

# SKA Regional Centre Activities in Canada

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**October 8, 2018**

**Canadian Astronomy Data Centre**

**Herzberg Astronomy and Astrophysics**



# SKA Pre-cursor activities



# CIRADA

CANADIAN INITIATIVE FOR RADIO ASTRONOMY DATA ANALYSIS

The screenshot shows the CADC website interface. At the top, it says "Canadian Astronomy Data Centre" with the Canada logo. Below this is a navigation bar with "Telescope Data Products", "Advanced Data Products", "Services", "Advanced Search", and "Login". A search bar is present with the text "Search for data by target" and a "Search" button. Below the search bar are three main sections: "Telescope Data Products" (listing Gemini, CFHT, JCMT, HST, BLAST, MOST, DAO, MACHO, QMM, EUSE, UKIRT), "Advanced Data Products" (listing MegaPipe, HLA, IRIS, CGPS, CENTLS, WIRwolf), and "Services" (listing Meetings, Community, and CANFAR). The footer includes "Terms and conditions", "Transparency", "About us", "News", and "Contact us".

The screenshot shows the CANFAR website interface. At the top, it says "CANFAR" with the logo and a "Login" button. Below this is the text "Canadian Advanced Network for Astronomical Research" and two buttons: "Take the tour" and "Documentation". The main content area features a grid of icons for "Storage", "Batch Processing", "Team Management", "Data Bench", "CANFAR Search", and "Open Stack". The footer includes "© 2018-2019", "Download" (with sub-items "Client applications" and "Web services"), social media icons for GitHub, Twitter, and a hashtag, "About" (with sub-items "CANFAR", "Astronomy", "Privacy", "Terms"), and "Acknowledgements" (with sub-items "Canadian Space Agency", "National Research Council", "Canarie", "Compute Canada").

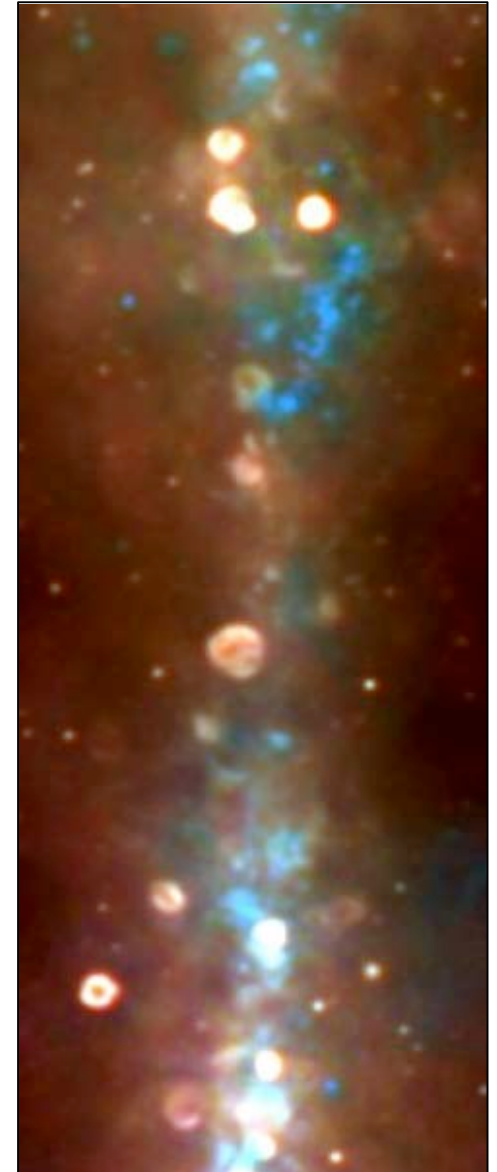
# CIRADA

## › **Canadian Initiative for Radio Astronomy Data Analysis** ([cirada.ca](http://cirada.ca))




- enhanced data products (EDPs) for VLASS, CHIME and ASKAP surveys
- advanced re-processing of raw data
- unified processing software stack
- cross-matches, advanced analytics, visualisation
- long-term archiving and data access
- ***enables full science return from major Canadian science & instrumentation programs***

