

Brian Kent

NRAO Charlottesville

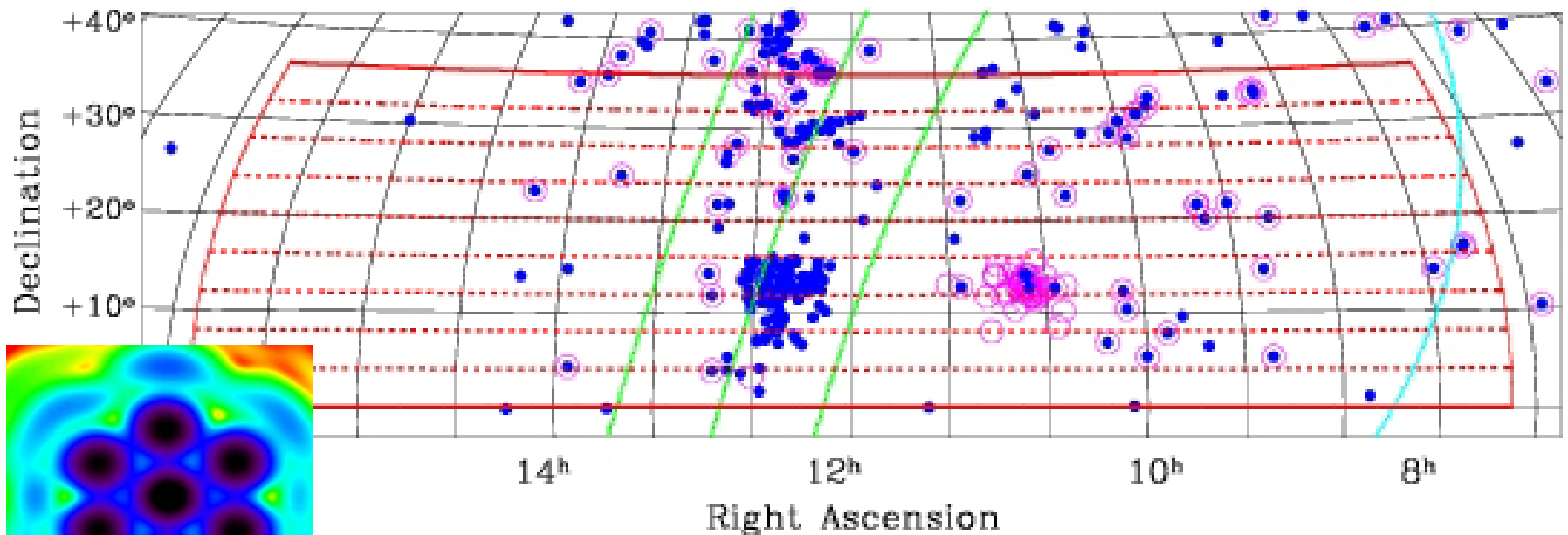
Visualization GUIs
Wide field images
Volume Rendering

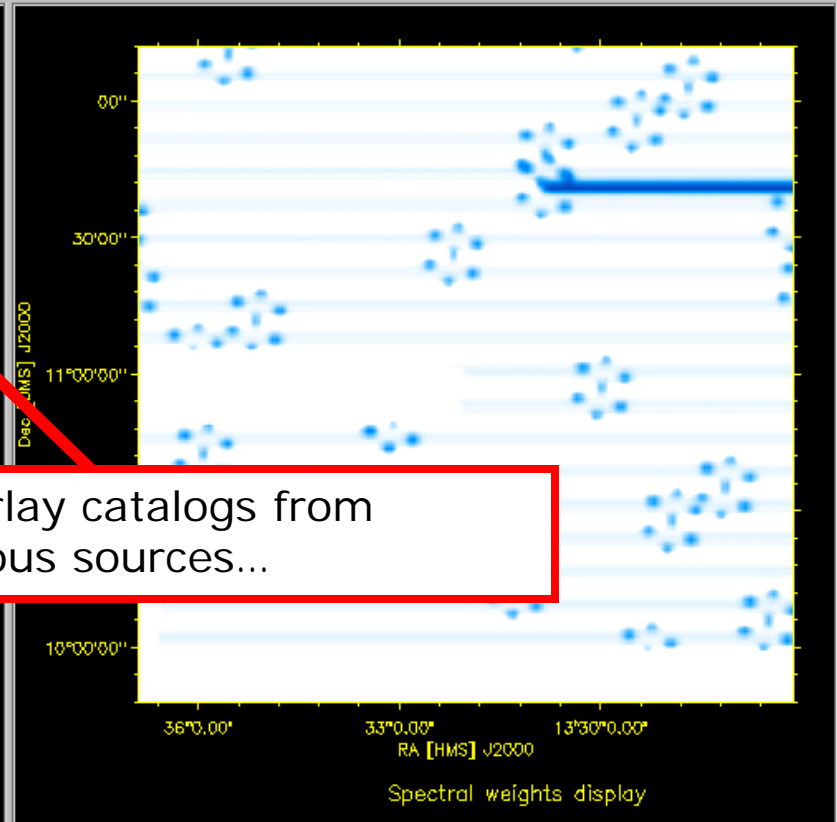
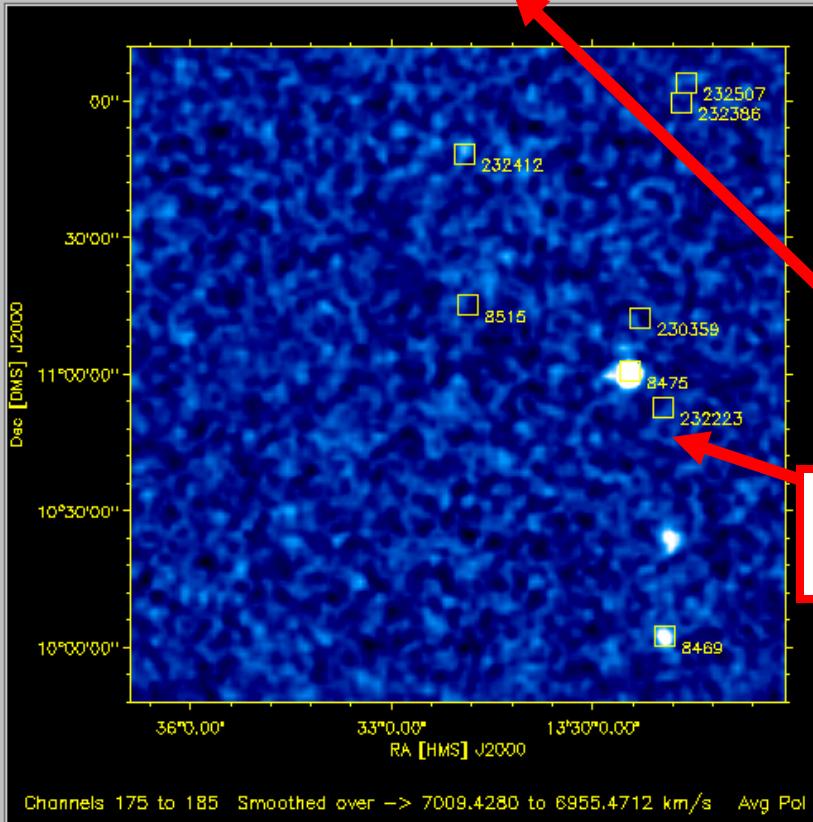
The Arecibo radio telescope and the ALFA receiver



