CIRADA Newsletter: August 2020

CIRADA is now two years into its five-year program. We have a full team of software developers on board, and many of our planned products and releases are taking shape. The program has experienced delays in the delivery of external data sets, along with the disruption and readjustments imposed by the COVID-19 pandemic. Nevertheless, excellent progress is being made across all CIRADA projects, and the upcoming timelines and risks are well understood. Everyone across CIRADA should be congratulated on a strong year, in which CIRADA has achieved significant national and international visibility, and has positioned itself well to meet its original goals.

CIRADA annual project review

CIRADA's annual project review took place over Aug 13-18, 2020. Each project presented the status of their work, and received feedback from external reviewers. The main findings and outcomes were:
- Significant progress has been made across all projects towards the creation of end-to-end pipelines that will generate science ready data products.
- More work is required with regards to overall CIRADA database and user-interface design, beyond CARTA, while managing scope.
- There seems to be a challenge engaging the broader astronomy community for feedback to make the products more useful and to expand the user base.
- The project team should review hardware needs to ensure that teams' progress in not hindered by a lack of resources.

Project Updates

Polarimetry
(Jennifer West, Cameron van Eck, Bryan Gaensler)

Data from the POSSUM pilot survey was observed in late 2019 (10 fields, ~360 sq deg.), and now has been processed and made available to the CIRADA team.

In the coming weeks, the data will be validated with CIRADA developed scripts and transferred to the CADC for further processing with CIRADA pipelines in the coming weeks. The "RM-Tools" software analysis package has now been officially released, and is available on Github and PyPi (pip). It offers the following features for polarimetric analysis:
- Rotation measure (RM) synthesis and RM-CLEAN, for sources including peak-fitting and uncertainty estimation.
- RM synthesis and RM-CLEAN for data cubes, for resolved sources and diffuse emission.
- QU-model fitting for sources including multiple models and uncertainty estimation.
- Helper scripts for extracting sub-regions from FITS cubes, and for breaking/reassembling large cubes into/from smaller pieces for efficient processing

Continuum
(Adrian Vantyghem, Yjan Gordon, Michelle Boyce, Chris O'Dea, Larry Rudnick)

Version 1 of the CIRADA VLASS quick look catalogue, containing ~1.6M unique and reliable components plus >600k host identifications is now available. The catalogue, described in full in the user guide (https://www.cadc-ccda.hia-iha.nrc-cnrc.gc.ca/files/vault/cirada/continuum/VLASS_QL_comp_catalogues_yg/VLASS1QLCIR_v1/VLASS1QLCIR_user_guide_v1.pdf) is structured in three joinable tables:

> 1) A Component Table (~3.4 million rows), providing measurements and additional quality metrics on the radio components detected in the quick look images

> 2) Host ID Table (~700,000 rows), containing unWISE host identifications for bright and isolated radio sources (groupings of one or more radio components representing a single object) with relatively simple morphology, i.e. either a single component or double/triple sources smaller than 10".

> 3) Subtile Information Table (~35,000) that provides metadata and statistics for the individual quick look images.

Users should read the User Guide in full before using this data. At a minimum, users should be aware that the catalogue contains bad data as well as good; we recommend only using data from the Component Table with Quality_flag == 0 and Duplicate_flag < 2, and from the Host ID table with P_Host > 0.8 and Source_reliability_flag == 0 for most cases.

The latest version of PINK, a self-organizing map developed by Tim Galvin, is being used on one field of the ASKAP EMU data pilot survey, as well as on a subset of VLASS Qicklook data, to produce first versions of enhanced EMU and VLASS catalog data products with complex source IDs.

CIRADA is also collaborating with EMU on software that will produce enhanced, science-ready catalogs for VLASS Single Epoch and Cumulative images when they become available. In the short term, this is being applied to ASKAP continuum observations (EMU) that are required as input to the POSSUM polarization catalog work.