## › Administrative structure

- CFI Innovation Fund 2017: \$10.6M
- five year program, commenced April 2018
- PI: Bryan Gaensler ; Deputy PI: Erik Rosolowsky
- six Canadian universities: Toronto, Alberta, McGill, Queen's, UBC, Manitoba
- plus NRC/CADC, Compute Canada, NRAO, ASTRON, IDIA, Cornell, Berkeley, Minnesota

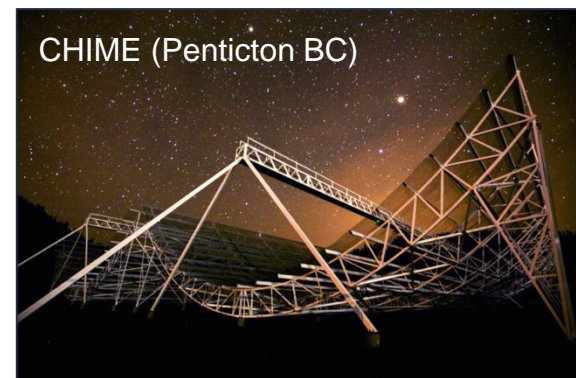


# Upcoming Surveys and Data Products

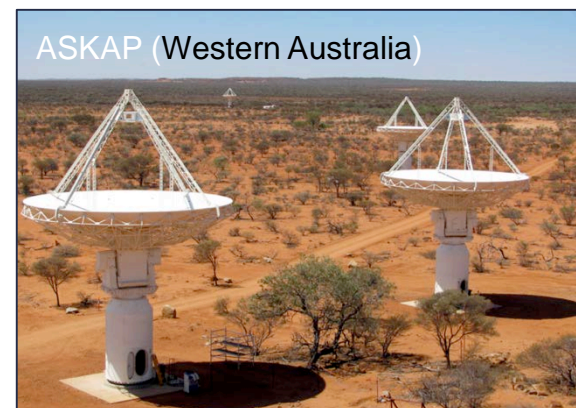
- › Very Large Array Sky Survey (VLASS): ~1 PB 
  - 80% of sky, 2-4 GHz, ~3" resolution
  - 3 epochs, 2017-2024
  - continuum images, polarimetry, time-domain
- › CHIME: ~17 PB 
  - 70% of sky, 400-800 MHz, ~15' resolution
  - commensal surveys for transients, polarisation, pulsar search, HI absorption, CMB foregrounds
- › ASKAP POSSUM & WALLABY: ~1 PB 
  - 75% of sky, 1.1-1.4 GHz, ~10" resolution
  - cosmic magnetism and extragalactic HI
- › Basic Data Products (BDPs)
  - raw data, images, postage stamps, coarse cubes, source catalogues
  - automated standard pipeline
  - produced by observatory
  - not real-time
  - useful for simple science applications



