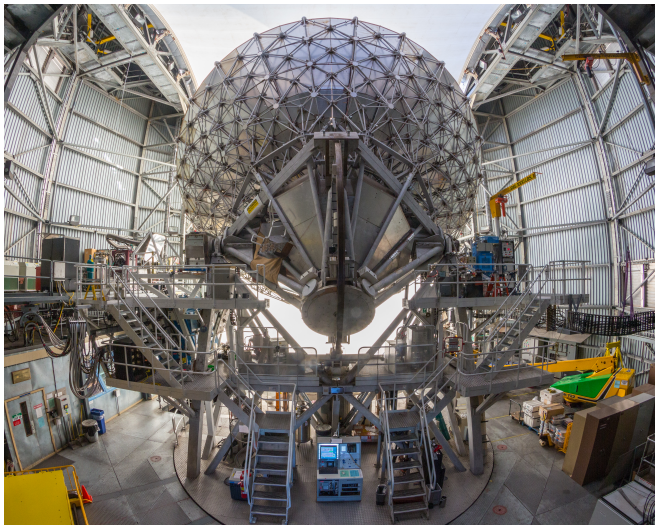
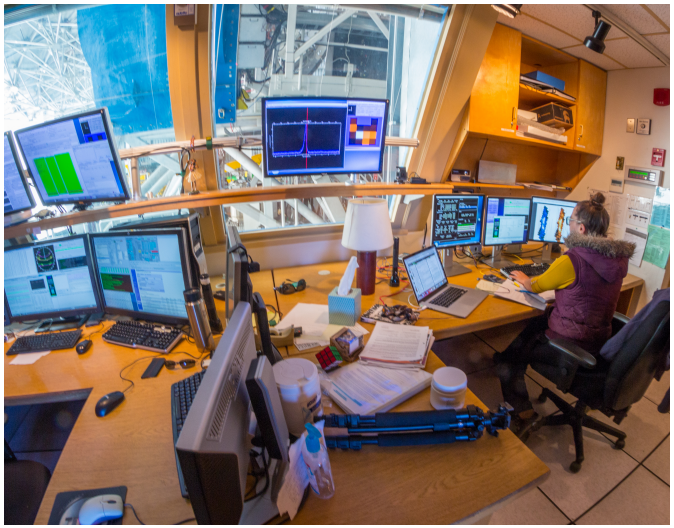
Observing with the JCMT: Capabilities and our Operational model

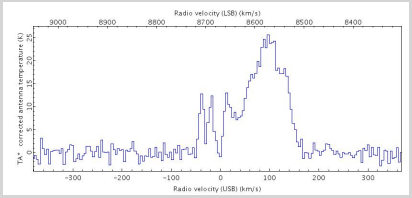
Harriet Parsons JCMT-LLAMA Community talk March 2023

JCMT

- 15m cassegrain telescope
- Maunakea, Hawai`i (19°49’22.2″N 155°28’37.0″W)
- Altitude 4,092m
- 24 micron surface accuracy
- Pointing accuracy ~2”
- Operate with GorTex Membrane
- Continuum, Spectral, Polarization
- Started operations in 1987
- Since 2019 operated remotely from Hilo base facility
- Single dish and VLBI observing

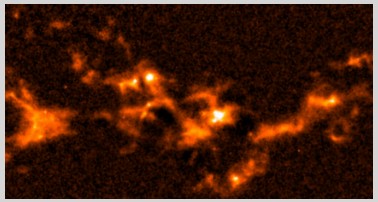
Science

JCMT Website



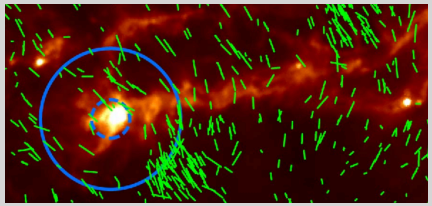
Spectral line

Mairs, S et al. 2016



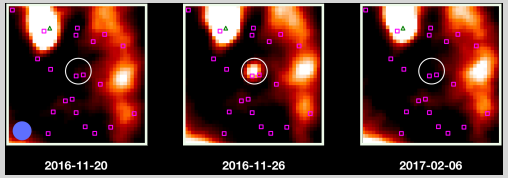
Continuum

Wang, J-W. et al. 2018



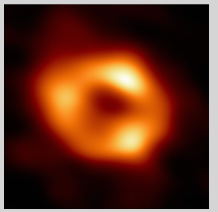
Polarization

Mairs, S et al. 2019



Variability

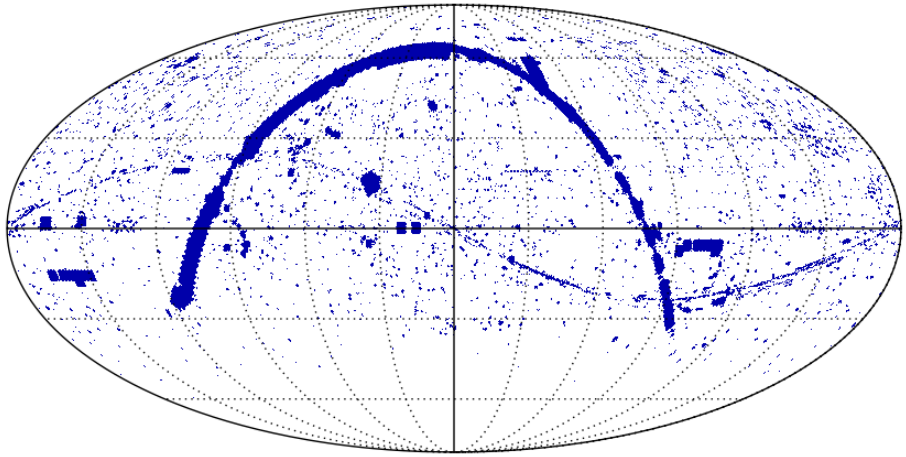
*EHT 2022 M87**



VLBI

Science

- Comets, planets, star formation, evolved stars, nearby galaxies, high-z studies, pulsars, gamma ray bursts, black holes.
- Large Programs, PI lead programs, ToO, archive mining
- Individual users to global consortiums

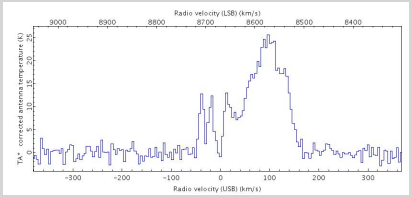


All areas of the sky observed by SCUBA-2 on the JCMT. This includes legacy survey fields as well as publicly available data (as of 2014).

