NRAO

National Radio Astronomy Observatory

Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array

Preparing for ALMA

http://science.nrao.edu/alma

National Radio Astronomy Observatory

North America ALMA Science Center

Charlottesville, Virginia U.S.

Atacama Large Millimeter/submillimeter Array

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Preparing for ALMA: User Tools

Anthony J. Remijan
North America ALMA Science Center

splatalogue
database for astronomical spectroscopy

ALMA Observing Tool

CASA

kayako

Atacama Large Millimeter/submillimeter Array
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Points to Take Home:

User tools include:

- User Portal
- ALMA Observing Tool
- Project Tracker
- Helpdesk
- Common Astronomical Software Applications (CASA)
  - ALMA simulator
- Splatalogue

The ARCs will provide full support for all user tools through an integrated helpdesk.

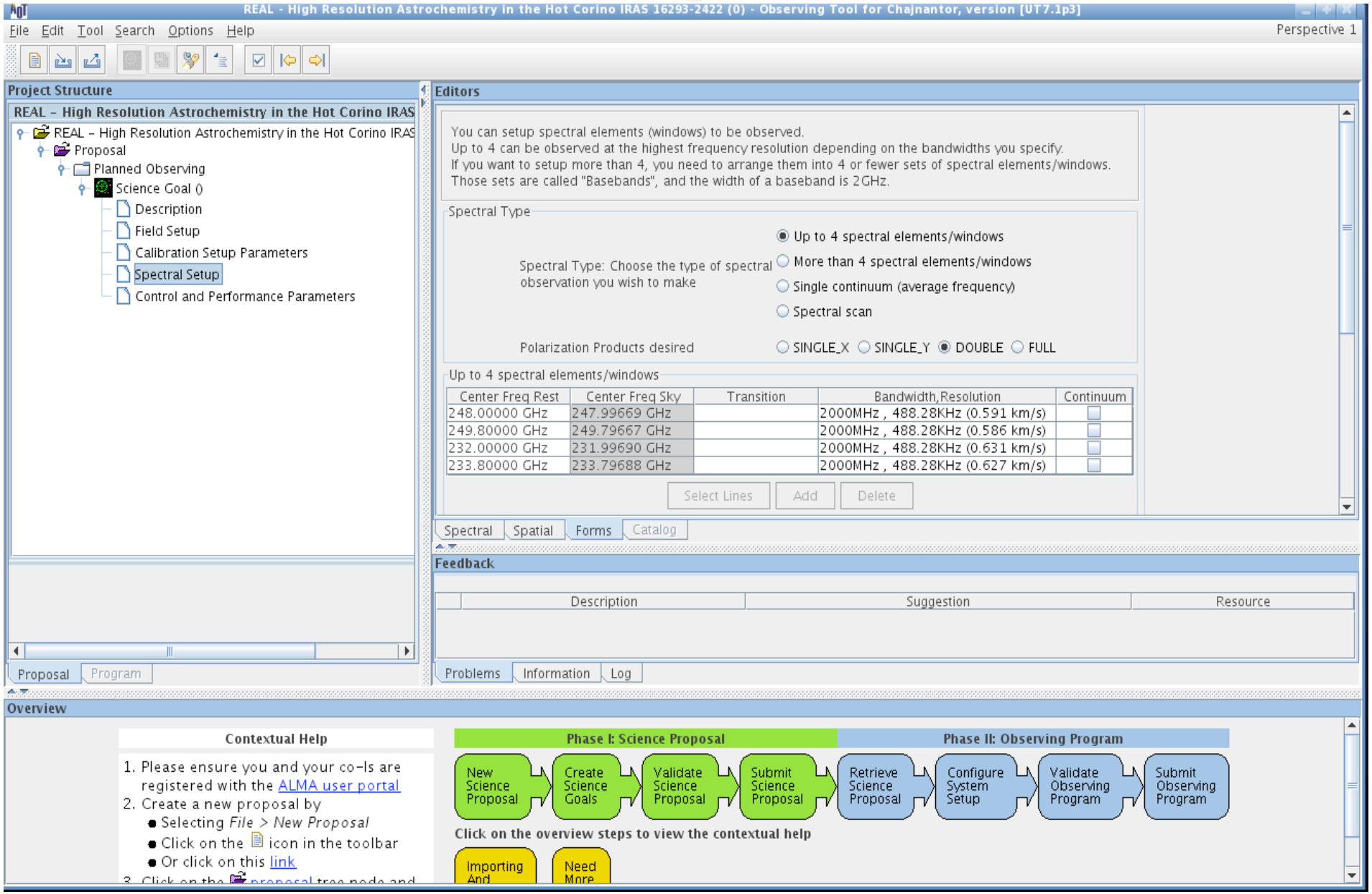
I'm already lost…where do I start???

Start with the User Portal:

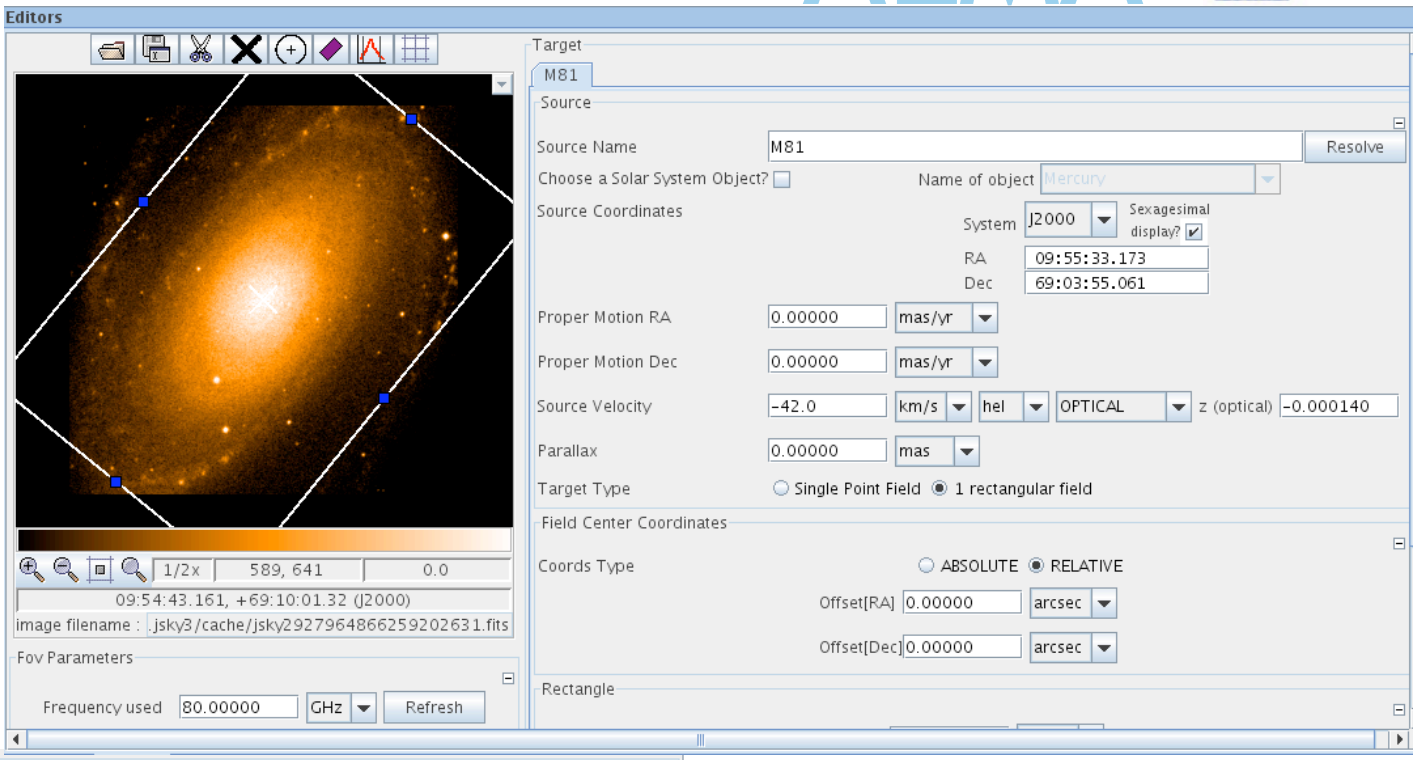
- Register with User Portal (single sign-on):
  - Helpdesk, Project Tracker, ALMA Science Archive