NRAO/AUI/NSF



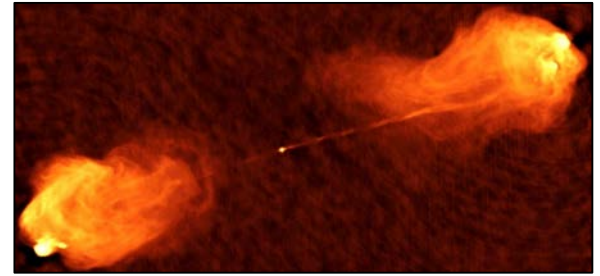
CHIME



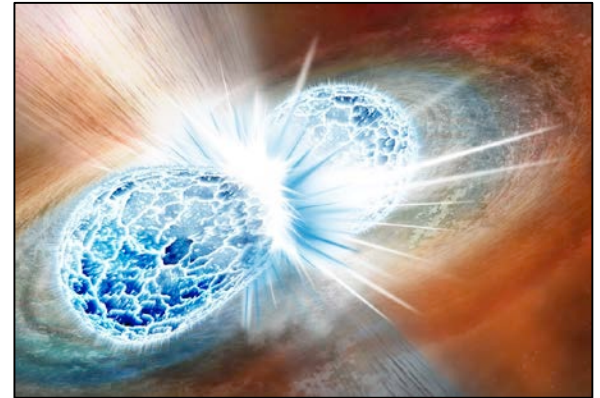
Ant Schinckel

# CIRADA Activities & Products (I)

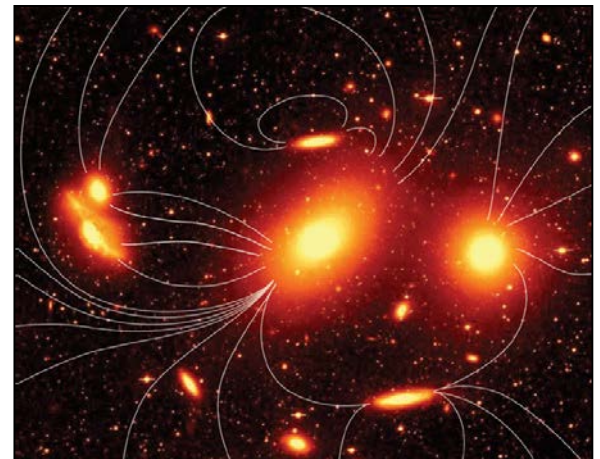
- › Pre-processing and storage
  - VLASS : real-time millisecond imaging
  - CHIME : Fourier transform, de-dispersion
  - CHIME : 1 kHz channelization
  - 10 PB of storage at Compute Canada & CHIME
  
- › Enhanced data products
  - **Advanced continuum** (VLASS, CHIME): component associations, spectral shapes
  - **Transients** (VLASS, CHIME): automatic identification, transient marshal, real-time alerts
  - **Polarimetry** (VLASS, CHIME, ASKAP): RM synthesis and Faraday cubes
  - **Pulsars** (CHIME): all-sky pulsar catalogue
  - **HI absorption** (CHIME): catalogue of  $\sim 10^5$  intervening absorbing galaxies
  - **HI emission** (ASKAP): resolved galaxy characteristics



NRAO/AUI/NSF



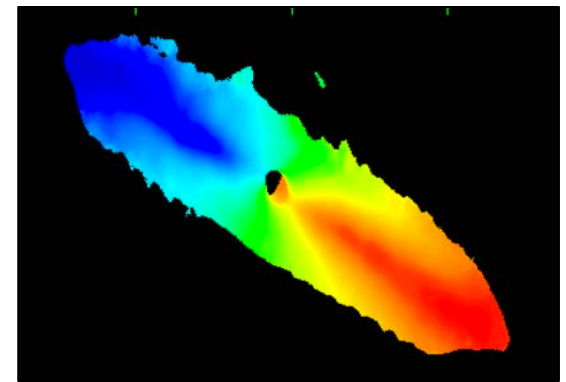
Robin Diemel / Carnegie



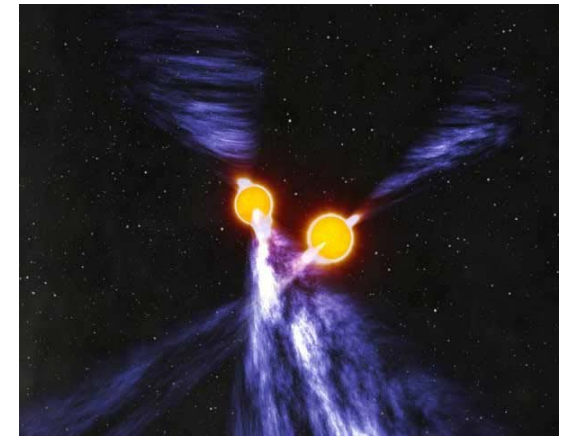
Mihos / Huey / Science

# CIRADA Activities & Products (II)

- › Unified processing software stack
  - coordinated by project-wide lead developer
  - staged public releases
  - able to operate in multiple environments
- › Cross-matching and accessibility
  - multi-wavelength cross-matching
  - high-performance distributed queries
  - Bayesian source classification
  - remote visualisation solutions
- › Long-term archiving by CADC
  - indefinite access to enhanced data products
  - CANFAR customisations to enable software stack
  - custom query interface
  - long-term maintenance of interfaces and data formats



Koribalski et al.