https://www.eaobservatory.org/jcmt/science/archive/

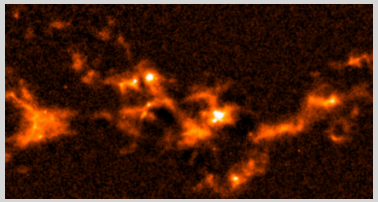
Science

JCMT Website



Spectral line

Mairs, S et al. 2016



Continuum

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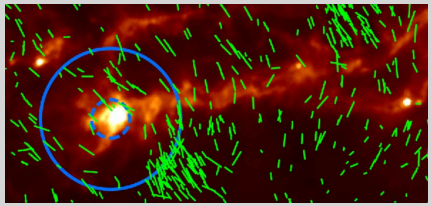

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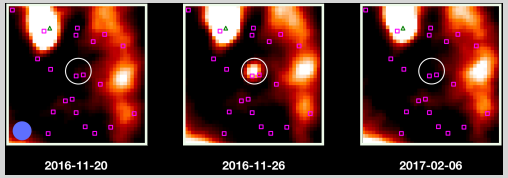

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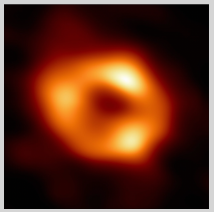
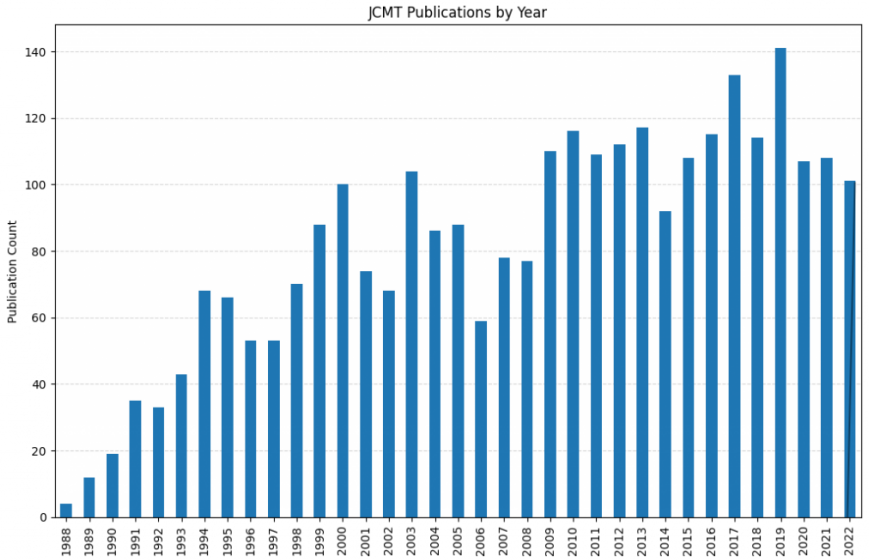


VLBI

Science

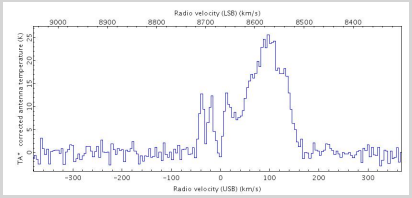
- Comets, planets, star formation, evolved stars, nearby galaxies, high-z studies, pulsars, gamma ray bursts, black holes.
- Large Programs, PI lead programs, ToO, archive mining
- Individual users to global consortiums
- Average > 100 publications a year

https://www.eaobservatory.org/jcmt/science/publications/



Science

JCMT Website



Spectral line

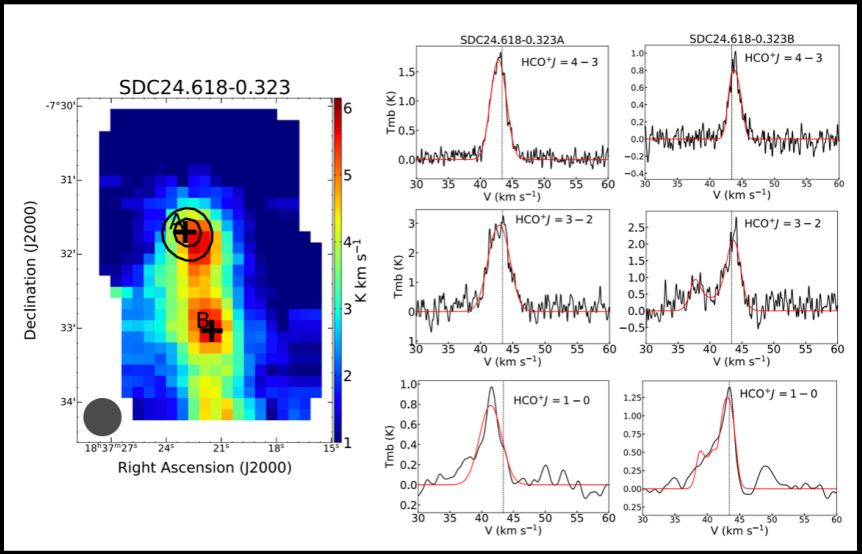
HCO+J=4–3 with HARP
HCO+ J =3–2 with RxA

RxA: now replaced with the `Ū`ū 230GHz insert inside Nāmakanui

Studying Infall in Infrared Dark Clouds with Multiple HCO+ Transitions

Xie, Jin-Jin et al. Research in Astronomy and Astrophysics, 2021

Goal: Use the JCMT to map 20+ clumps in 11 IRDCs in HCO+ J=4-3 and J=3-2 to study evolutionary stages and properties of protoclusters



The integrated intensity map of HCO+J =1–0 (IRAM) overlaid with HCO+J =4–3 contours (JCMT). A and B are the observed positions of HCO+J =3–2 (JCMT). The grey dot at the corner of the emission map represents the IRAM beam size.