ALFALFA: Brief Overview

- The extragalactic HI survey will cover 7000 square degrees of the high galactic latitude sky out to a distance of ~ 250 Mpc. (Credit to the entire ALFALFA team!)
- Observations have covered ~ 130 deg² towards Virgo region at $12^{\text{h}} 12^{\circ}$ to the supergalactic plane.
- An extragalactic HI survey affords advantages over optical surveys, namely *detection of gas-rich extragalactic systems that may not have initiated star formation, as well as blind tidal interactions traced by HI.*





Overlay catalogs from various sources...

GRID: 1332+11 RA/DEC: ----

2.4 X 2.4 degrees cz value: 6982,4472

2500,34 to 7956,76 km/s (X,Y) pix: -----

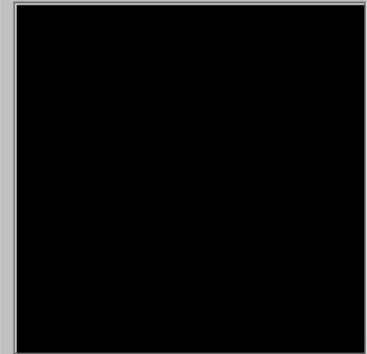
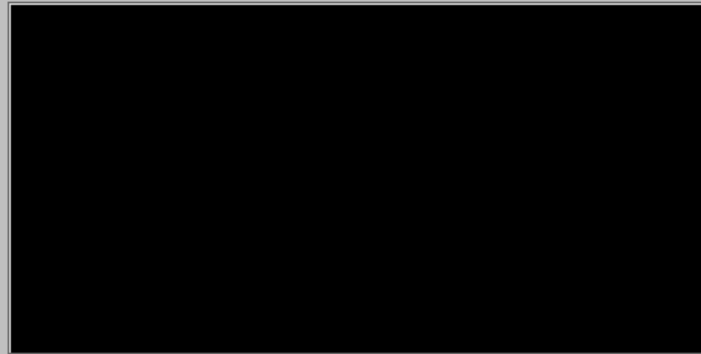
Epoch: 2000,00 Intensity: ----

Spectral Continuum

PREV NEXT Channel 180

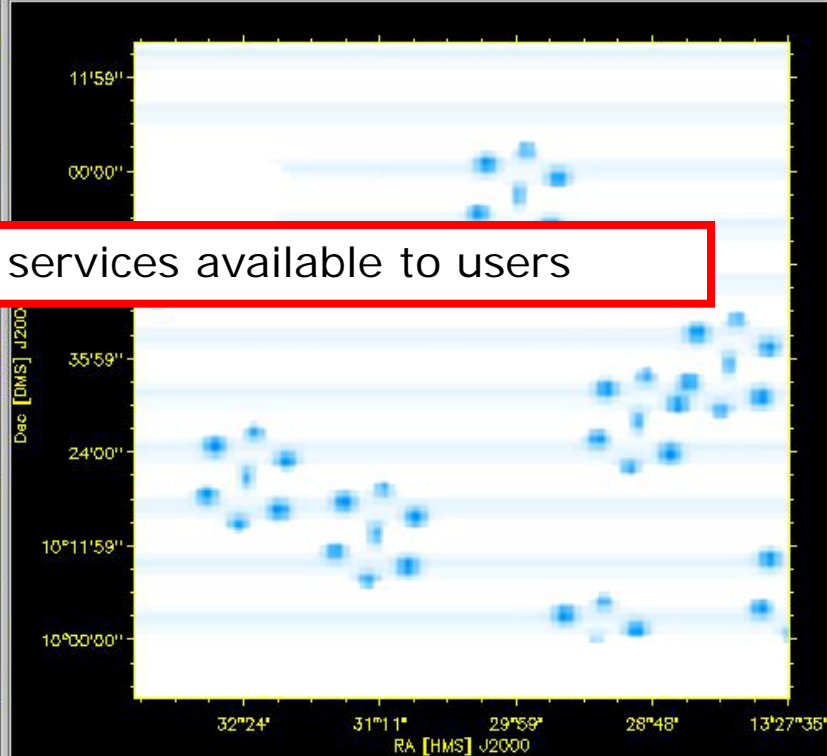
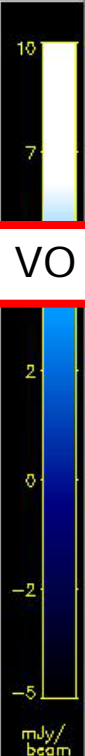
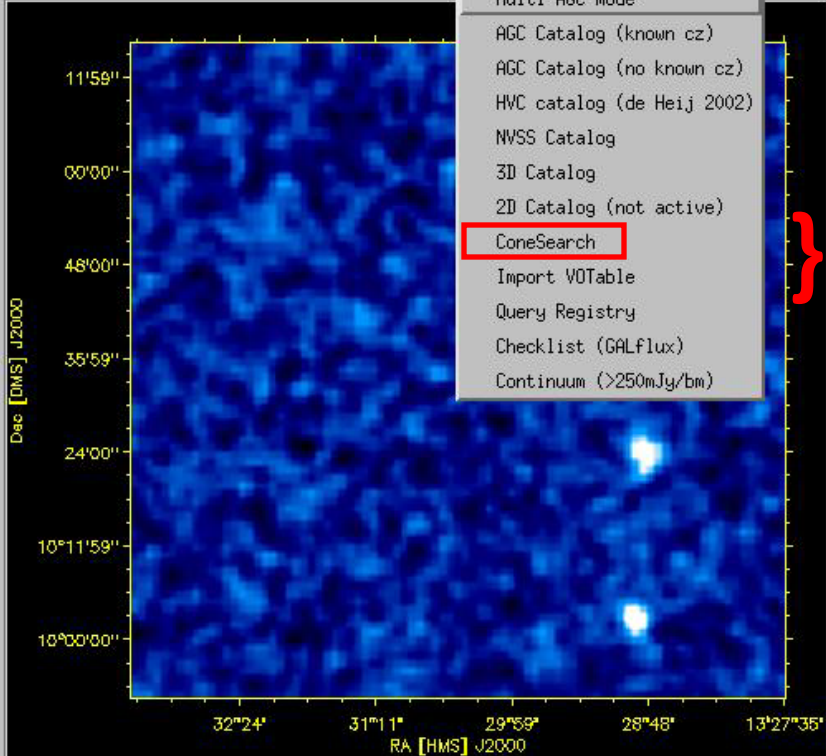
Image smooth 3 Boxcar (+/-) 5 chan