© John Rowe Animations



Cassam-Chenai et al. (2008)

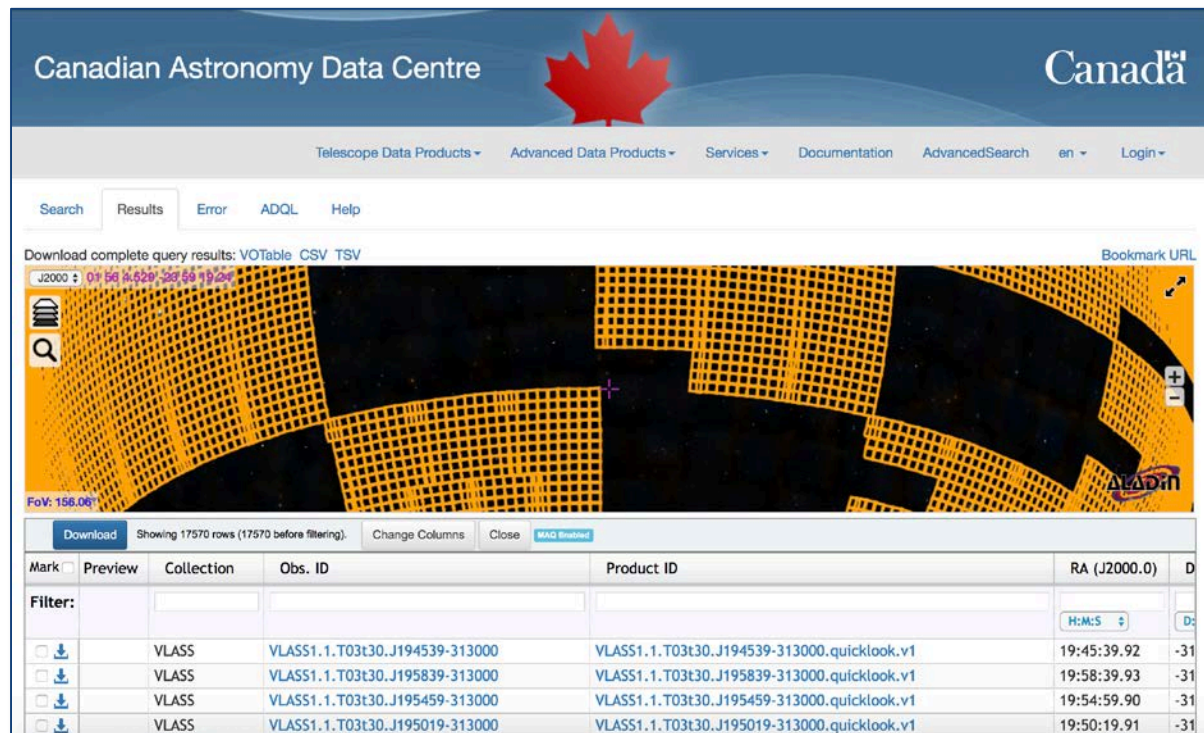
# Canadian Astronomy Data Centre

- National facility for open access
- Telescope collections:
  - Multiple missions, facilities and wavelengths
  - Pointed and survey observations
  - 12 telescopes
  - 6 advanced data collections
- IVOA services on data
  - TAP, SIA, ObsCore, DataLink, SODA
- Development and operations hub for CANFAR