Results

★ Size and luminosity distributions were derived and compared across 11 IRDCs

★ HCO+(J=3-2) reliably traces the infall signature. The median velocity is 1.0 km/s with a maximum of 2.7 km/s

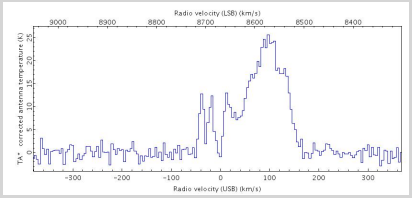
★ The values are comparable to known massive star-forming clumps in late evolutionary stages

https://iopscience.iop.org/article/10.1088/1674-4527/21/8/208/meta

Slide credit: Steve Mairs EAO/JCMT

Science

JCMT Website

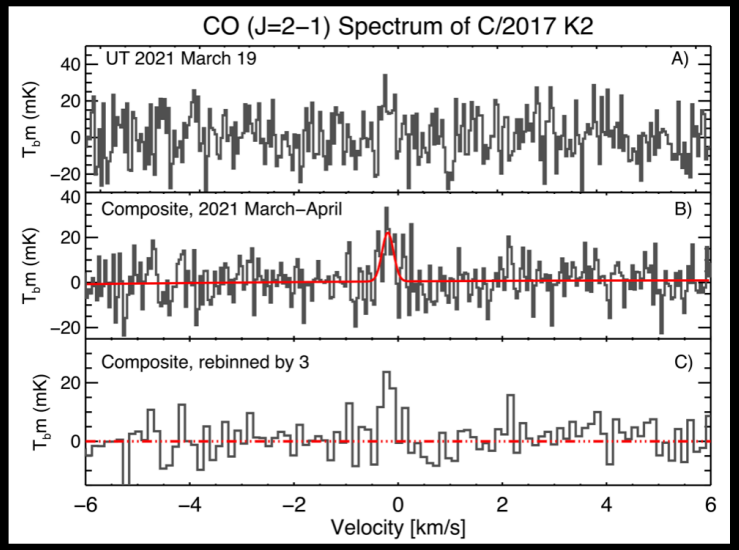


Spectral line

Discovery of Carbon Monoxide in Comet C/2017 K2

Yen et al. The Astrophysical Journal. 2021

Goal: Investigate the abnormal long-period comet C/2017 K2 to explain its activity at large heliocentric distances



Spectrum of CO(J=2-1) emission obtained by the JCMT (ʻŪʻū).
A) The first detection of the CO line was obtained on UT 2021 March 19 (1.8 hr)
B) A composite spectrum from 2021 March to April (6.62 ≤ r_H ≤ 6.83 AU; 7.7 hr)
C) The spectrum rebinned by 3 spectral channels to a resolution of ~0.12 km/s

Results

★ First observations of a gaseous species in C/2017 K2 that can explain mass loss: Carbon Monoxide

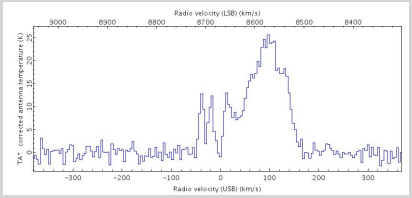
★ The measured CO production can be explained by surface sublimation of CO from a 1 km² ice patch

★ This super volatile sublimation better explains the activity at large heliocentric distances than water ice

Slide credit: Steve Mairs EAO/JCMT

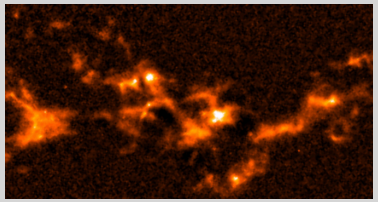
Science

JCMT Website

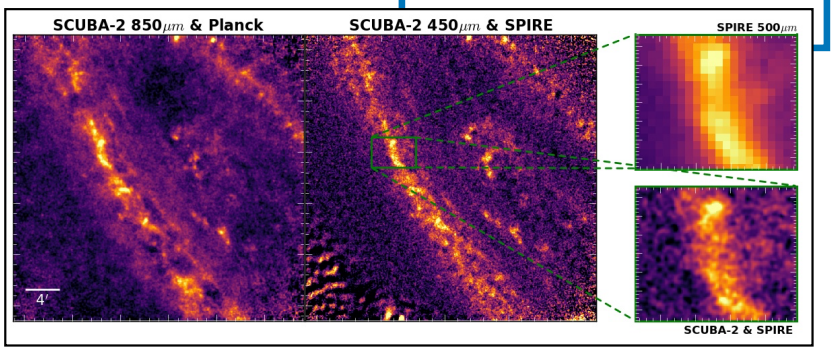


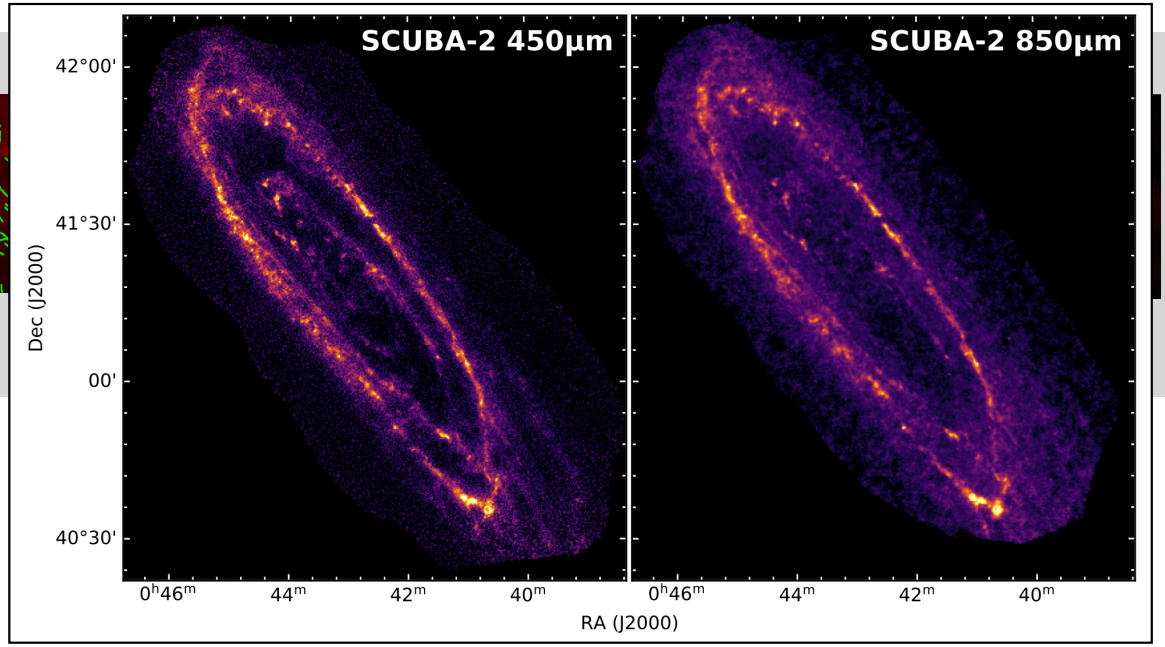
Spectral line

Mairs, S et al. 2016



Continuum





The HASHTAG project: The First Submillimeter Images of the Andromeda Galaxy from the Ground.