Avg Pol AGC Information Displayed Here



- Multi-AGC mode
- AGC Catalog (known cz)
- AGC Catalog (no known cz)
- HVC catalog (de Heij 2002)
- NVSS Catalog
- 3D Catalog
- 2D Catalog (not active)
- ConeSearch**
- Import VOTable
- Query Registry
- Checklist (GALflux)
- Continuum (>250mJy/bm)

VO services available to users



Channels 175 to 185 Smoothed over -> 7009.4280 to 6955.4712 km/s Avg Pol

Spectral weights display

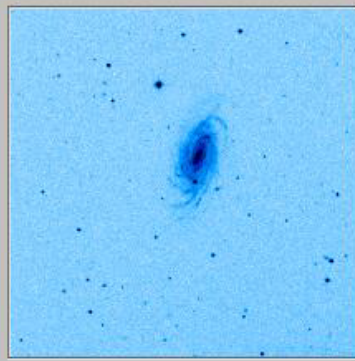
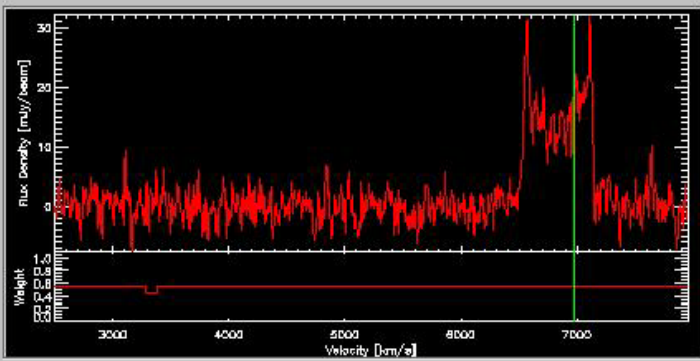
GRID: 1332+11 RA/DEC: ----
 2.4 X 2.4 degrees cz value: 6982.4472
 2500.34 to 7956.76 km/s (X,Y) pix: 32 67
 Epoch: 2000.00 Intensity: 2.09941