The screenshot shows the Canadian Astronomy Data Centre (CADC) website. At the top, there is a navigation bar with the text "Canadian Astronomy Data Centre" and the "Canada" logo. Below the navigation bar, there is a search box with the text "Search for data by target" and a "Search" button. The main content area is divided into three columns: "Telescope Data Products", "Advanced Data Products", and "Services". Each column contains a grid of icons representing different astronomical facilities and data collections. The "Telescope Data Products" column includes Gemini, CFHT, JCMT, HST, BLAST, MOST, DAQ, MACHO, OMM, FUSE, and UKIRT. The "Advanced Data Products" column includes MegaPipe, ILLA, IRIS, CGPS, CFHTLS, and WIRwolf. The "Services" column includes Meetings, Community, SSOIS, and CANFAR. At the bottom of the page, there is a footer with links for "Terms and conditions", "Transparency", "About us", "Our mandate", "Acknowledgements", "News", and "Contact us". The date "Date modified: 2014-04-28" is also visible.

# Canadian Astronomy Data Centre

- Commitment to support CIRADA and DRAO
- Adding support for radio data formats
- Adding SODA services on radio data
- IVOA discovery and access services
- Integrating VLASS data products



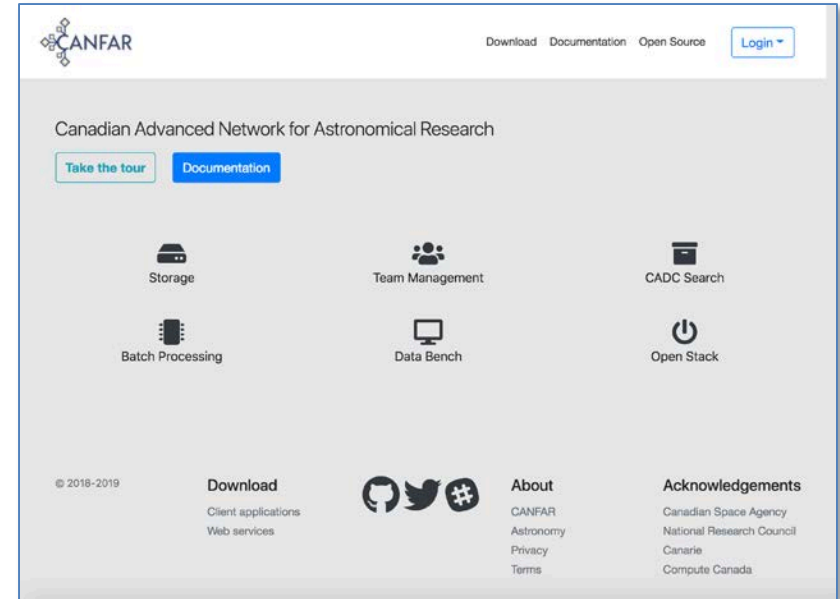
The screenshot displays the Canadian Astronomy Data Centre (CADAC) website interface. The header includes the site name, a red maple leaf logo, and the Canadian flag. Navigation links include Telescope Data Products, Advanced Data Products, Services, Documentation, AdvancedSearch, en, and Login. The main content area shows search results for VLASS data products, including a table with columns for Mark, Preview, Collection, Obs. ID, Product ID, RA (J2000.0), and D. The table lists four rows of VLASS data products with their respective IDs and RA values.

Mark	Preview	Collection	Obs. ID	Product ID	RA (J2000.0)	D
<input type="checkbox"/>		VLASS	VLASS1.1.T03t30.J194539-313000	VLASS1.1.T03t30.J194539-313000.quicklook.v1	19:45:39.92	-31
<input type="checkbox"/>		VLASS	VLASS1.1.T03t30.J195839-313000	VLASS1.1.T03t30.J195839-313000.quicklook.v1	19:58:39.93	-31
<input type="checkbox"/>		VLASS	VLASS1.1.T03t30.J195459-313000	VLASS1.1.T03t30.J195459-313000.quicklook.v1	19:54:59.90	-31
<input type="checkbox"/>		VLASS	VLASS1.1.T03t30.J195019-313000	VLASS1.1.T03t30.J195019-313000.quicklook.v1	19:50:19.91	-31