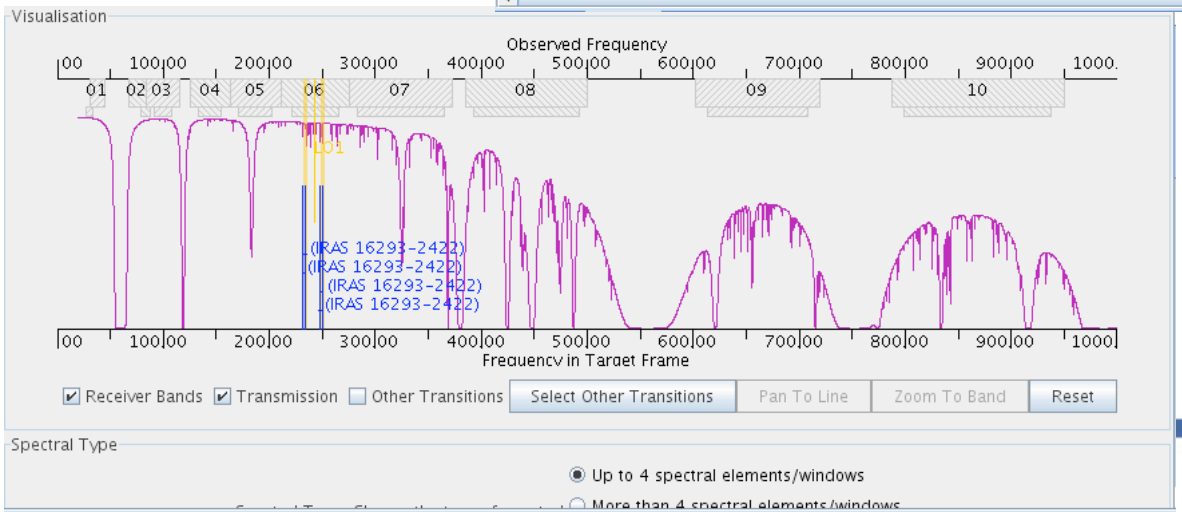
So far so good…now I want to write a proposal…?

Download the ALMA Observing tool:



ALMA Observing Tool:



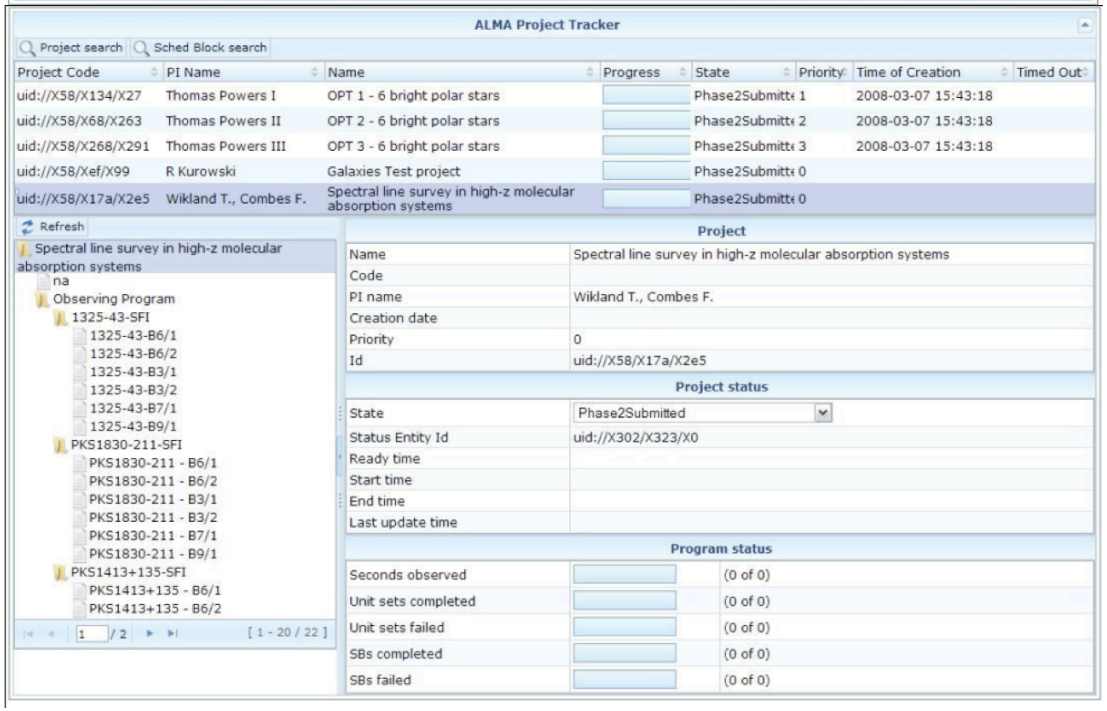


First "public preview" will be available July 20th

What's happening with my project?

ALMA

The ALMA Project Tracker:



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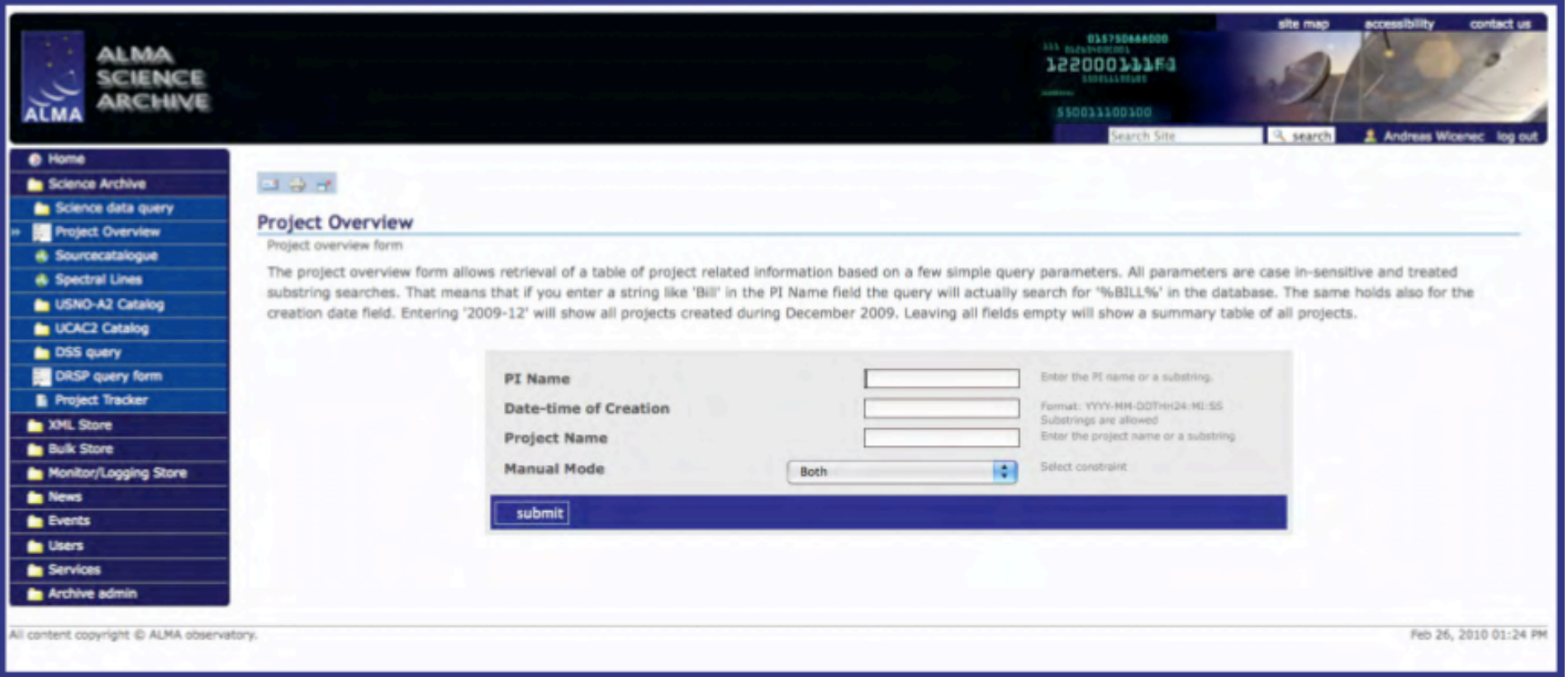
Great…where do I get the data?

