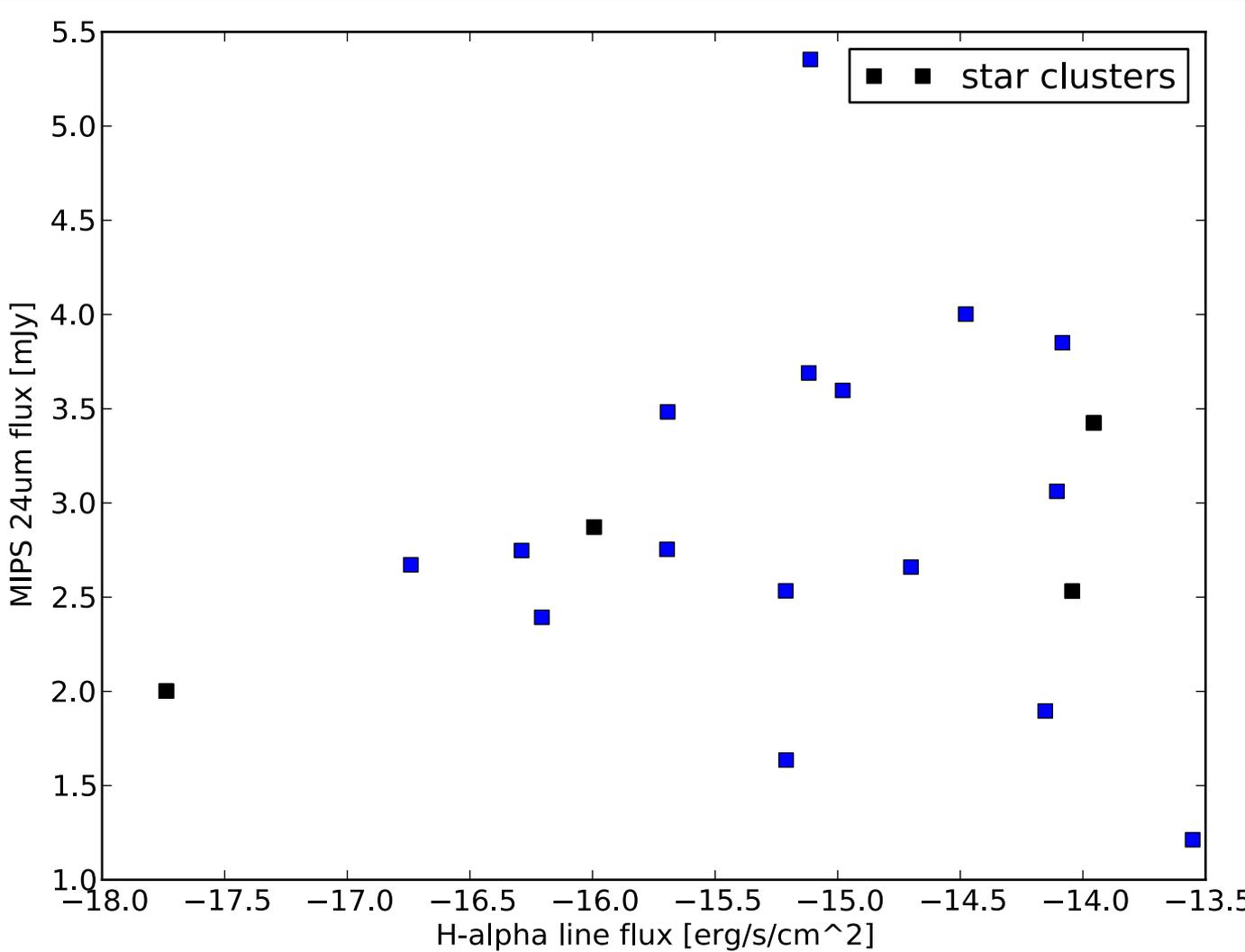
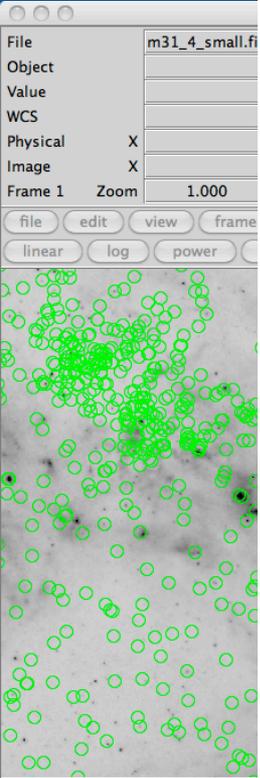