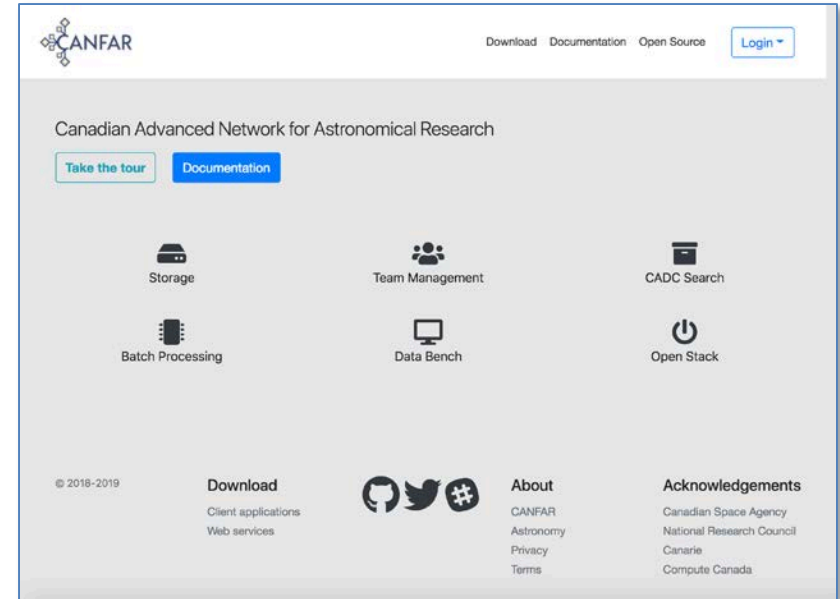
# Canadian Advanced Network for Astronomical Research

- A science platform
- A cloud ecosystem for data intensive astronomy
- User services
  - Store and share data
  - Create and share VMs
  - Run VMs close to data
    - Interactive for data exploration
    - Persistent for SaaS
    - Batch processing in Virtual Clusters
- Federated research cloud resources
  - Compute Canada
- Integrated:
  - Authentication and authorization
  - Access to telescope data
  - Access to user storage
- In operation since 2011



# Canadian Advanced Network for Astronomical Research

- Commitment to support CIRADA
- Adding VO services on user storage
- Adding user created and managed databases integrated with group management
- Adding support for container-based interactive and batch processing
- Designing for scalability



# The path to a Canadian SKA Regional Centre

- Recognition that Canadian participation in SKA may require a Canadian SRC
- Recognition that a wavelength agnostic data science infrastructure is in the national interest
- To be included in budget for the construction and operations era
- Coordinating building blocks: Universities, Compute Canada, NRC HAARC and CADC, CANARIE

## WIDE FIELD ASTRONOMY IN CANADA

Conference Date: Wednesday, October 10, 2018 (All day) to Friday, October 12, 2018 (All day)

Scientific Areas: Astronomy  
Astrophysics  
Cosmology

Canada has great ambitions in the area of wide-field astronomical surveys, and a strong heritage. On the eve of the Canadian Long Range Plan 2020, this workshop brings together the Canadian wide field astronomy community to discuss our strategy, including possible areas of scientific and technical coordination. We will review existing and near-term surveys, on facilities including CFHT, MWA, CHIME, Dragonfly, Gaia, SDSS-V, DESI, Euclid, and LSST, as well as future projects like MSE and SKA1 on the ground and WFIRST and CASTOR in space. Invited talks will highlight areas of rapid expansion, including time domain astrophysics and radio surveys, as well as data archives and computing platforms like CADC, Canfar, and CIRADA that enable the exploitation of wide field and time-domain data by the community. Our activities aim to ensure that wide field and time-domain science emerge with strong support in LRP2020 and are able to attract significant funding.

Registration for this event is now closed.

This workshop is being held in partnership with the [Dunlap Institute](#).



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