ALMA

ASA Portal Project Overview



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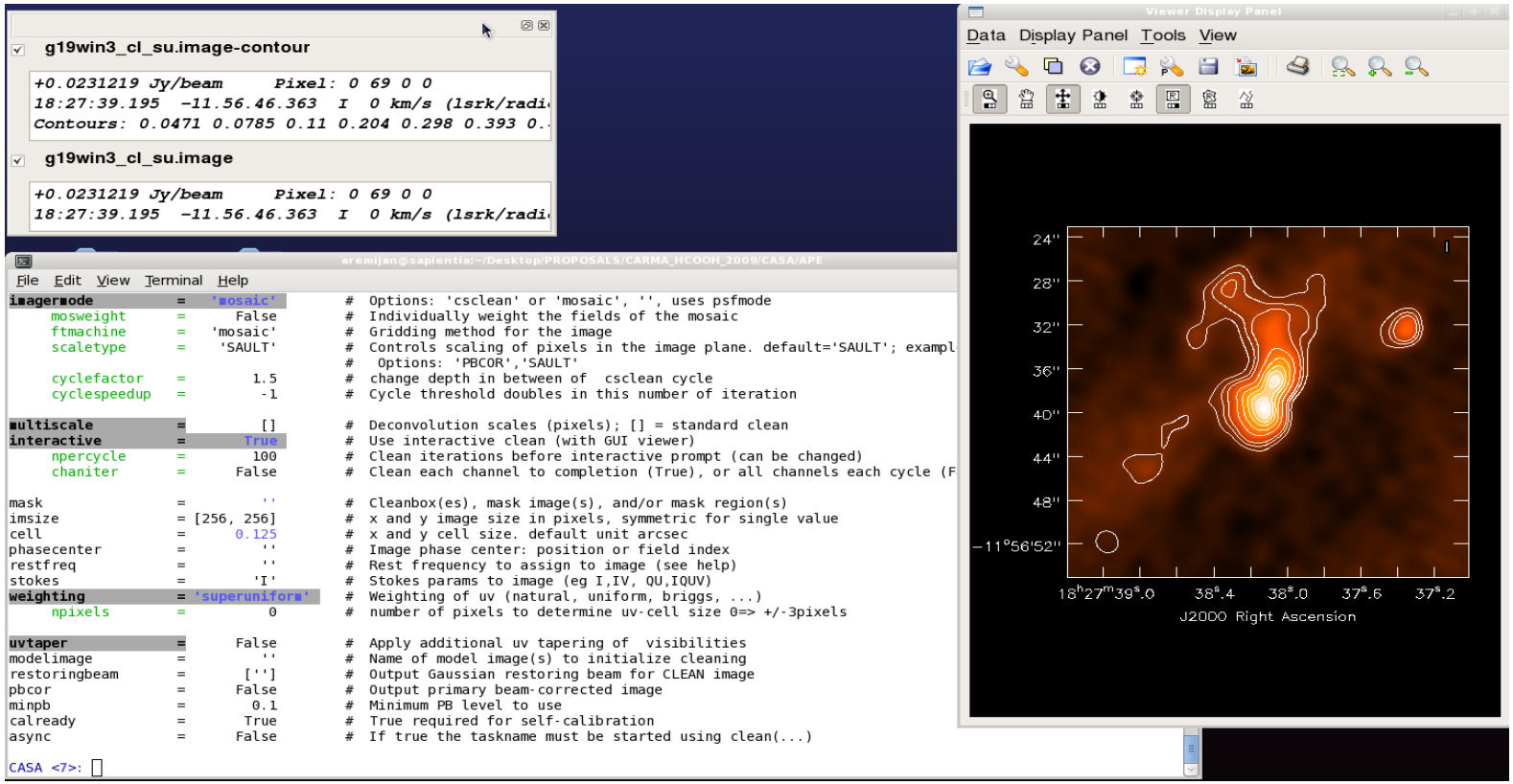
I got my data…now what?

What is CASA?

ALMA

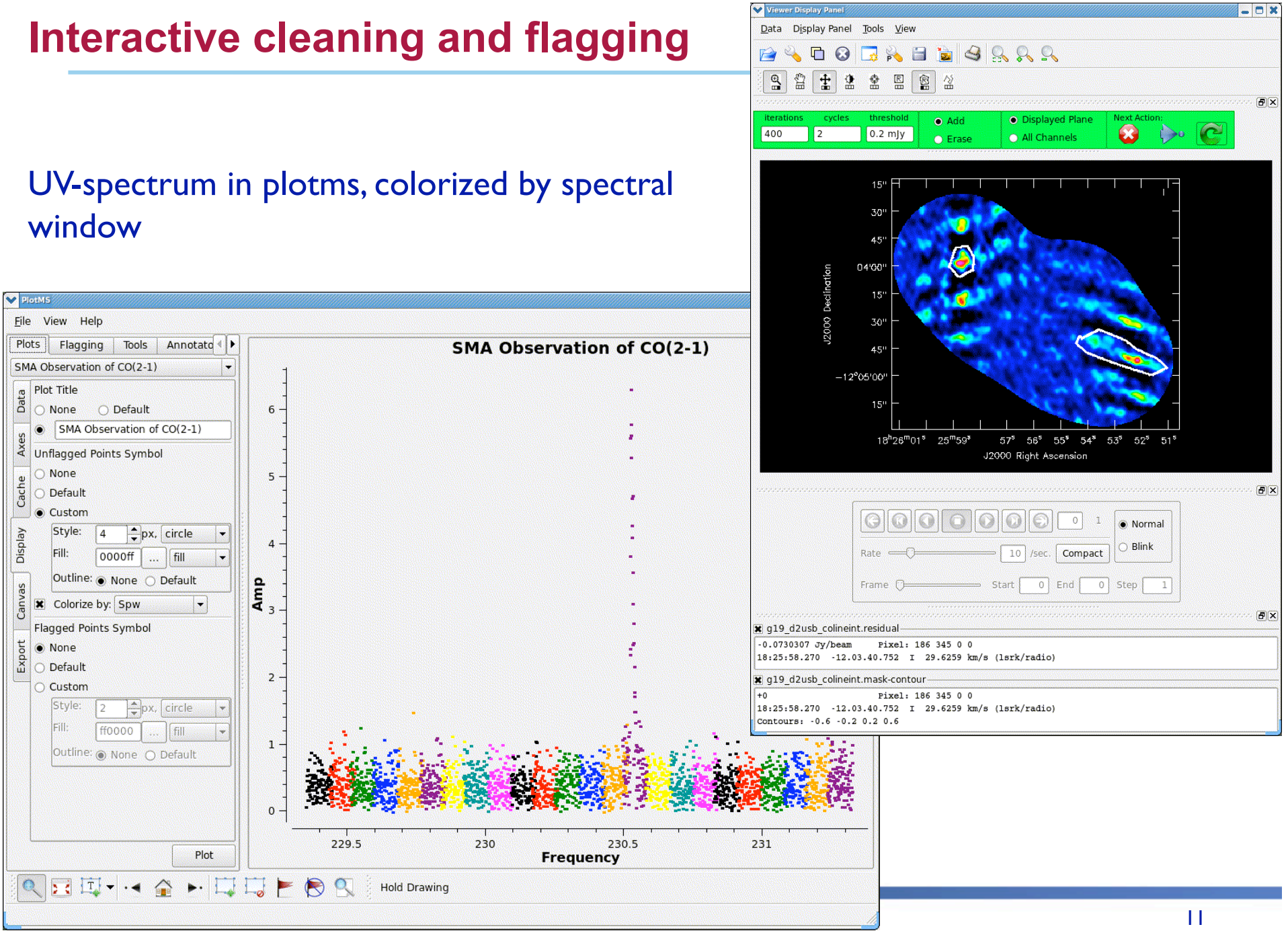
- CASA is the post-processing package for ALMA and EVLA (interferometric and single dish)



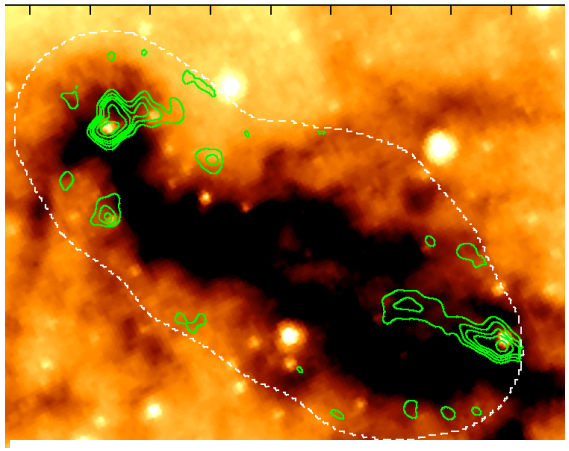
Available at: casa.nrao.edu

Interactive cleaning and flagging

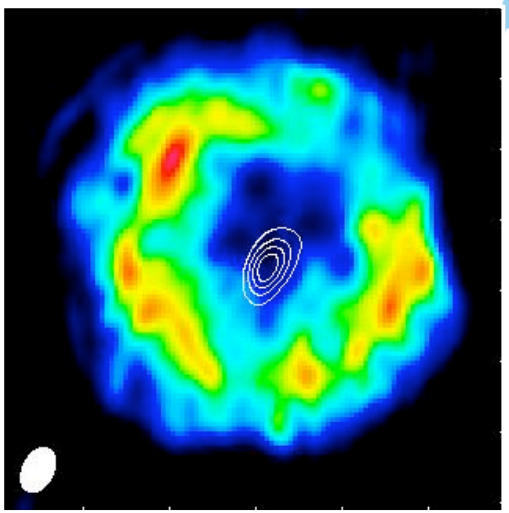
UV-spectrum in plotms, colorized by spectral window