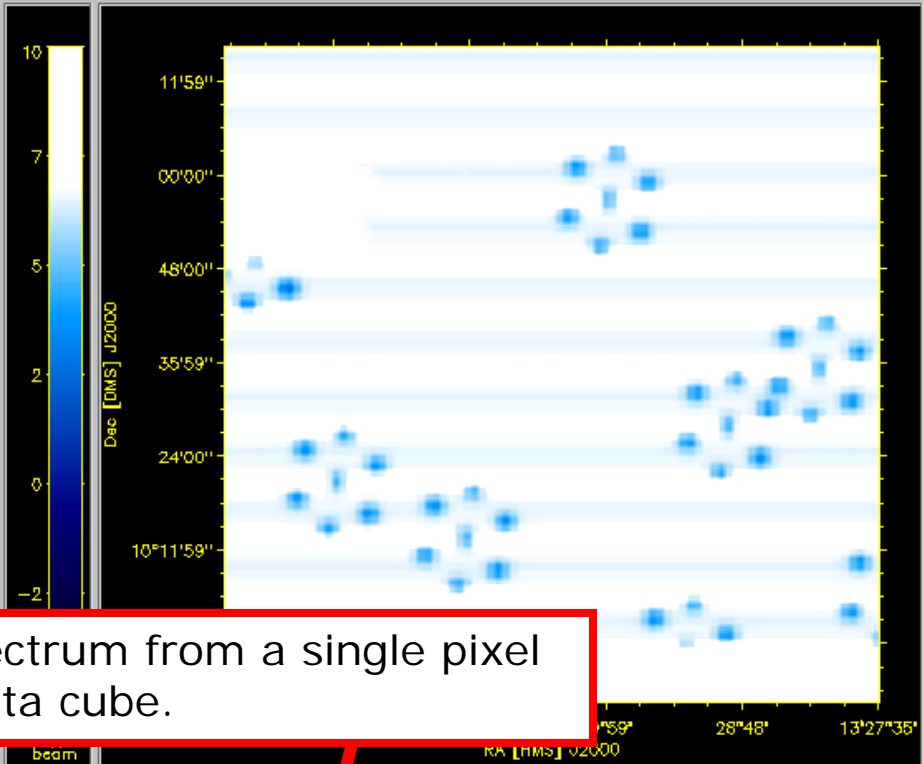
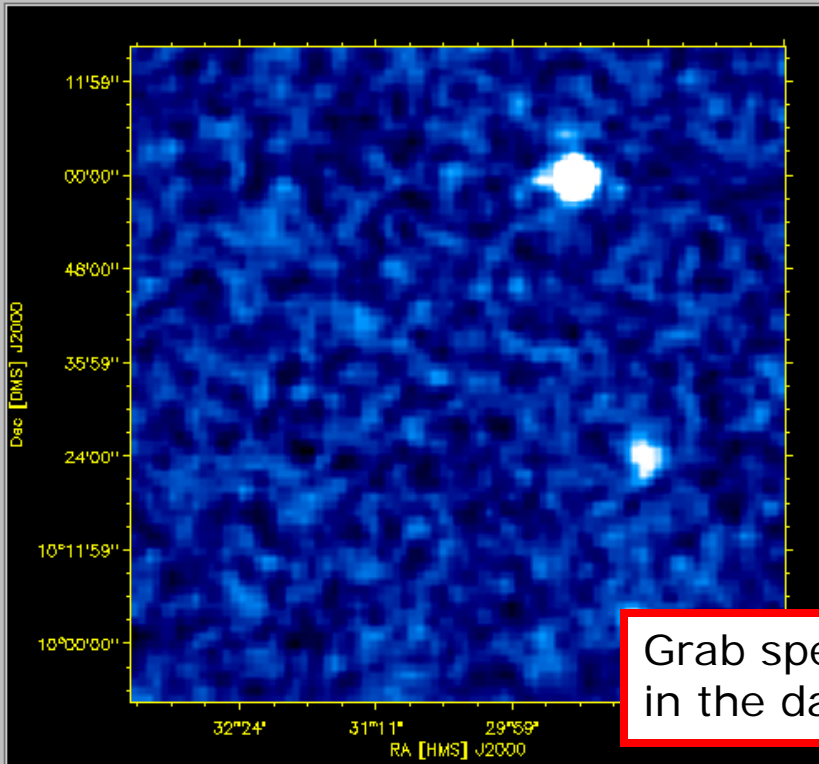
Spectral Continuum

PREV NEXT Channel 180

Image smooth 3 Boxcar (+/-) 5 chan

Avg Pol -----





Grab spectrum from a single pixel in the data cube.

Channels 175 to 185 Smoothed over -> 7009.4280 to 6955.4712 km/s Avg Pol

Spectral weights display

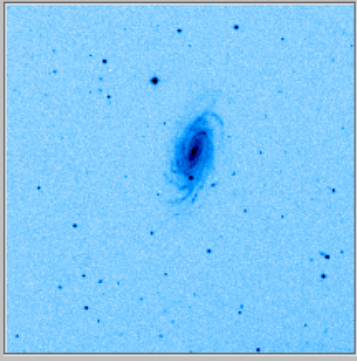
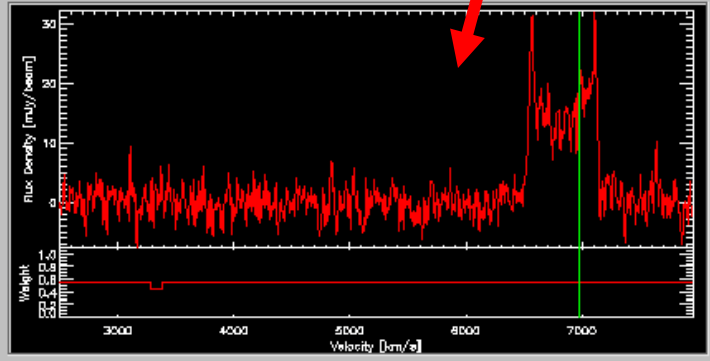
GRID: 1332+11 RA/DEC: --- ---
 2.4 X 2.4 degrees cz value: 6982,4472
 2500,34 to 7956,76 km/s (X,Y) pix: --- ---
 Epoch: 2000,00 Intensity: --- ---

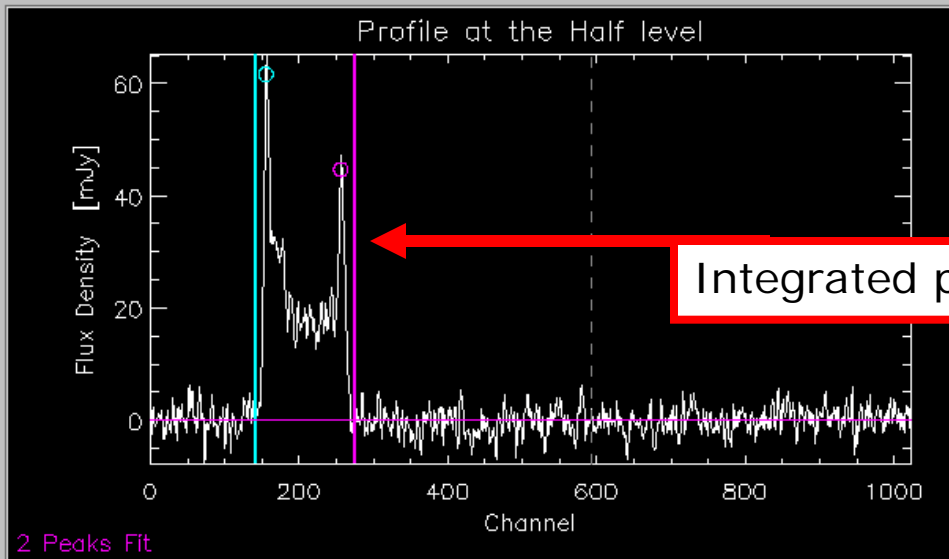
Spectral Continuum

PREV NEXT Channel 180

Image smooth 3 Boxcar (+/-) 5 chan

Avg Pol





Integrated profile created...