Need to figure out how to harness the power of many dimensions

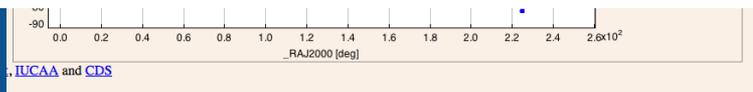


Cid Fernandes et al. 13

Catalogs & n-dimensional data



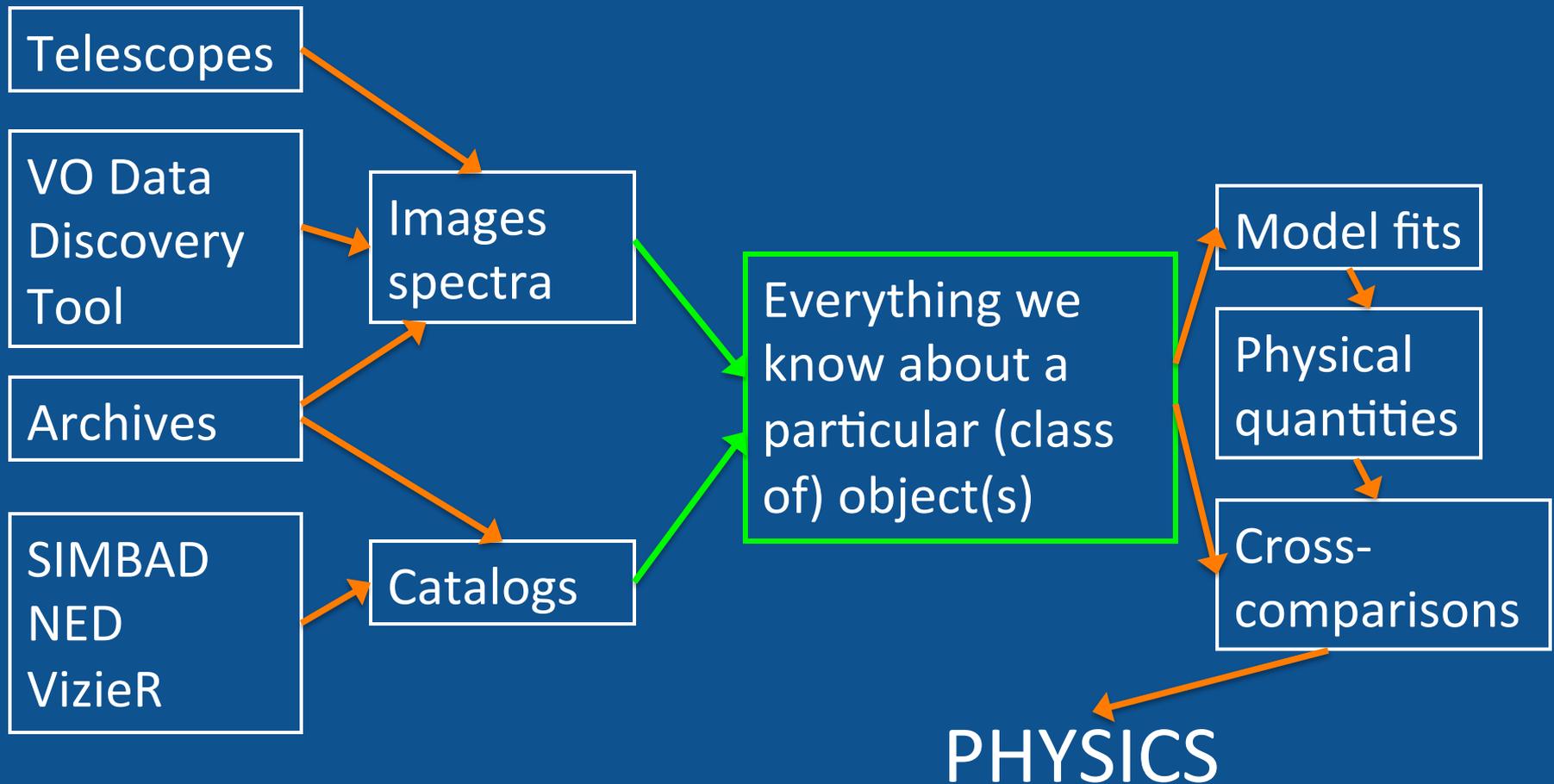
ds9



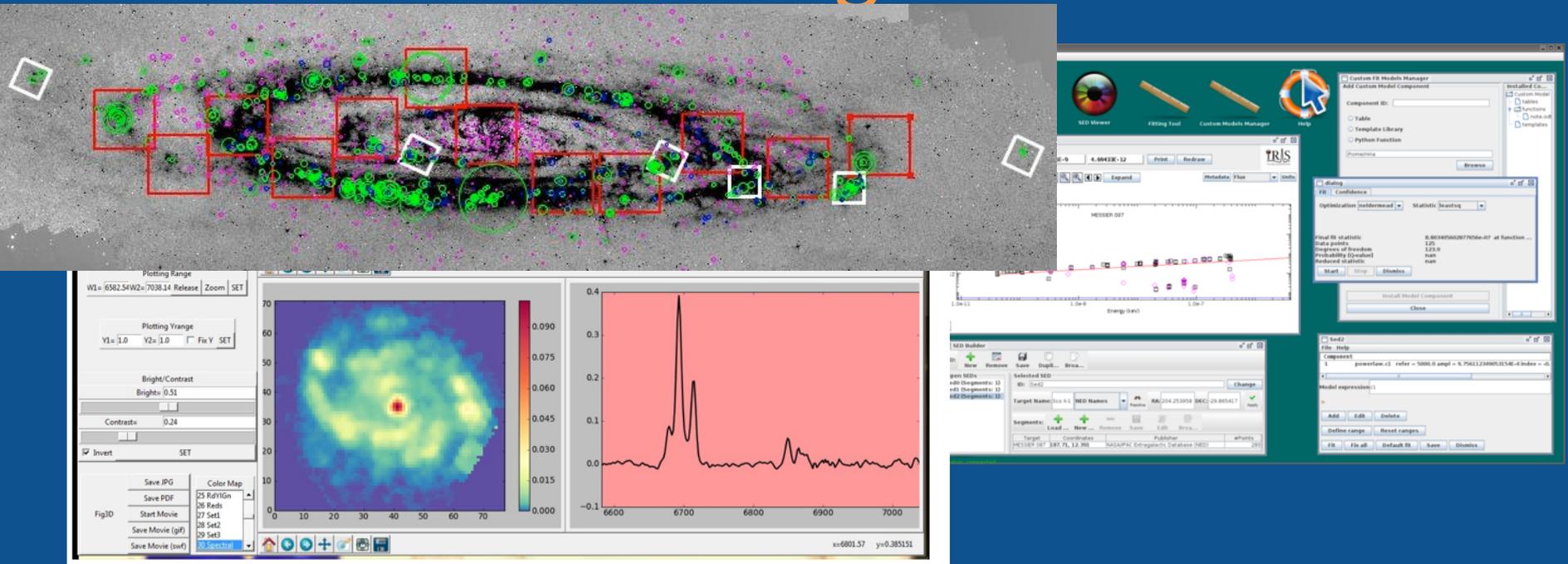
VOPlot

Aladin

The tools and data are mostly there: just need to join them



Wanted: more! More nearby galaxies with more spatial coverage, and more data integration



Collaborators: R. Marciniak, M. Azimlu, G. Farhani, M. Croley, D. Stock, S. Lianou (Western); E. Rosolowsky (UBC-O); E. Peng (PKU)