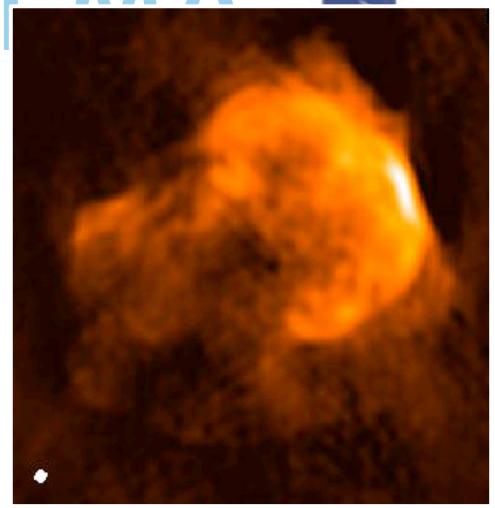
Diverse Data Reduced & Imaged in CASA…



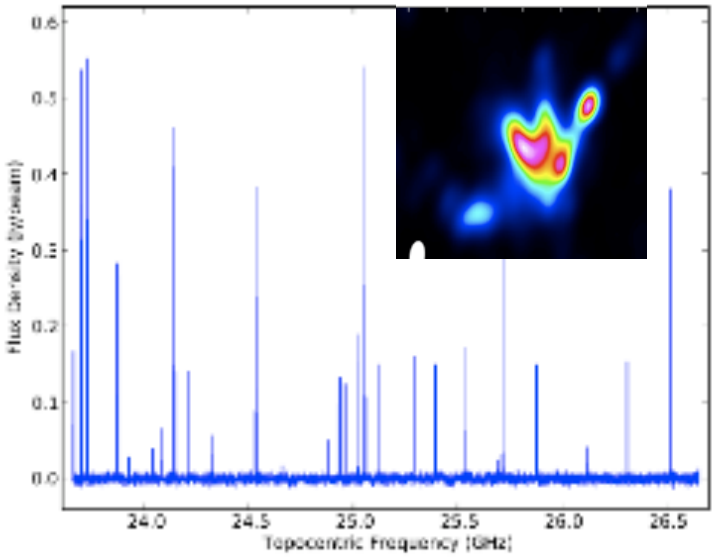
SMA ^{12}CO (2-1) mosaic toward IRDC G19.3+0.07



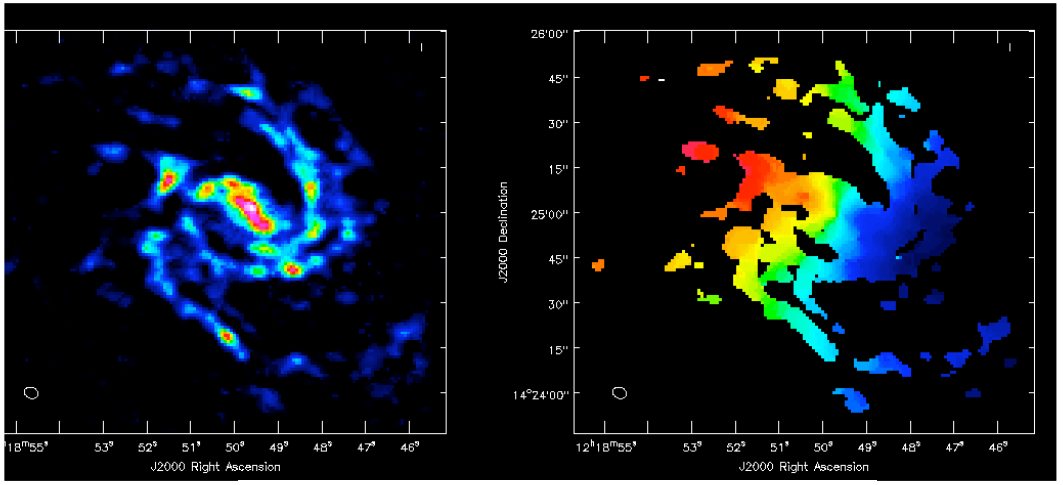
EVLA Ka-band of HC_3N in AGB star IRC+10216



EVLA 6cm mosaic of SNR: 3C391



EVLA demo science: Orion Hot Core this spectrum has 24k channels!

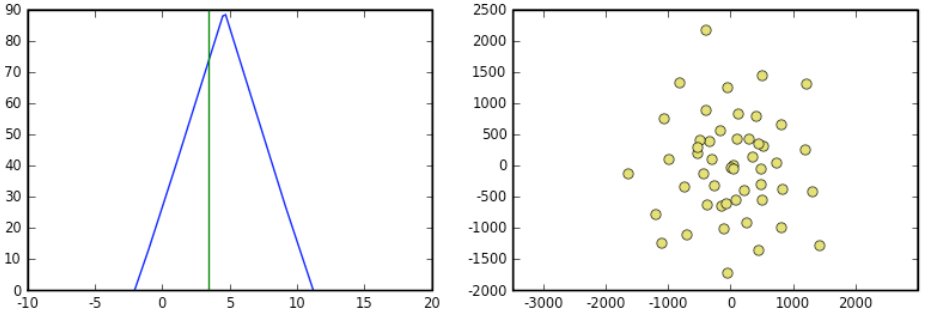


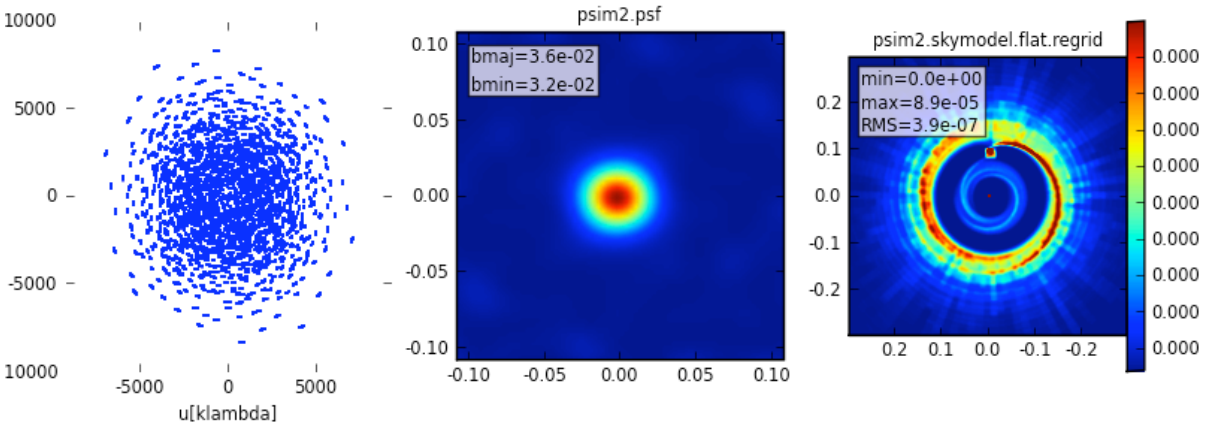
CARMA CO(1-0) mosaic of M99 (data courtesy STINGS team)

