

RSRO Report

Elisabeth Mills (UCLA)

Period of RSRO Residency: May 29, 2012 - August 27, 2012

Overview

As PI of RSRO Project 11B-210, which consisted of 24 hours of fixed-time observing toward the Galactic Center in DnC configuration, I spent several months in residence at the VLA. This consisted of several weeks in both December, 2011 and January, 2012 spent preparing for and setting up the observations, and performing an initial calibration, and then three months (from late May to late August, 2012) spent analyzing the data and assisting with various observatory projects. The bulk of my time in residence was spent in conjunction with my Co-I on the project, Professor Cornelia Lang (U. Iowa). Below, I describe my Summer RSRO contributions (which included assisting with the Synthesis Imaging workshop (SIW), as well as testing and documentation), and some initial results from the data we obtained.

Assisting with the 13th SIW

At the beginning of my RSRO stay, I volunteered to help with the 13th SIW. I provided assistance with several aspects of the workshop: running tutorials for the VLA and ALMA observing tools, and leading VLA tours. First, from the experience I gained setting up my own RSRO observations in December and January, I was able to help lead a several hour tutorial on using the RSRO features of the VLA Observation Preparation Tool which would be standard for the next proposal call. I also assisted with a several hour tutorial on using the ALMA Observing Tool, in advance of their summer call for proposals. Finally, I was one of several tour guides to lead a group through a half-day visit of the the VLA site.

Contributions:

1. Helped lead a demonstration and tutorial of the VLA Observation Preparation Tool
2. Gave a guided Saturday tour of the VLA site
3. Assisted with a demonstration of the ALMA Observing Tool

Testing

My summer residence coincided with the 13A call for proposals in early August, which required both software upgrades and the development of new tools to cover the enhanced capabilities being offered. As part of my RSRO duties, I helped to test several of these new offerings. First, using my experience setting up RSRO spectral line observations, I was able to test both the html and python versions of the *TUNE* script developed by Nirupam Roy. This script determines the optimum placement of lines in the fixed 128 MHz spectral windows, and the corresponding baseband frequencies to be input into the proposal submission tool (PST) and observing submission tool (OST). I ran multiple test scenarios through the code, using both my RSRO setup as well as other complicated line setups. I then provided a written feedback document with suggestions to Nirupam in advance of the public release of this tool.

In addition to testing *TUNE*, I also tested the implementation of 15 minute granularity into the PST. This was an option to allow for additional flexibility in specifying the start time, end time, and overall length of scheduling blocks. I tested a variety of scheduling block lengths and start times, and reported my findings back to the developers.

Contributions:

1. Tested the *TUNE* tool, developed by Nirupam Roy to set up spectral line observations
2. Tested the implementation of 15 minute time granularity in the Proposal Submission Tool

Documentation

Cycle 13A:

The 13A call for proposals also required new documentation for the additional capabilities available for this cycle. I helped with two pieces of this documentation: editing Juergen Ott's *Spectral Line Guide*, and writing up one of two test cases for Joanna Corby's *Spectral Line Examples* document. In preparation for the public release of Juergen's Spectral Line Guide, a document describing how to prepare spectral line observations, I edited this document and provided suggestions for modifying its structure and language. To further help users understand how to utilize the new proposal tools available for Cycle 13A, Joanna Corby put together a Spectral Line Examples document. I wrote the first test case for this document, a line and continuum setup that was based on my own RSRO observations, and that detailed the necessary considerations for setting up such an observation using *GOST* and *TUNE*.

Casaguides:

After the call for proposals, I worked with Juergen Ott to update the Casaguides wiki, to make the layout more streamlined, easier to navigate, and generally more user-friendly.

In preparation for making changes, I solicited feedback on the current layout from a group of peers who are current users of Casaguides, to determine how they used Casaguides, and its perceived strengths and weaknesses. A common weakness that was noted was the inability to locate content, which I worked to remedy by making links more visible on the front page, and by making sure that direct links to the majority of the content can be found on several main pages which consolidate links to available guides – 'Hints, Tips, and Tricks', 'User Contributed Scripts and Tasks', and a new page listing all of the current tutorials. Finally, I also annotated the available documentation on the spectra line viewer, a tool I used frequently this summer, and transformed it into a Casaguides page accessible on the wiki.

Contributions:

1. Edited and provided feedback on Juergen's Spectral Line Guide
2. Documented a test observing case for Spectral Line Examples guide
3. Updated the Casaguides wiki:
 - (a) Redesigned the front page so that more content is immediately visible, tutorials have direct links, and the linked content is described
 - (b) Made a new page with a list of all (current, v3.3 and v3.4) CASA data tutorials

- (c) Reorganized the Tips and Tricks page, added more links to existing content
 - (d) Reorganized the User-contributed Tasks page so that all tasks are more visible, added more links to existing scripts
4. Created a Spectral viewer tutorial for casaguides

Data

Our RSRO Project (11B-210) consisted of 24 hours of fixed-time observing toward the Galactic Center in DnC configuration. RSRO capabilities tested by this data included observing multiple spectral windows of different widths and numbers of channels, and sustaining a high data rate, using a large number of baseline boards. The observations were designed to optimize both continuum and spectral line data. The main science goal of these observations was to probe the conditions on Galactic center molecular clouds, particularly their heating sources and their potential to form stars. To achieve this goal, our observations:

- Took advantage of the increased continuum sensitivity to make a thorough census of continuum emission in Galactic center molecular clouds
- Mapped ammonia (1,1) through (9,9) in a sample of six molecular clouds, to allow for the construction of detailed temperature maps
- Mapped the 36 GHz methanol maser line, a shock tracer, in these same clouds.

Early results of our observations indicate several exciting results, including the widespread prevalence of the 36 GHz methanol masers in Galactic center clouds, with dozens of masers in each cloud, as well as the surprising presence of ammonia (3,3) masers in several clouds. In late July, we submitted an exploratory proposal to follow up on these results toward on of our target sources.

On July 18, I gave a Wednesday lunch talk on the the results of this data, as well as my related thesis work using the GBT and Atacama Pathfinder Experiment (APEX) telescope. After the talk, I made images from these data, including our deep continuum maps and maps of the 36 GHz methanol masers, available to NRAO staff for use in various internal and external presentations.

Contributions:

1. Gave a public lunch talk on the initial results of these data
2. Provided publicity slides from this data to NRAO for various internal and external presentations
3. Submitted an Exploratory proposal for timely follow-up of one of our most exciting results: widespread 36 GHz maser emission.

Links

Spectral Line Guide: <https://science.nrao.edu/>

Spectral Line Examples: <https://science.nrao.edu/facilities/evla/observing/spectral-line-observing-examples>

Casa Guides test page: casaguides.nrao.edu/index.php?title=NewPage

Spectral Viewer Tutorial: casaguides.nrao.edu/index.php?title=Spectral_Viewer