BASELINE MODE

LEFT-click the map to mark baselined regions.
 RIGHT-click to drag a zoom box.
 DRAG the slider to adjust the fit order.
 GALflux will fit a baseline when an even number of marks have been placed.
 LEFT-click existing markers and drag to the desired positions.
 Click the ISOPHOTE drop down menu to cycle through the various profiles, and examine the fits. Click the Remove Baselines Box when completed.
 Click Reset baseline to begin again.

Xmin: 0 Xmax: 1023 Ymin: -20 Ymax: 30 Rescale

Channel: 593 Velocity: 4770.10 km/s Flux Density: 72.73 mJy

MODE: Ellipse Baseline Measure Hanning: None Sys Err

BASELINE: Reset baseline Fit order: 4 Remove Baseline?

ISOPHOTE: Half Modify all in isophote list?

PEAKS fit PEAKS reset One peak Two peaks

GAUSS fit GAUSS reset Gaussian Width: 7 channels

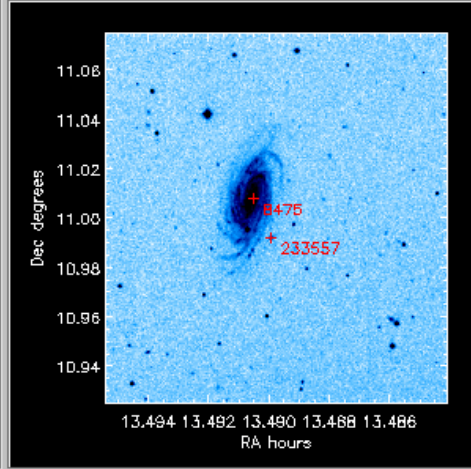
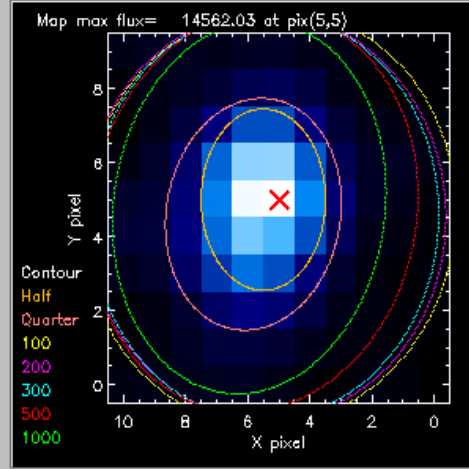
MSR MODE: Gaussian Peaks

Add an AGC entry Digital HI Archive entries

Do not add an AGC galaxy

233557 8475 - click here for Archive data.