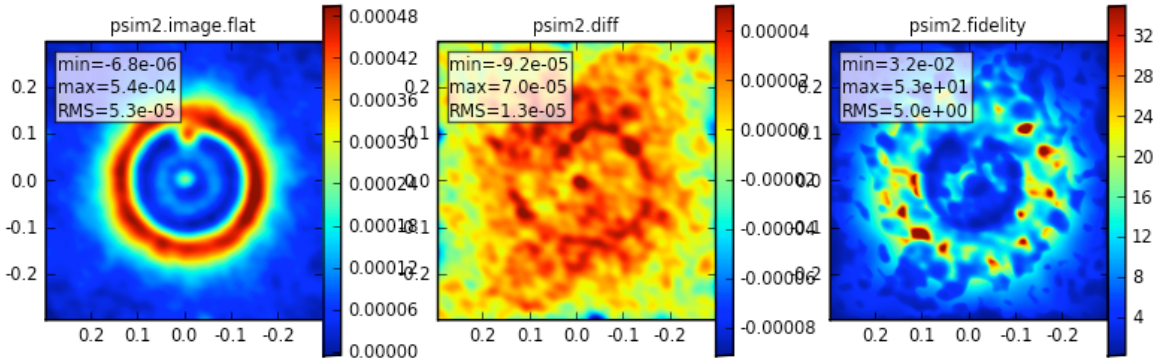
CASA Simulator: "simdata"

ALMA

- 1-stop task to simulate ALMA, EVLA, SMA, CARMA, ATCA, SKA
  - Simulate continuum, simple cubes
  - Create coordinate system for model images
  - Automatically calculate mosaic pointings or manually
  - Optionally interleave a calibrator
  - Simulate total power observations
  - Add thermal noise and linear cross-polarization
  - Re-image the data, interferometric + total power
  - Analyze the difference in output and input images



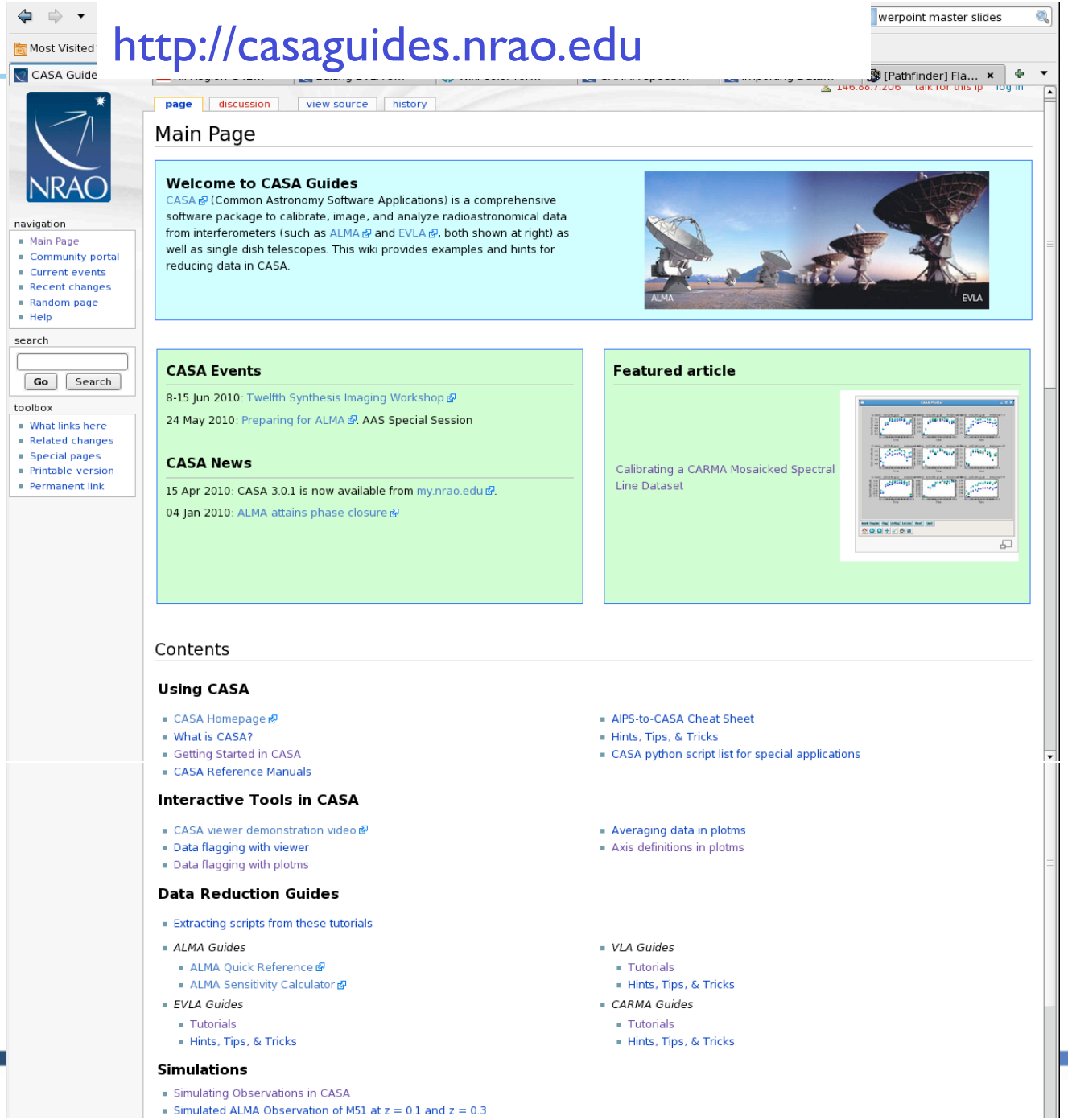




CASAguides

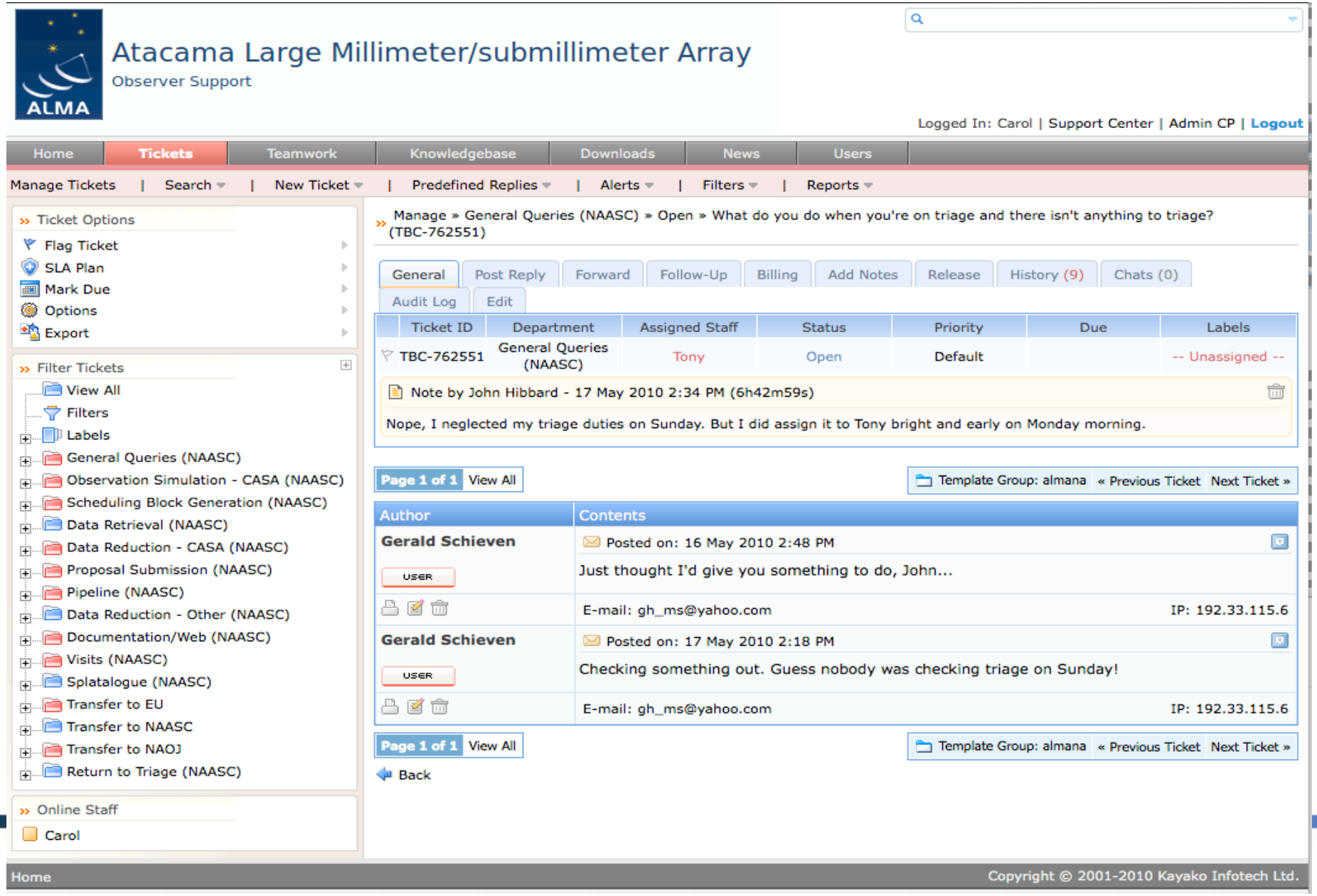
http://casaguides.nrao.edu

- Uses mediawiki to enable fully annotated scripts
- Additional "guides" continue to be added
- NRAO Synthesis Imaging summer school tutorials will be delivered this way



I really need help!