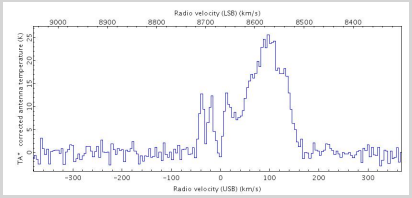
Smith et al. 2021: https://ui.adsabs.harvard.edu/abs/2021ApJS..257...52S/abstract
https://hashtag.astro.cf.ac.uk/index.html

Challenges for nearby galaxy observations with ground based sub-mm telescopes

1) brightness is significantly reduced at long submillimeter wavelengths compared to the brightness at the peak of the dust emission.
2) Second, it is necessary to use a high-pass spatial filter to remove atmospheric noise on large angular scales, which has the unwelcome by-product of also removing the galaxy's large-scale structure.

Science

JCMT Website



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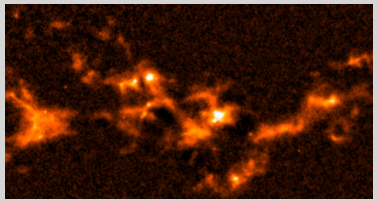

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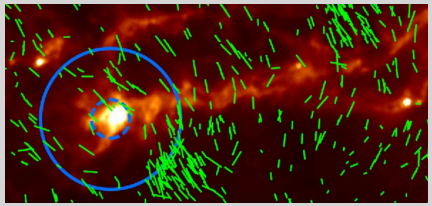
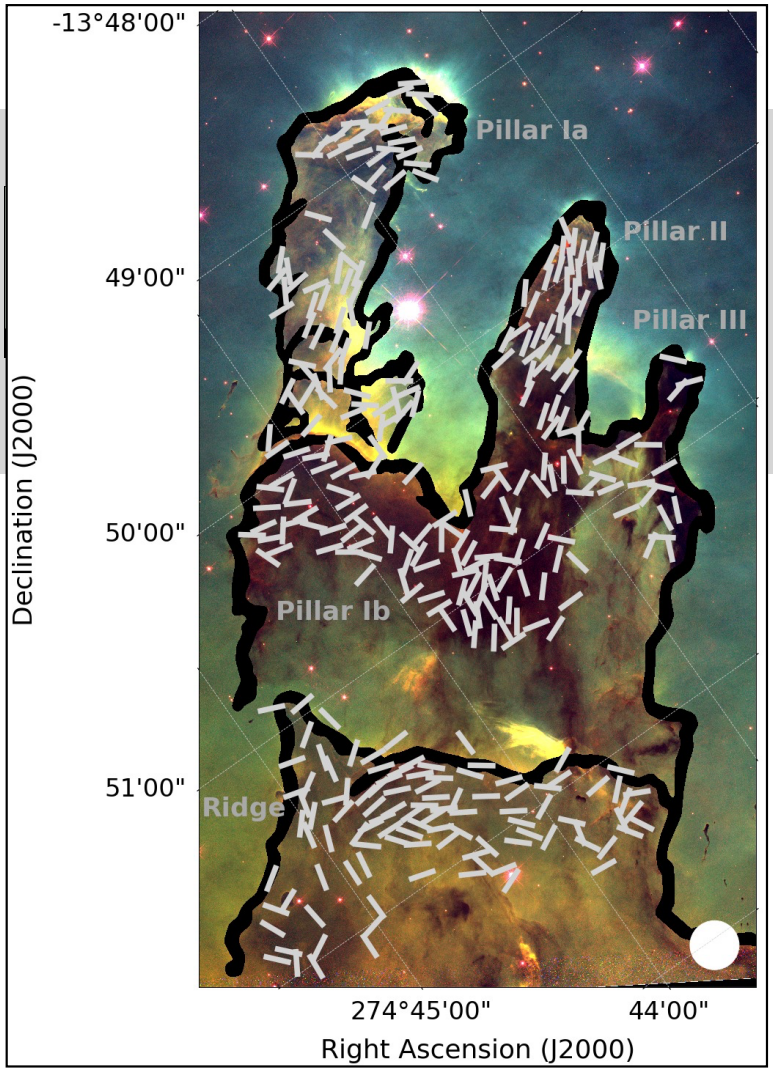


Polarization

Pillars of creation - results from BISTRO

- Pattle et al. 2018 - https://ui.adsabs.harvard.edu/abs/2018ApJ...860L...6P/abstract
- First direct observations of magnetic fields inside Pilars of creation



Science

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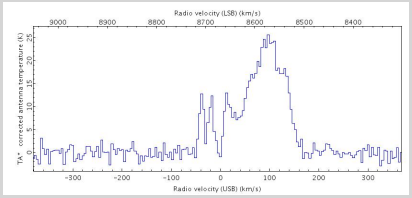

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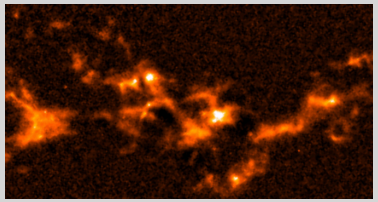

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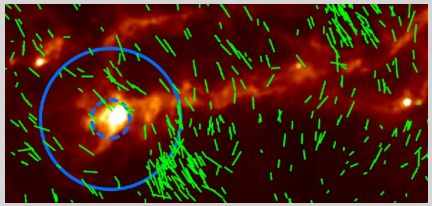