8475

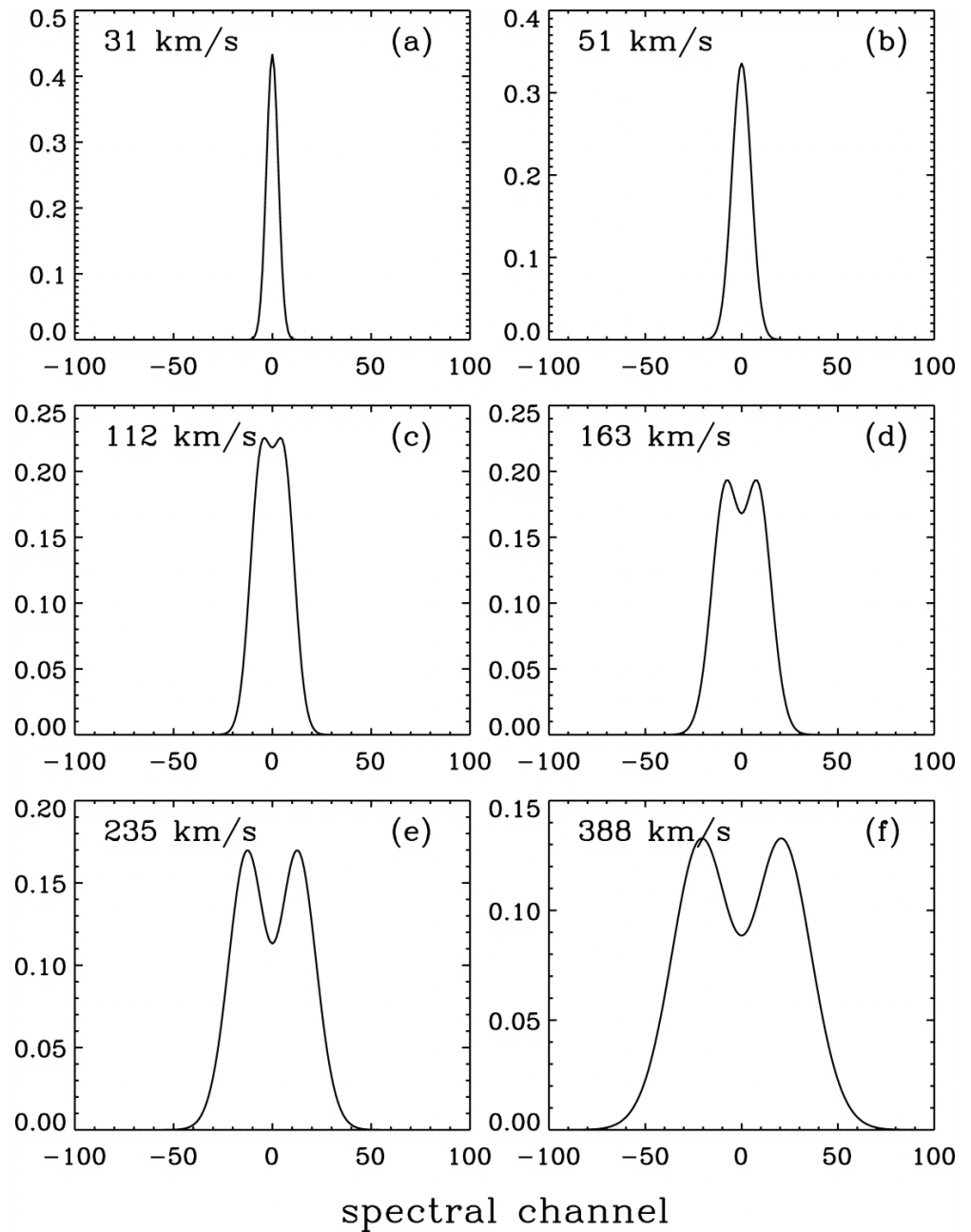


AGC8475 Type= Sc a x b= 3.70 x 2.00 arcminutes
 Other ID: N5174 Optical coords (J2000)= 132925.799+110028.00
 Ellipse fit compare: deltaRA= 0.64329 seconds
 deltaDEC= -2.00000 arcseconds
 Vopt= 6779 +/- 29 km/s Detcode= 1
 V21= 6826 km/s Width= 597 +/- 7 km/s

3D Matched filter
signal extraction in
the Fourier domain

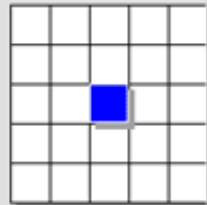
Templates built using
an orthogonal set of
basis functions with
Hermite polynomials

See Saintonge 2007 AJ



Montage Reprojection Module

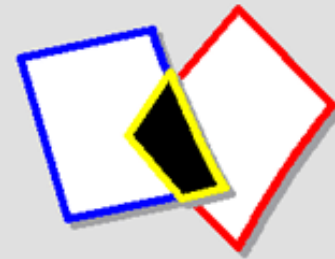
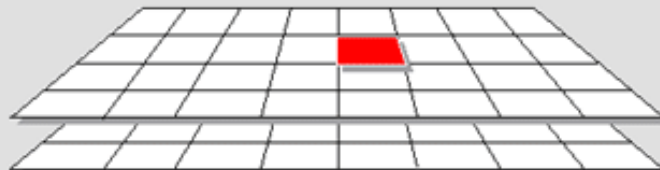
Arbitrary
Input
Image



```
SIMPLE =          1 /  
BITPIX =         -64 /  
NAXIS =           2 /  
NAXIS1 =          3000 /  
NAXIS2 =          3000 /  
CDELT1 =      -3.333333E-4 /  
CDELT2 =       3.333333E-4 /  
CRPIX1 =          1500.5 /  
CRPIX2 =          1500.5 /  
CTYPE1 = 'RA---TAN' /  
CTYPE2 = 'DEC--TAN' /  
CRVAL1 =          265.91334 /  
CRVAL2 =          -29.35778 /  
CROTA2 =           0. /  
END
```

FITS header defines output projection

Reprojected
Image



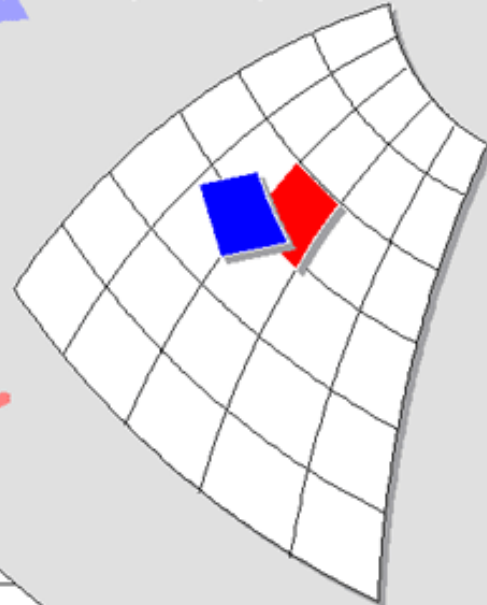
Central to the algorithm is accurate calculation of the area of spherical polygon intersection between two pixels (assumes great circle segments are adequate between pixel vertices)