ALMA



ALMA

Splatalogue was created to satisfy ALMA's need to have an up-to-date and complete spectral line database

Until now most observatory software included only a single catalog or ad hoc line list into their:

- Observing tool
- Proposal tool
- Data reduction tool(s)

This is problematic because there are pros and cons associated with each individual list and moreover, these observatory line lists were almost never updated (e.g. BIMA) – a situation that ALMA cannot afford to follow

Our goal is to include all of the standard catalogs (i.e. JPL, CDMS) plus others from around the world (i.e. ToyaMA, SLAIM, OSU), and also recombination and atomic lines

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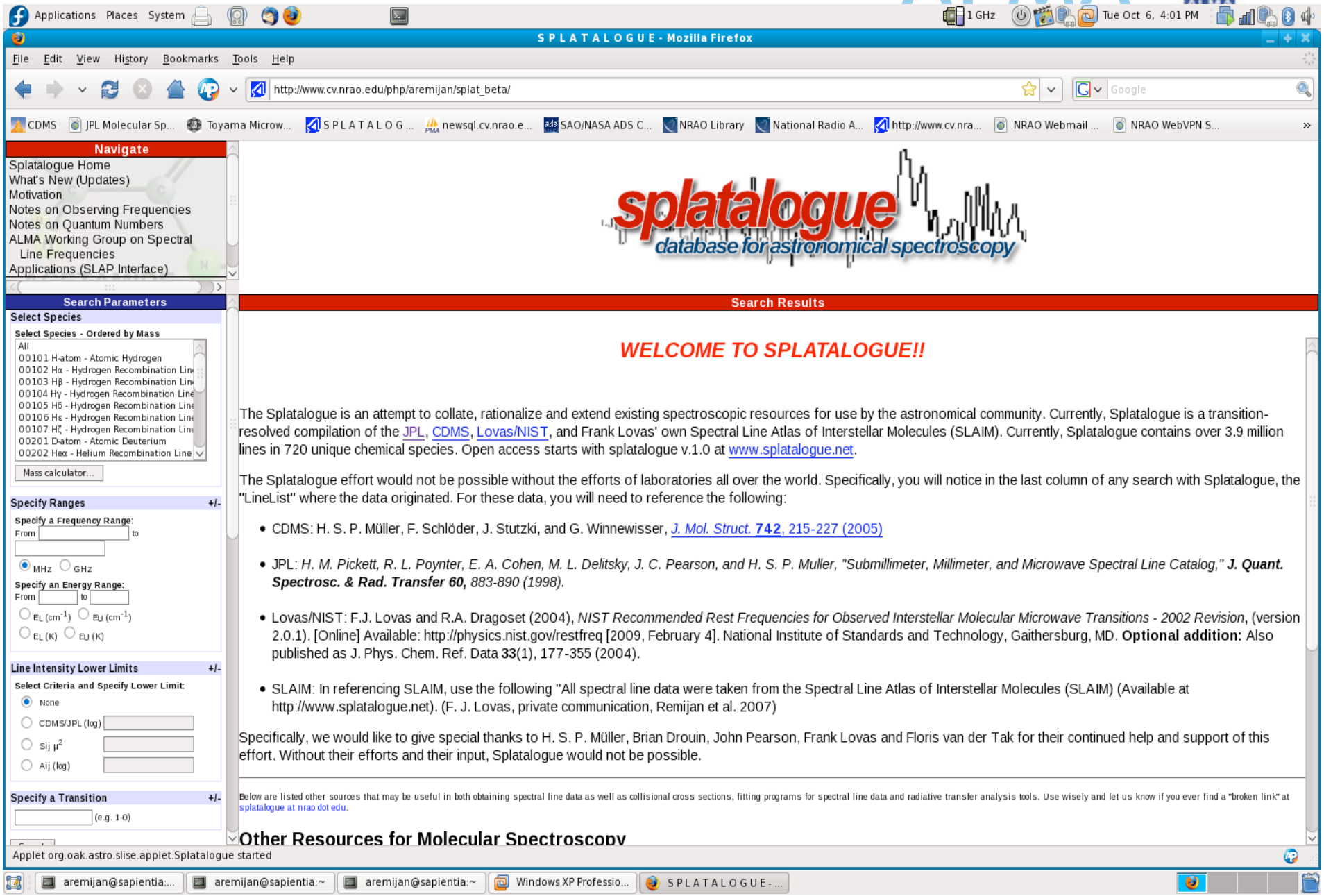
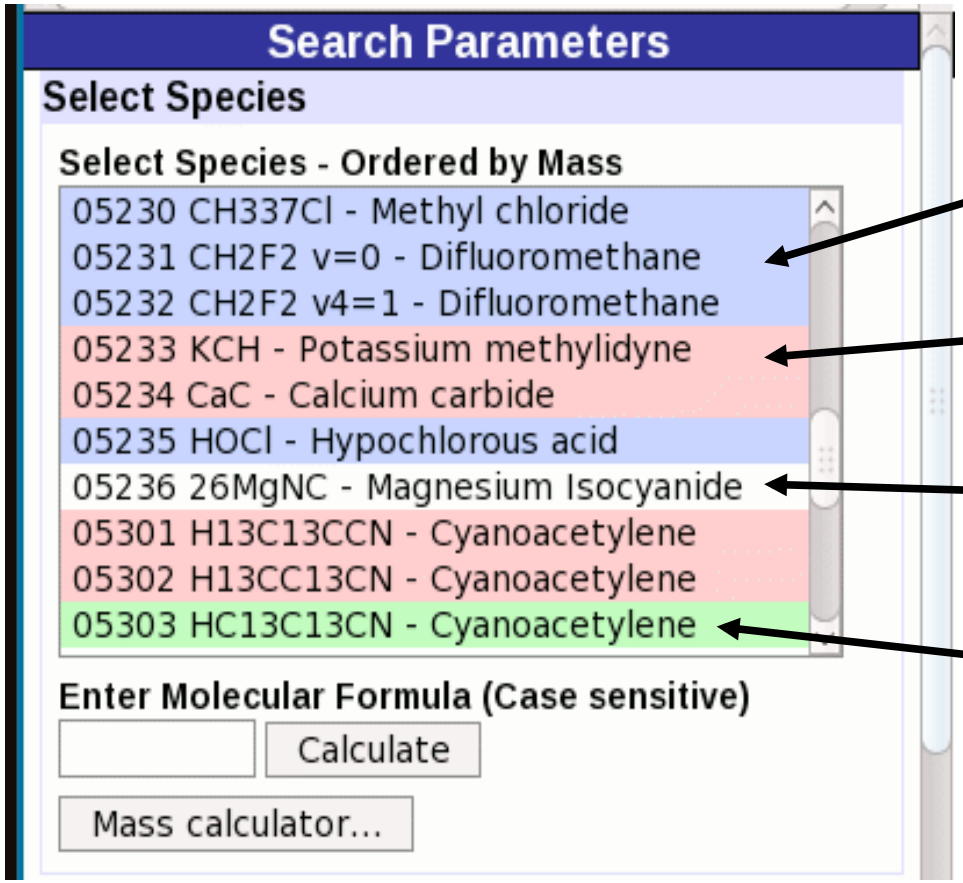
What else you got for us?



splatalogue
database for astronomical spectroscopy

ALMA



BLUE
(atmospheric)

RED
(possible)

WHITE
(known)

GREEN
(probable)