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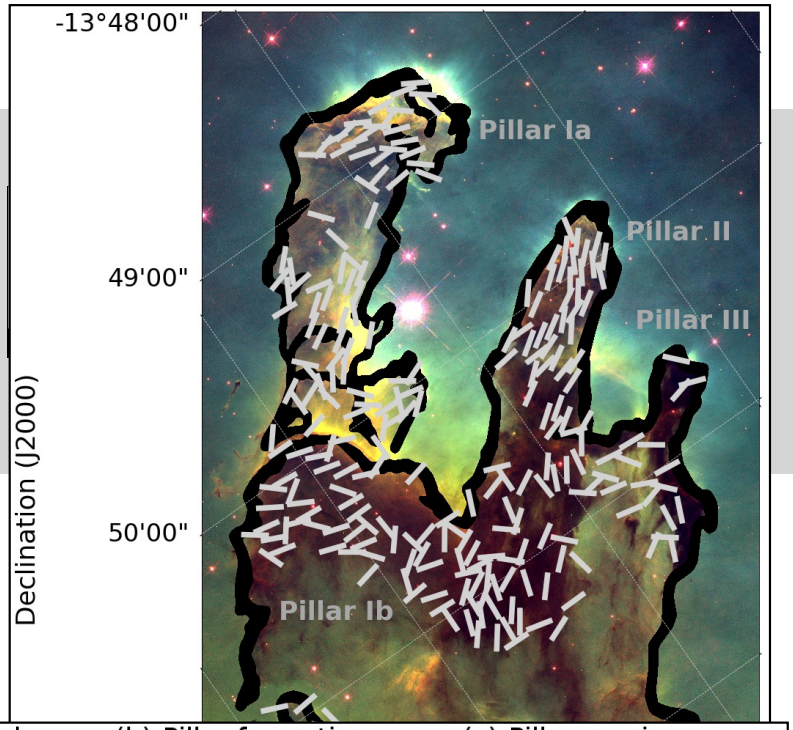

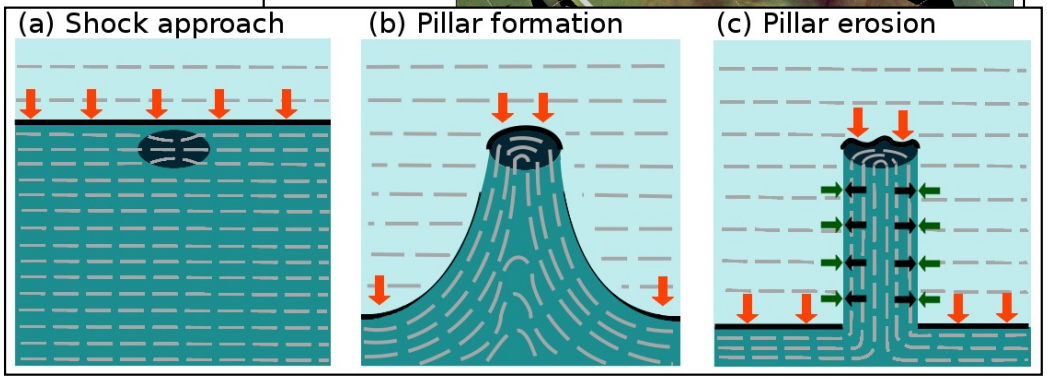

Science

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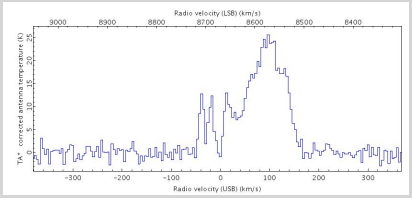

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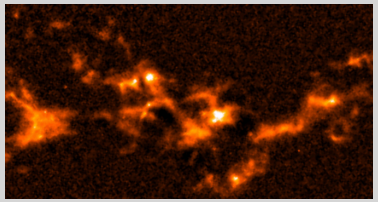

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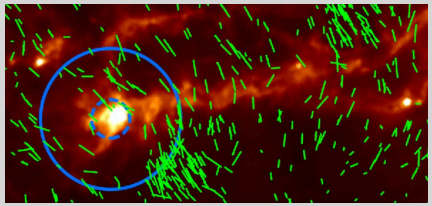

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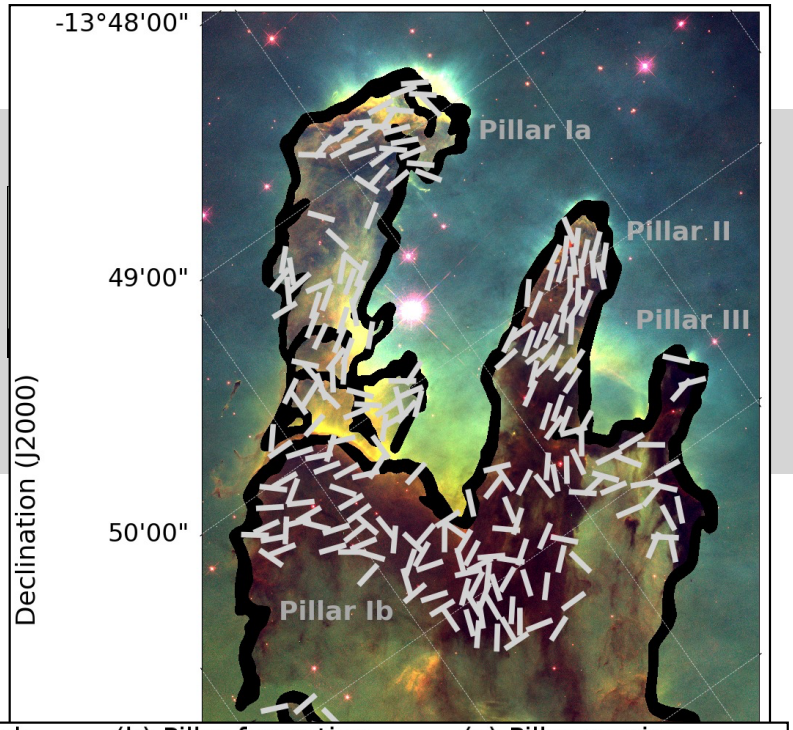
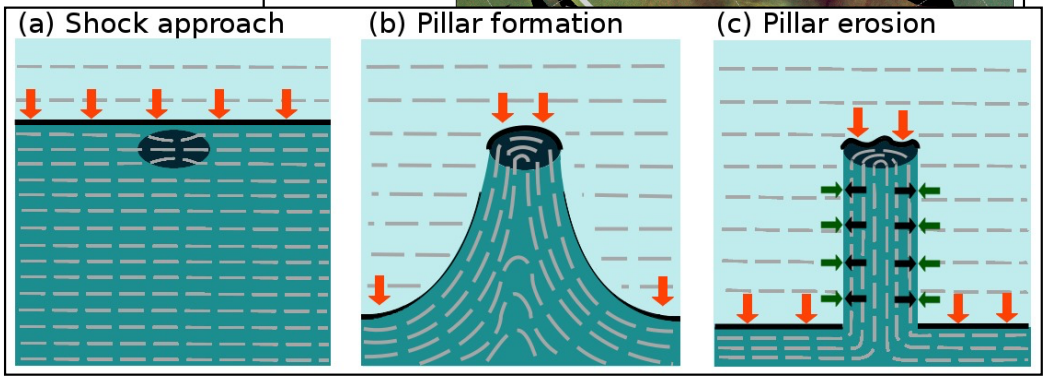
Continuum Spectral line Polarization

$$B_{pos} = Q\sqrt{4\pi\rho}\frac{\sigma_v}{\sigma_\theta} \approx 9.3\sqrt{n(\mathrm{H_2})}\frac{\Delta v}{\sigma_\theta}\ \mu\mathrm{G}$$