Input pixels
projected on
celestial sphere

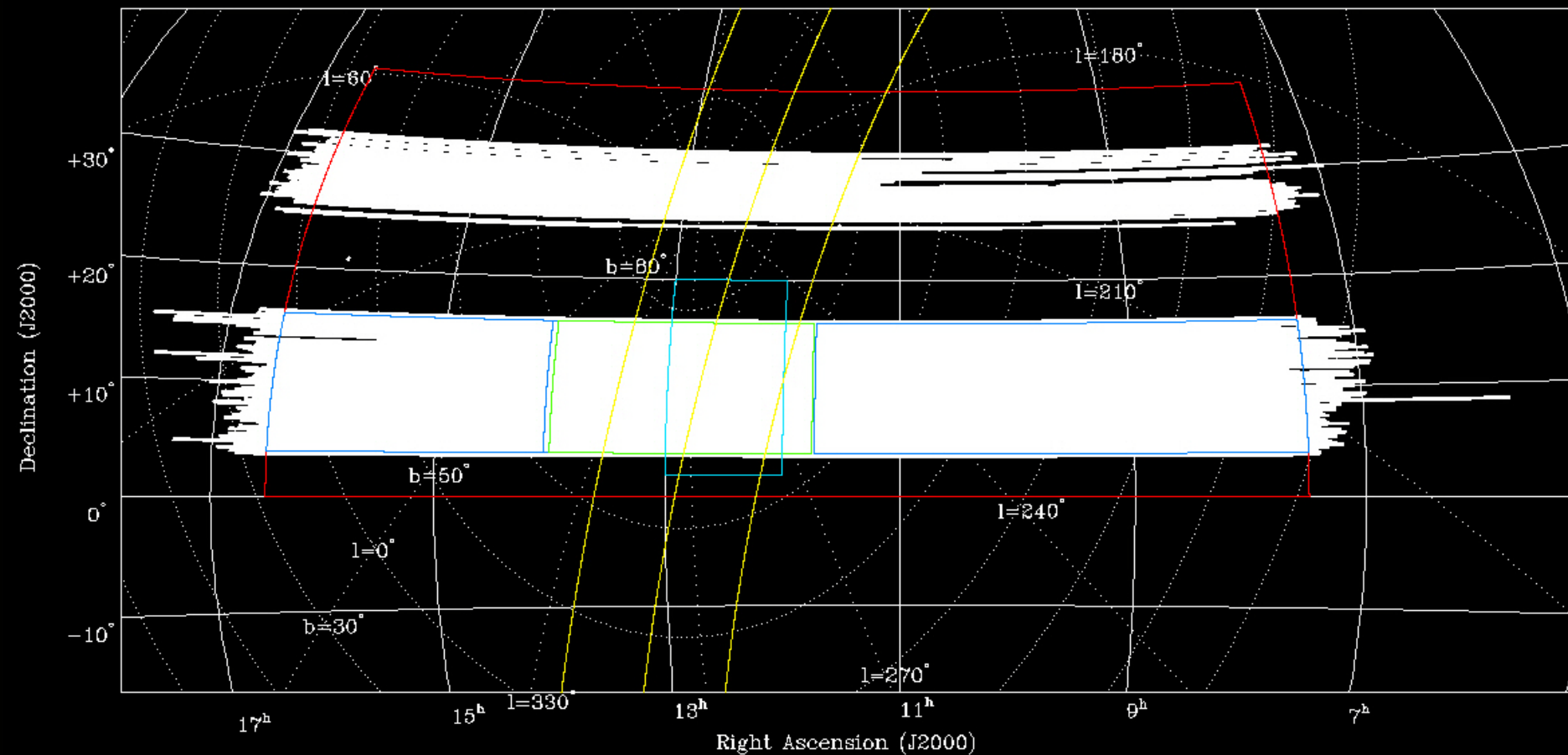


Output pixels
projected on
celestial sphere



Total Flux
Sky Area Coverage
(steradians)

ALFALFA In Prep Thesis Level I Virgo SGP($\pm 10^\circ$)



Survey status available at <http://egg.astro.cornell.edu/alfalfa/>

$-50 < v_{\text{LSR}} < 0 \text{ km/s}$

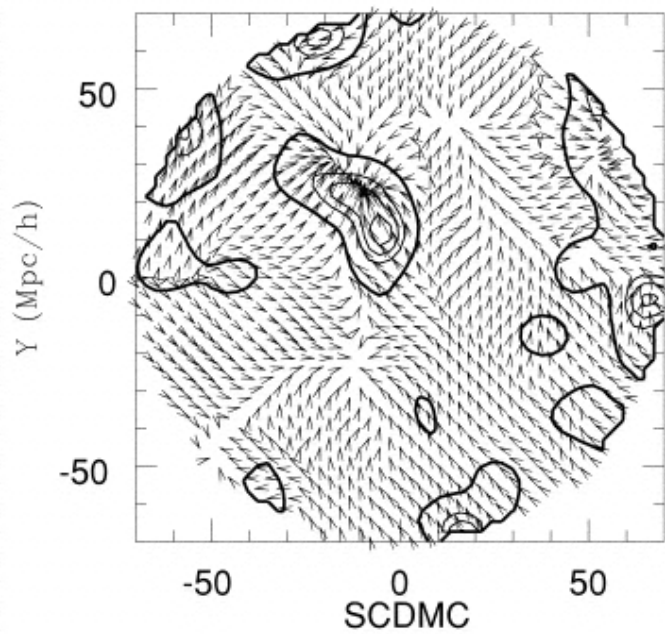
$-25 < v_{\text{LSR}} < +25 \text{ km/s}$

$0 < v_{\text{LSR}} < +50 \text{ km/s}$

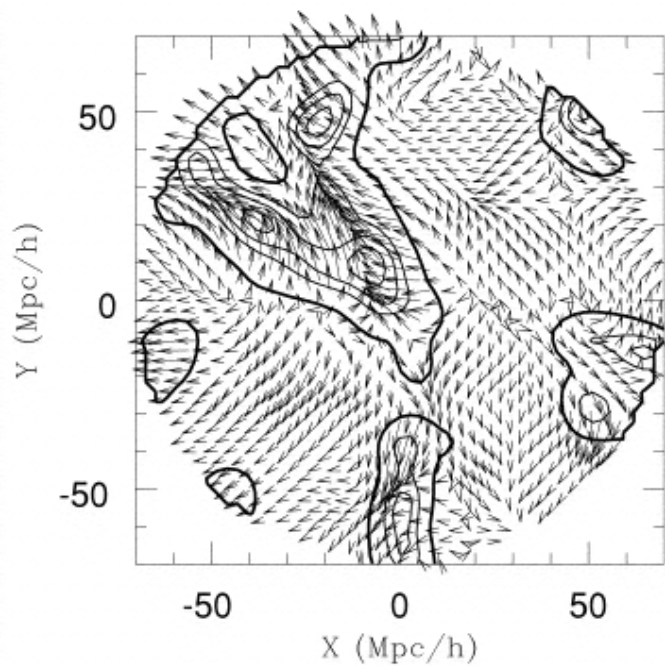


- RGB tri-color image created in the Montage toolkit (IPAC/VO libraries for mosaicking)
- 1200 images from 400 data cubes (2 pol each)
- 1500 deg² and ~5.5 million pixels of the “Spring” sky dataset
- At the time, I/O bound problem – getting the parts of the data cubes that are needed.
- Cubes have more than 3 dimensions in order to properly calibrate and/or reduce the data.
- Viewing data cubes is reaching the limit of “DS9 style” paradigm of opening a file/cube and “sliding” through it.