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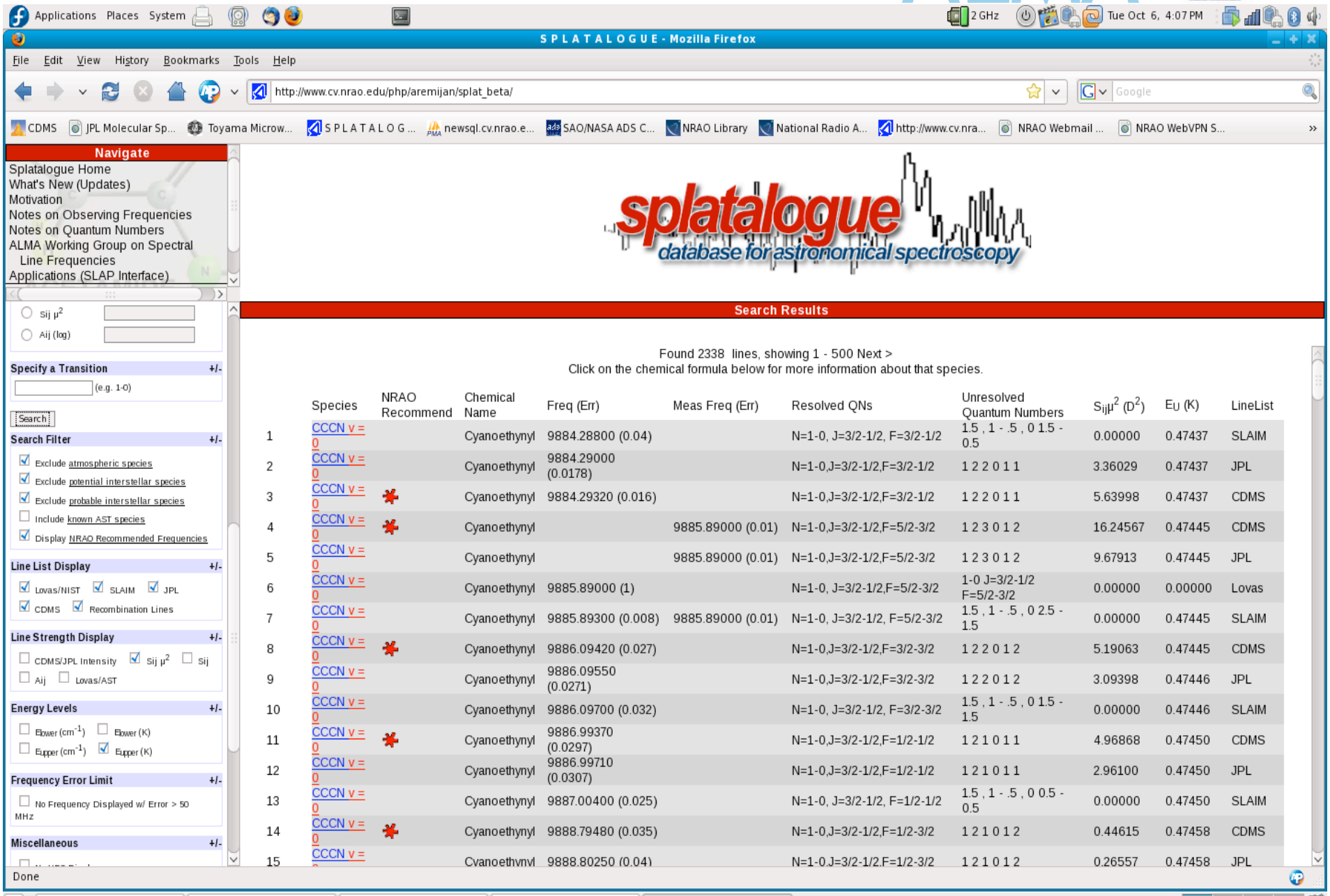

	Species	NRAO Recommend	Chemical Name	Freq (Err)	Meas Freq (Err)	Resolved QNs	Unresolved Quantum Numbers	$S_{ij}\mu^2$ (D^2)	E_U (K)	LineList
1	CCCN v = 0		Cyanoethynyl	9884.28800 (0.04)		N=1-0, J=3/2-1/2, F=3/2-1/2	1.5 , 1 - .5 , 0 1.5 - 0.5	0.00000	0.47437	SLAIM
2	CCCN v = 0		Cyanoethynyl	9884.29000 (0.0178)		N=1-0,J=3/2-1/2,F=3/2-1/2	1 2 2 0 1 1	3.36029	0.47437	JPL
3	CCCN v = 0	*	Cyanoethynyl	9884.29320 (0.016)		N=1-0,J=3/2-1/2,F=3/2-1/2	1 2 2 0 1 1	5.63998	0.47437	CDMS
4	CCCN v = 0	*	Cyanoethynyl		9885.89000 (0.01)	N=1-0,J=3/2-1/2,F=5/2-3/2	1 2 3 0 1 2	16.24567	0.47445	CDMS
5	CCCN v = 0		Cyanoethynyl		9885.89000 (0.01)	N=1-0,J=3/2-1/2,F=5/2-3/2	1 2 3 0 1 2	9.67913	0.47445	JPL
6	CCCN v = 0		Cyanoethynyl	9885.89000 (1)		N=1-0, J=3/2-1/2,F=5/2-3/2	1-0 J=3/2-1/2 F=5/2-3/2	0.00000	0.00000	Lovas
7	CCCN v = 0		Cyanoethynyl	9885.89300 (0.008)	9885.89000 (0.01)	N=1-0, J=3/2-1/2, F=5/2-3/2	1.5 , 1 - .5 , 0 2.5 - 1.5	0.00000	0.47445	SLAIM
8	CCCN v = 0	*	Cyanoethynyl	9886.09420 (0.027)		N=1-0,J=3/2-1/2,F=3/2-3/2	1 2 2 0 1 2	5.19063	0.47445	CDMS
9	CCCN v = 0		Cyanoethynyl	9886.09550 (0.0271)		N=1-0,J=3/2-1/2,F=3/2-3/2	1 2 2 0 1 2	3.09398	0.47446	JPL
10	CCCN v = 0		Cyanoethynyl	9886.09700 (0.032)		N=1-0, J=3/2-1/2, F=3/2-3/2	1.5 , 1 - .5 , 0 1.5 - 1.5	0.00000	0.47446	SLAIM
11	CCCN v = 0	*	Cyanoethynyl	9886.99370 (0.0297)		N=1-0,J=3/2-1/2,F=1/2-1/2	1 2 1 0 1 1	4.96868	0.47450	CDMS
12	CCCN v = 0		Cyanoethynyl	9886.99710 (0.0307)		N=1-0,J=3/2-1/2,F=1/2-1/2	1 2 1 0 1 1	2.96100	0.47450	JPL
13	CCCN v = 0		Cyanoethynyl	9887.00400 (0.025)		N=1-0, J=3/2-1/2, F=1/2-1/2	1.5 , 1 - .5 , 0 0.5 - 0.5	0.00000	0.47450	SLAIM
14	CCCN v = 0	*	Cyanoethynyl	9888.79480 (0.035)		N=1-0,J=3/2-1/2,F=1/2-3/2	1 2 1 0 1 2	0.44615	0.47458	CDMS
15	CCCN v =		Cyanoethynyl	9888.80250 (0.04)		N=1-0,J=3/2-1/2,F=1/2-3/2	1 2 1 0 1 2	0.26557	0.47458	JPL

splatalogue database for astronomical spectroscopy

ALMA

Note how Splatalogue reports the quantum numbers

"Click on" the chemical formula

Found 2217 lines, showing 1 - 500 Next >
Click on the chemical formula below for more information about that species.

Species	Chemical Name	Freq (Err)	Meas Freq (Err)	Resolved QNs	Unresolved Quantum Numbers	$S_{ij}\mu^2$ (D^2)	E_U (cm^{-1})	LineList
CCCN v = 0	Cyanoethynyl	9884.29000 (0.0178)		N=1-0,J=3/2-1/2,F=3/2-1/2	1 2 2 0 1 1	3.36029	0.32970	JPL
CCCN v = 0	Cyanoethynyl	9884.29320 (0.016)		N=1-0,J=3/2-1/2,F=3/2-1/2	1 2 2 0 1 1	5.63998	0.32970	CDMS
CCCN v = 0	Cyanoethynyl		9885.89000 (0.01)	N=1-0,J=3/2-1/2,F=5/2-3/2	1 2 3 0 1 2	16.24567	0.32976	CDMS
CCCN v = 0	Cyanoethynyl		9885.89000 (0.01)	N=1-0,J=3/2-1/2,F=5/2-3/2	1 2 3 0 1 2	9.67913	0.32976	JPL
CCCN v = 0	Cyanoethynyl	9886.09420 (0.027)		N=1-0,J=3/2-1/2,F=3/2-3/2	1 2 2 0 1 2	5.19063	0.32976	CDMS
CCCN v = 0	Cyanoethynyl	9886.09550 (0.0271)		N=1-0,J=3/2-1/2,F=3/2-3/2	1 2 2 0 1 2	3.09398	0.32976	JPL
CCCN v = 0	Cyanoethynyl	9886.99370 (0.0297)		N=1-0,J=3/2-1/2,F=1/2-1/2	1 2 1 0 1 1	4.96868	0.32979	CDMS
CCCN v =	Cyanoethynyl	9886.99710		N=1-0,J=3/2-1/2,F=1/2-1/2	1 2 1 0 1 1	2.96100	0.32979	JPL