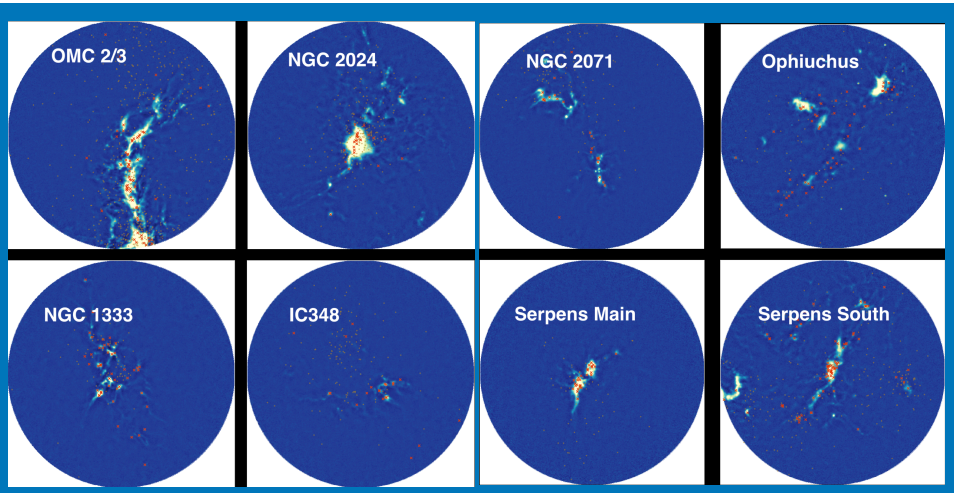
Crutcher et al. 2004, ApJ 600:279

Davis-Chandrasekhar-Fermi (DCF) method combines Polarization, Contunnium, and spectral line data to calculate the B-Field strength





Science

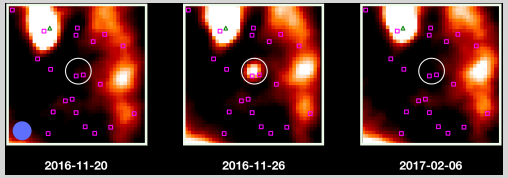


Transient

Cadenced observation of 8 star-forming regions wide field of view needed for good statistics to search for source variability.

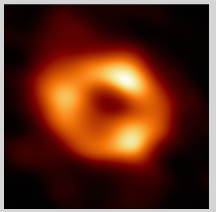
(Herczeg et al 2017, Yoo et al 2017, Mairs et al 2017a,b…)

Mairs, S et al. 2019

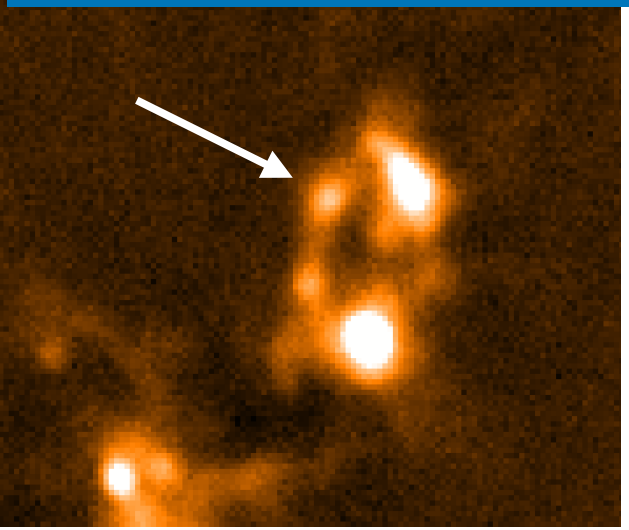


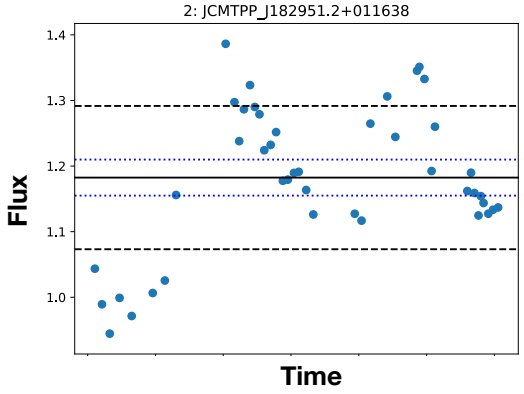
Variability

*EHT 2022 M87**

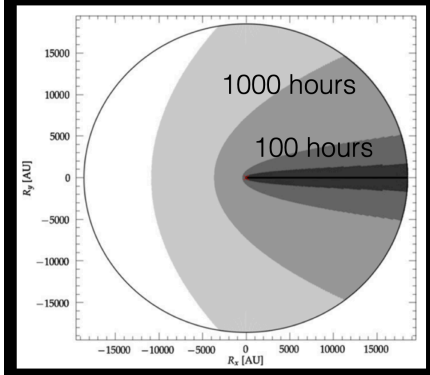


VLBI





Variability at Submillimetre Wavelengths



Johnstone et al (2013)
Modelled the SED of a deeply embedded Protostar undergoing an accretion burst using *DUSTY*

The light from the central source is reprocessed by the surrounding dust

A typical low-mass star-forming envelope Takes ~weeks to months to brighten and be detected in Submm