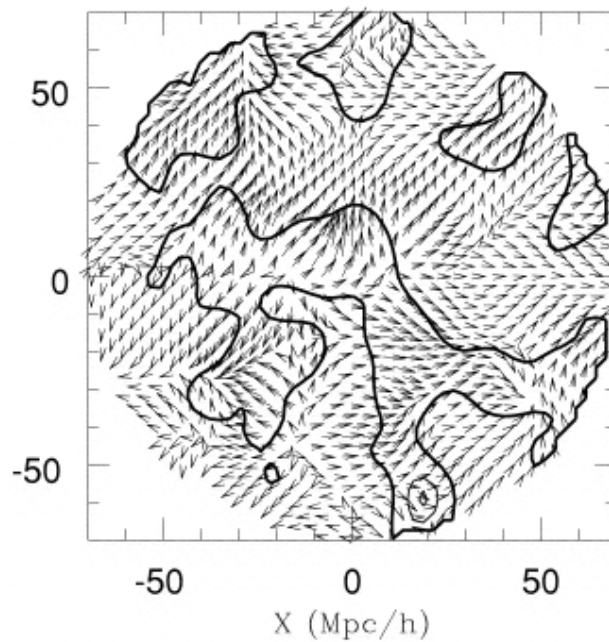
LCDM

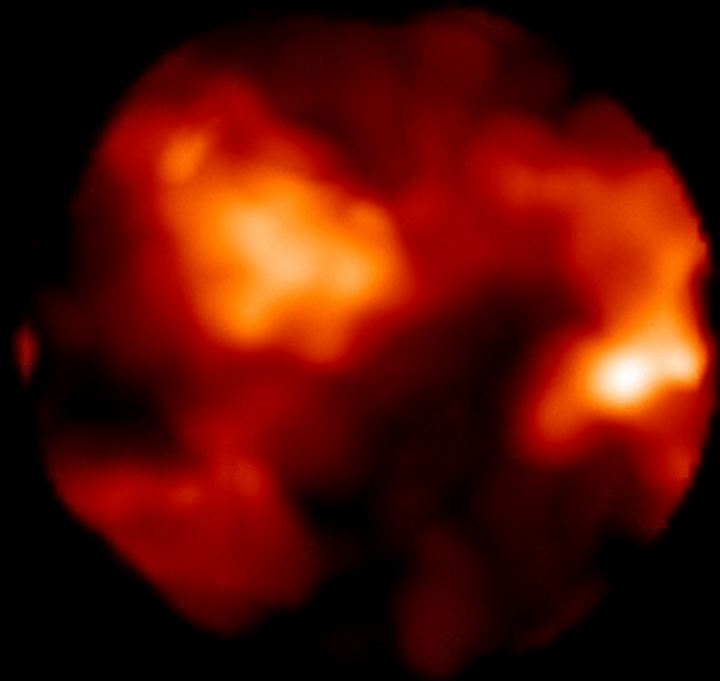
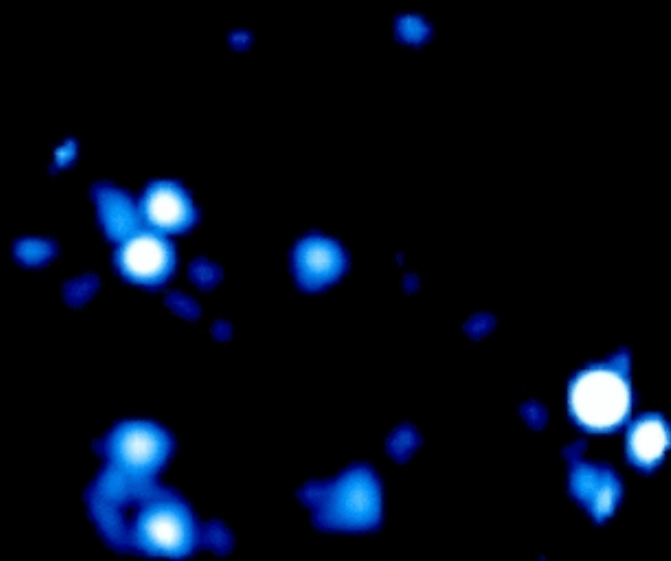


Schmoldt et al. 1999
Point Source Redshift Catalog
PSCz



SCDMG







Abstract

We describe a simple implementation of a RESTful web service for astronomical datasets. The service is implemented in `web.py`, a minimalist Python web framework that uses the model view controller (MVC) architectural pattern. The services use clean and simple URIs to access methods within Python classes. We show an example implementation that interfaces with a molecular line catalog.

What is web.py?

`web.py` is a minimalist framework for developing web apps in Python. It comes complete with a mini web server for testing, and separates the Python app code from the view templates.

<http://webpy.org/>



MySQL or SQLite

Model

Python Class

View

XML templates

Web Server

Controller

Class Methods

How about an example?

Sure! A MySQL database for Splatologue is used as the data source. However, the framework lends itself very well to development with many astronomical databases. A few simple Python classes with methods for REST calls can be used. View templates with minimal code serve as the interface to the web server.

The `web.py` framework easily allows a REST style (Representational State Transfer) service to be written. We hope to experiment with other astronomical datasets and metadata, as this framework allows for rapid prototyping.



API Search by: Wavelength Frequency Chemical Name Object Identifier Position Redshift

RESTful GET: HTML VOTable XML Formatted Text

Does a user need to know Python to retrieve a result?

Not at all! URIs for `web.py` application are similar to what you would see for a Django app and are cleaner than typical PHP or Java services.

For example:

<http://slap.net/freq/vot/155.4/155.5>

[http://slap.net/name/html/Carbon Monoxide](http://slap.net/name/html/Carbon%20Monoxide)

[http://slap.net/objectid/csv/NGC 4254](http://slap.net/objectid/csv/NGC%204254)

Can documentation and a tutorial for new users be created?

Yes! Sphinx is a Python application for creating elegant documentation with inline examples and tutorials – advantageous for astronomers who might be new to a particular computing or web service concept.



Learning more...

I'm happy to show simple demos of the code to meeting participants.

Acknowledgements

Thanks to Tony Remijan for providing a Splatologue copy and Joe Masters for an introduction to the Sphinx Documentation system.



<http://www.cv.nrao.edu/~bkent/computing/>