Transients
(Falon Scheers, Greg Sivakoff)

Version 2 of the CIRADA cutout web service is now available on the CIRADA portal; details regarding functionality are available in the SRS on our product page.The team is currently working on version of a transient marshal in preparation for the release of VLASS 2.1 QL images.

21cm emission
(Nathan Deg, Kristine Spekkens)

The WALLABY team has begun analysis on pilot data for the Hydra field. There are ~150 objects in this field, and, at CIRADA we are working on an initial kinematic analysis of the

large' resolved galaxies. The latest WALLABY newsletter is available [here](#) and a new newsletter will be sent out in August 2020.

CHIME slow pulsar search
(Chia Min Tan, Davor Cubranic, Vicky Kaspi, Ingrid Stairs)

The team is testing an end-to-end software pipeline that temporarily stores CHIME FRB data and looks for slow pulsars, using the novel "H-hat" algorithm developed at Perimeter Institute

CHIME cosmology and 21cm emissions
(James Willis, Richard Shaw, Anja Boscovic, Rick Nitsche, Mark Halpern, Ue-Li Pen)

The team is developing and testing the Kotekan software pipeline that processes raw CHIME cosmology data

Partner Updates

CSIRO

Earlier this year, ASKAP concluded observations for its first phase of pilot surveys. These observations were designed to assess data quality from the telescope and verify that we could produce science-ready data from our processing workflows. Tuning of the processing parameters requires iteration with the survey science teams, so processing is still ongoing and is expected to conclude late this year. Several large-scale data sets are already available on ASKAP's science data archive (https://research.csiro.au/casda/).

While the survey science teams assess the results of pilot survey phase I, we are busy planning pilot survey phase II, which will focus on optimising our observing strategies.

The latest news and information on ASKAP is published in a monthly newsletter which can be found at https://www.atnf.csiro.au/projects/askap/commissioning_update.html

CADC

In support of the CIRADA project the CADC is providing:
1. Archival data services in the CADC:
    1. Continually transferring VLASS quicklook images from NRAO as they become available, generating preview images and ingesting metadata into the CADC observation database.
    2. VLASS data is discoverable by using the AdvancedSearch GUI, astroquery.cadc module or direct queries to the TAP service.

3. Data access is by whole file or by cutout on spatial and/or energy constraints.
4. To date: 35,616 first epoch and 1,185 second epoch observations are available
2. Storage services in CANFAR
   1. Vault object store: using 2.53 TB of a 10 TB allocation
   2. Cavern file system: using 4.1 TB of a 10 TB allocation
   3. Persistent store in cloud: 19.5 TB of a 19.5 TB allocation
   4. Access to storage is controlled by CIRADA group membership
3. Interactive virtual machines in CANFAR
   1. Running 8 virtual machines continuously
   2. Using 11 floating public IPs   , 104 virtual CPUs and 900 GB RAM.
   3. Access to these VMs is controlled by CIRADA group membership
4. Batch processing with virtual machines in CANFAR
   1. Currently not used by CIRADA
5. Youcat database as a service in CANFAR
   1. 4 catalog tables created and tested in the CIRADA database allocation
   2. All tables query-able through the youcat TAP service
   3. Access to these tables is controlled by CIRADA group membership
6. Interactive container deployments in CANFAR
   1. CARTA deployed and operating on files in the Cavern file system
   2. Access is by individual request.
7. Access control groups
   1. 6 CIRADA groups created and assigned to different resources
   2. Membership to groups is administered by CIRADA project management
   3. The access control is integrated in all services and resources mentioned above.
8. CADC staff support
   1. Supporting various CIRADA team members with using the above services, planning workflows or defining data products to be persisted.
   2. Serving on the CIRADA Management Committee to ensure coherent interaction between CIRADA and CADC/CANFAR.
   3. Serving on the CIRADA Science Board to maintain active understanding of the evolution of the CIRADA Science impact and providing oversight of the overall project.
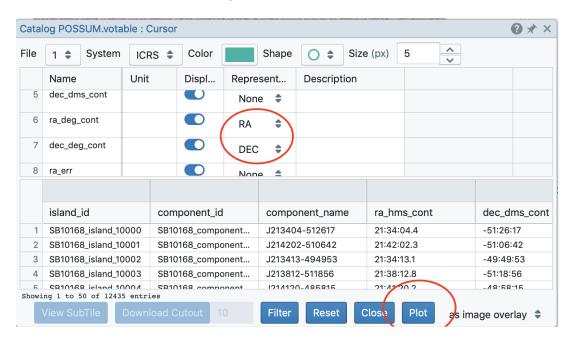
Database & Visualization Update