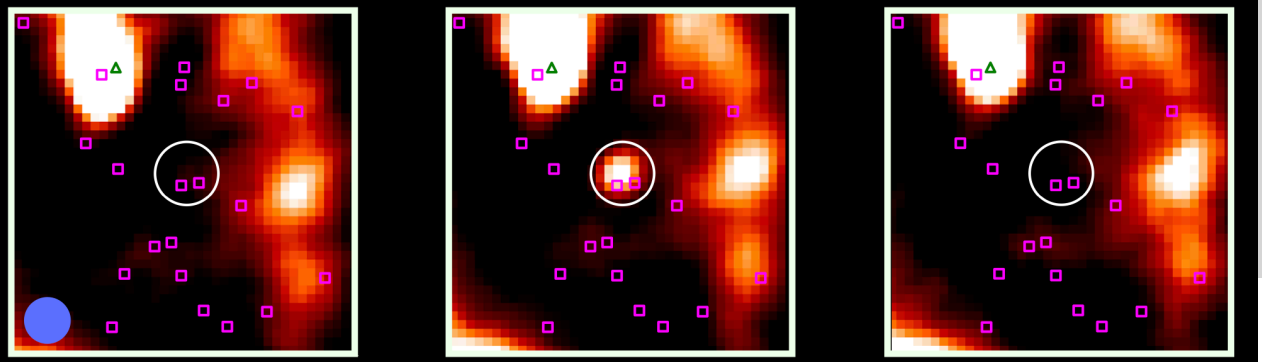
***Hops 383**
Safron et al (2015)

Slides contribution from Mairs EAO/JCMT

Science

An Extraordinary Submillimetre Flare Event

(Mairs et al, 2019, ApJ 871:72)



2016-11-20 2016-11-26 2017-02-06

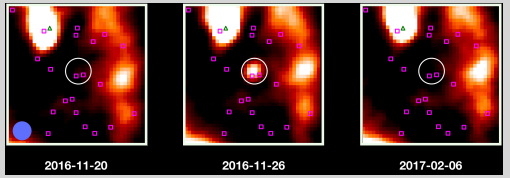
□ = Previously Identified Class II (Disk) Source (Megeath et al. 2012)

● = JCMT Beam size (~15" at 850 microns)

- ✳ Point Source
- ✳ Coincident with binary disk system JW 566
- ✳ Previously known X-ray Variable (timescales of hours)
- ✳ No simultaneous optical, infrared, x-ray, or radio data

Slides from Mairs 2019 talk: Highlights from the JCMT-Transient Survey
https://www.eaobservatory.org/jcmt/science/futures-2019/eao-sub-mm-futures-program/

Mairs, S et al. 2019



Variability

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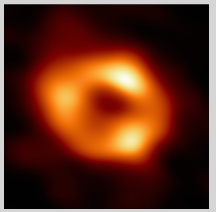
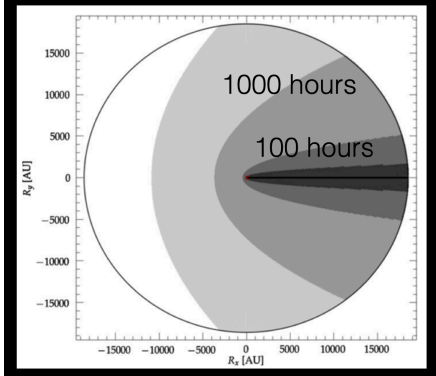


VLBI

Variability at Submillimetre Wavelengths



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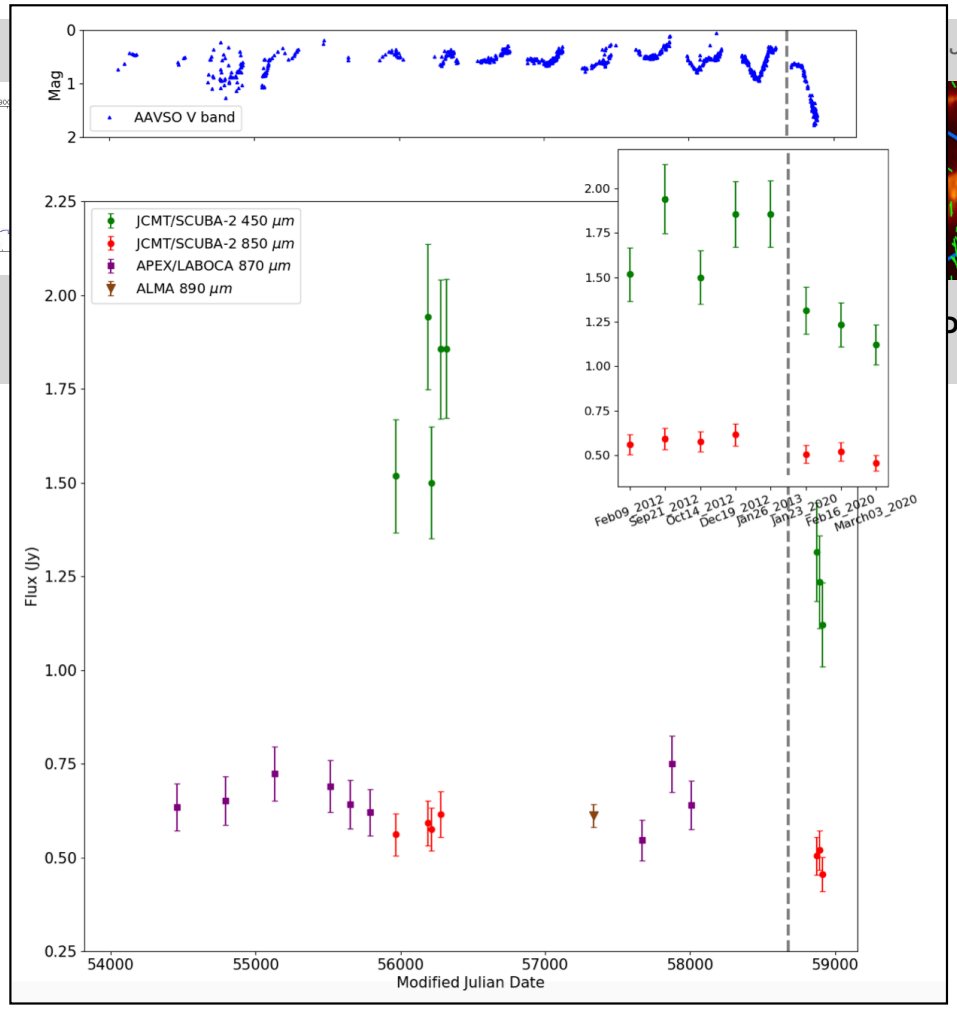
Modelled the SED of a deeply embedded Protostar undergoing an accretion burst using *DUSTY*