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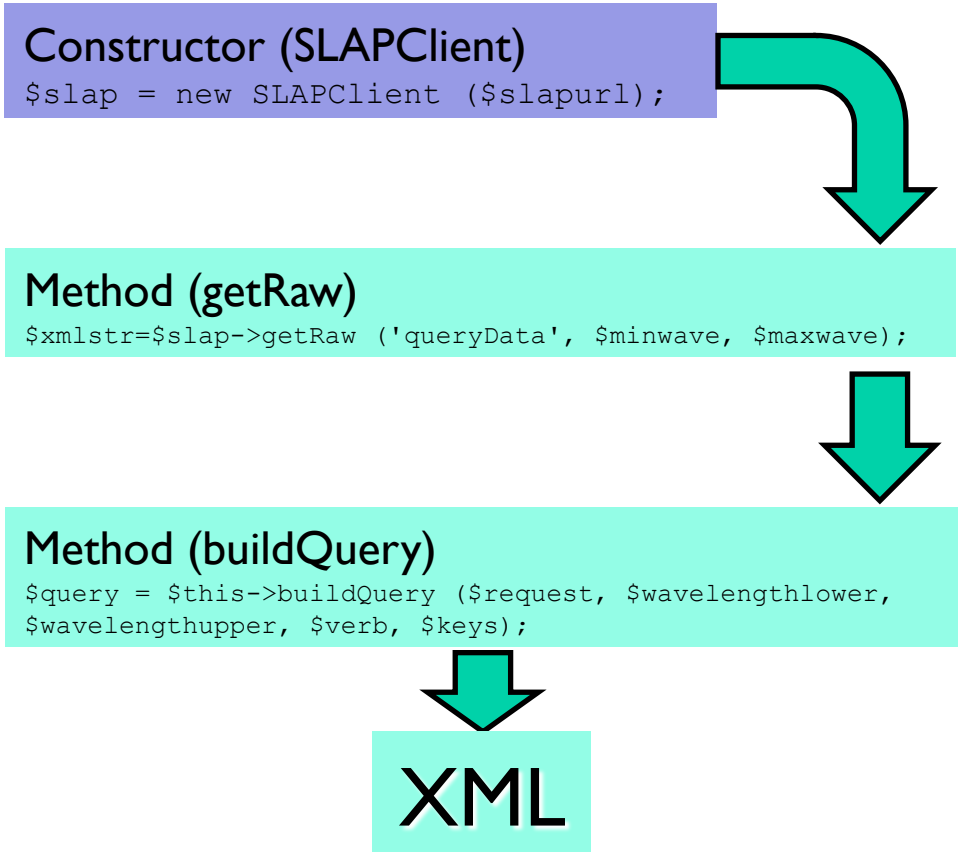
SLAP example with PHP

- A Simple Line Access Protocol (SLAP) client written in PHP was created to test the new SLAP server at NCSA.
- The class contains methods to query the SLAP service and return an XML file – readable by variety of VO programs and web services.
- The class can be easily implemented in a web page or form.
- It requires Chris Miller's IDL library, which is also included in the directory:
  - ftp://ftp.cv.nrao.edu/NRAO-staff/bkent/slap/idl/



Slide provided by Brian Kent

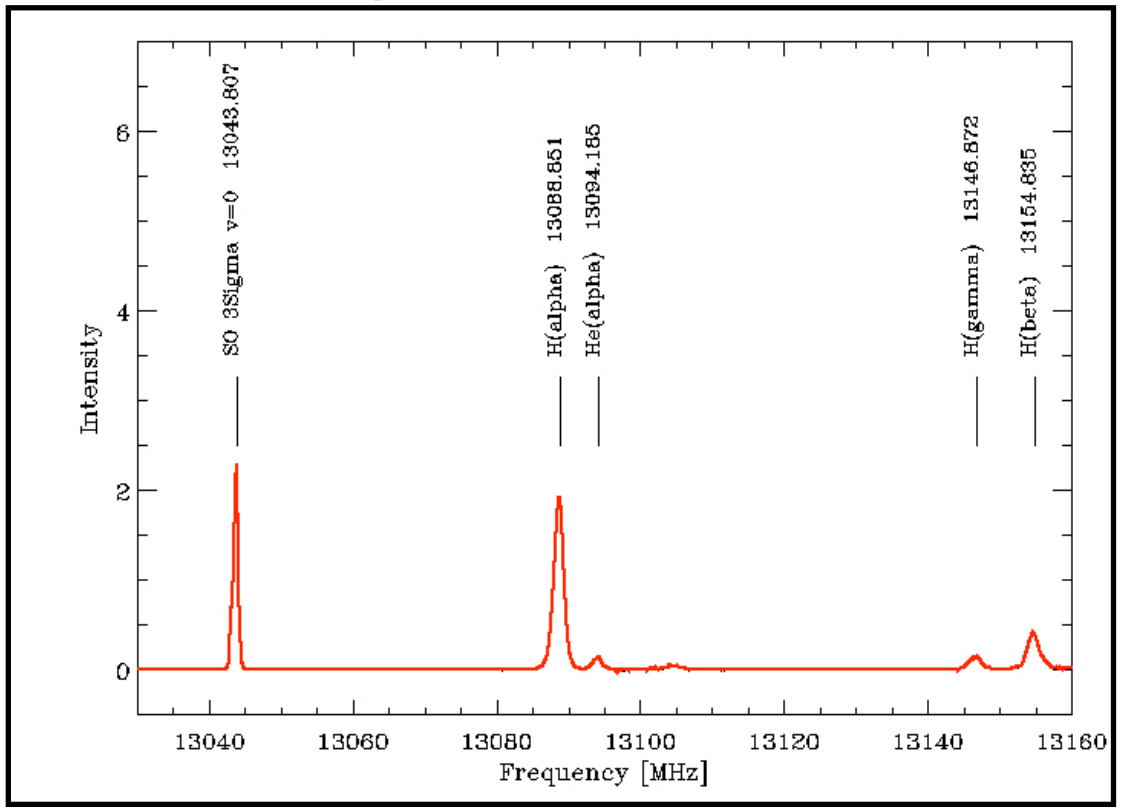
SLAP example with IDL

- The SLAP service can be also used within a scripting or programmatic interface.
- Using IDL:

```
xrange=[13030.0,13160.0]    ;MHz

minwave=c/(xrange[1]*1.0e6) ;meters

maxwave=c/(xrange[0]*1.0e6) ;meters

url='http://voera.ncsa.uiuc.edu:8080/
splat-slap/slap'

slapsearch, url, minwave, maxwave, slap
```

```
IDL> help, slap, /st
** Structure <a9c2054>, 9 tags,
       length=84, data length=84, refs=1:

CREATED               STRING   '2010-03-09'
TITLE                 STRING   Array[1]
CATALOGNAME           STRING   Array[1]
WAVELENGTH            DOUBLE   0.023060131
FREQUENCY             DOUBLE   13000.466
MOLECULARFORMULA      STRING   Array[1]
MOLECULETYPE          LONG     0
FREQUENCYRECOMMENDED  LONG     -999
QUANTUMNUMBERS        STRING   Array[1]
```

GBT Ku-band spectrum



Slide provided by Brian Kent

splatalogue
database for astronomical spectroscopy

A stable version of Splatalogue (v1.0)

http://www.splatalogue.net

And if you are not convinced yet…you may want to

Watch this

Demos of Splatalogue, CASA and the OT will be available tomorrow from 2-4PM at the NRAO Booth

THANK YOU !!!

www.almaobservatory.org

The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership among Europe, Japan and North America, in cooperation with the Republic of Chile. ALMA is funded in Europe by the European Organization for Astronomical Research in the Southern Hemisphere, in Japan by the National Institutes of Natural Sciences (NINS) in cooperation with the Academia Sinica in Taiwan and in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC). ALMA construction and operations are led on behalf of Europe by ESO, on behalf of Japan by the National Astronomical Observatory of Japan (NAOJ) and on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI).

NRAO

PREPARING FOR ALMA

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