We continue to work closely with CADC/CANFAR who are providing us with important computing resources, file storage, and database storage/access.The OpenStack cloud computing platform has been a vital infrastructure as a solution (IaaS) environment for hosting our website and web services, as well as providing virtual machines for pipeline development.The VOSpace file system continues to satisfy our permission-based file storage needs across all teams. Files and directories are being accessed both manually via

the web and programmatically via an API.The YouCat database service is allowing us to store and access our enhanced catalogues in an IVOA-compliant manner, allowing our catalogues to be accessed by the community via TAP and ADQL.Our database currently contains early enhanced Continuum and Polarimetry tables. We expect more tables to be added in the next several months as BDPs arrive and pipeline development continues. We are working on developing a web interface, with a table viewer, that will make table querying and cross-matching of our tables easy for users.We are beginning to use the Cavern file system along with the Arcade tool. Cavern will be crucial for allowing quick and local access to large input files (e.g. polarization cubes) for pipeline execution within the VM environment as well as image visualization within the on-site CARTA environment.
The 1.3 release of CARTA, our main data visualization tool, is currently installed on-site at CADC with access to several large POSSUM Pilot cubes that have been transferred to the Cavern file system. A more recent build version of CARTA is currently installed on our web server for testing potential CIRADA customizations.

CIRADA portal

The CIRADA portal is now live at cirada.ca, with a link to the old CIRADA wiki site available as a link from the front page.The portal will eventually contain links to all the services and products that CIRADA provides. Currently we have the VLASS cutout server, links to our released RM code, and VLASS quick look catalogues.The portal also contains links showing our work on the CARTA image viewer. You can access CARTA through the Services tab, using the username cirada and password cirada2020. There you can load a part of the POSSUM image being studied by the Polarization team and their catalogue. To visualize the catalogue using a prototype catalogue viewer, select "Append Catalog" from the File menu. To plot POSSUM.votable catalogue on the image, you can select the mapping of ra_deg and dec_deg columns to the RA and DEC image axes and select the Plot button (see attached.)

CIRADA Publication policy

There are broadly two types of outputs expected resulting from CIRADA activity: releases of data, software, catalogues and tools, and journal publications. The process for each is different.

General considerations:Journal publications cannot be produced using CFI funding, so if you're doing any time- or effort-tracking, the actual writing/submitting of the paper plus any astrophysics/science in the paper both need to be on ***non-CIRADA time***. (But all the non-science work leading up to the paper, anything in the paper which is actually documentation, and the catalogue itself, can all be worked on within CIRADA.)

- **Authorship:** CIRADA is not a scientific collaboration, so there are no "builders' lists", no opportunity for everyone in CIRADA to opt in as authors, and no requirement to circulate papers for comment across CIRADA. CIRADA members and investigators should not expect to be authors on any publications except for things they've personally worked on or contributed to.
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Quality control: A crucial part of CIRADA is quality control and quality assurance. The project office will provide internal processes for this.

Approval process: Advance approval from the CIRADA director and deputy director must be obtained before submission/release of all products and publications. Please submit such requests to the project manager. Turnaround will usually be rapid, no more than 5 business days.**Output tracking:** The project management office needs to know when a paper is submitted, then accepted, then published, so that the relevant publication list can be kept up to date. Please keep the project manager up to date on the progress of all publications. All releases and publications must be either hosted or linked to from the CIRADA portal.

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- **Standard CIRADA Acknowledgement**: There is a standard CIRADA acknowledgement that all papers should include