The light from the central source is reprocessed by the surrounding dust

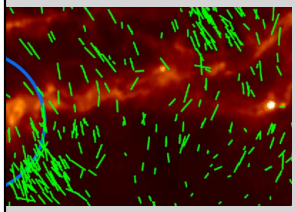
A typical low-mass star-forming envelope Takes ~weeks to months to brighten and be detected in Submm

***Hops 383**
Safron et al (2015)

Science

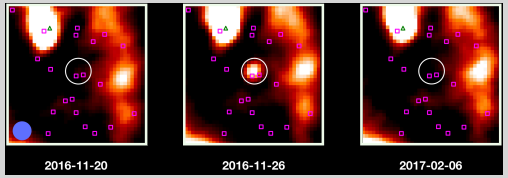


J-W. et al. 2018



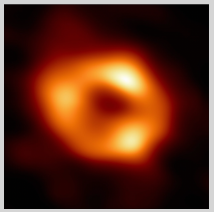
Polarization

Mairs, S et al. 2019



Variability

*EHT 2022 M87**



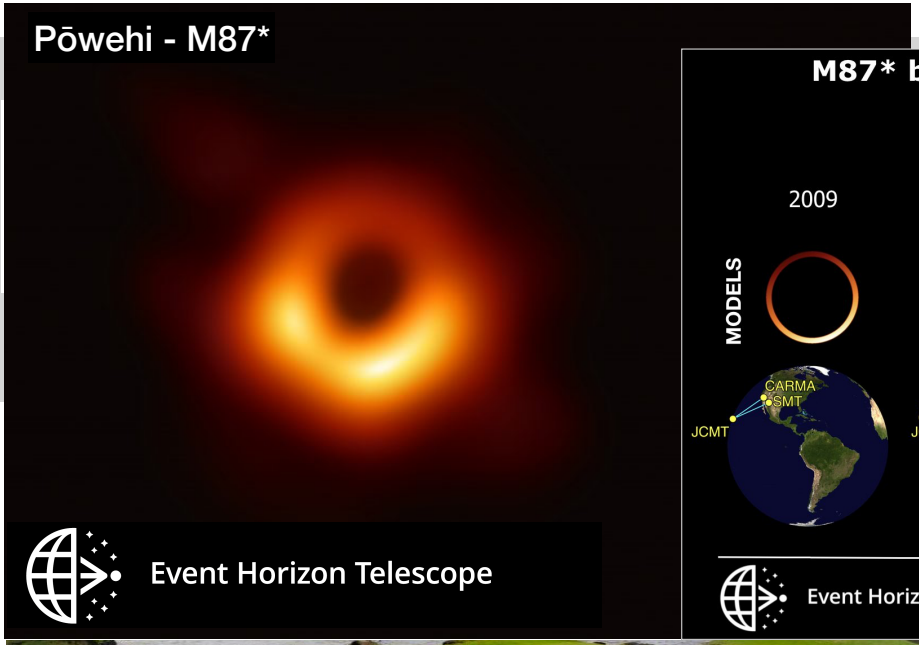
VLBI

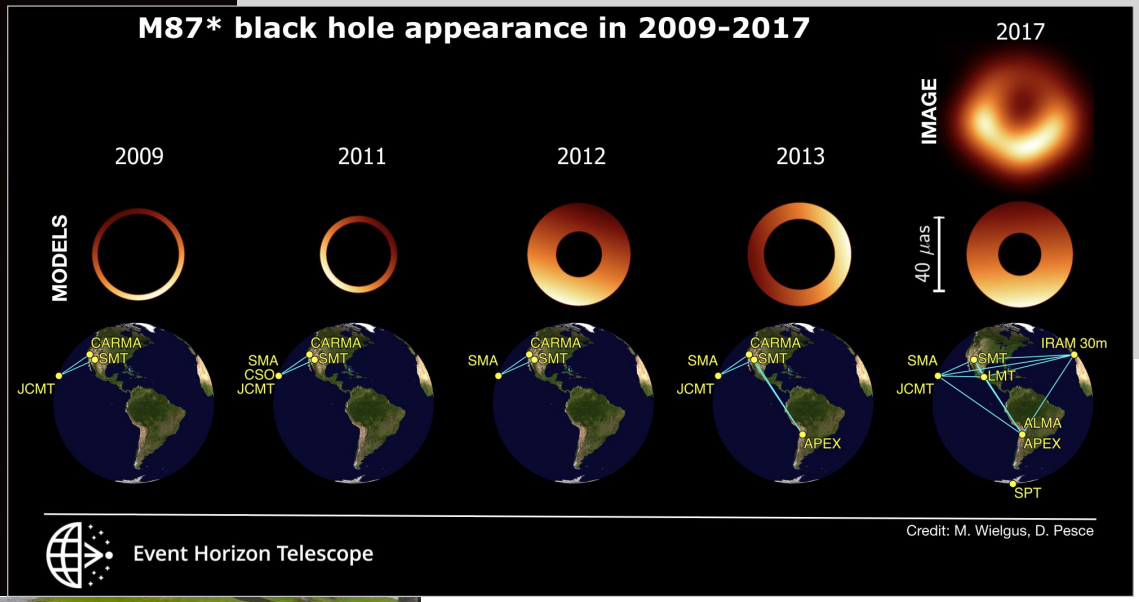
October 2019 Betelgeuse dimming event:

- Dharhawardena et al. 2020
- Result: 20% dimming found in sub-mm
- Modeling indicated change in photosphere of star
- Data: Archival & PI continuum observations
  - JCMT/SCUBA-2 & APEX/LABOCA
  - 2007- 2020 (LABOCA for extended time monitoring)
  - JCMT observations during the event.

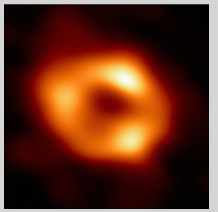
https://ui.adsabs.harvard.edu/abs/2020ApJ...897L...9D/abstract

Science





*EHT 2022 SgrA**



VLBI

2019 EHT meeting, Hilo, Hawai`i

EHT

2019 First image of a Black Hole - M87*

2020 First “movie” of M87* from 2009-2013 data

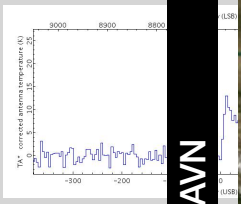
2021 First look at polarization ring around M87*

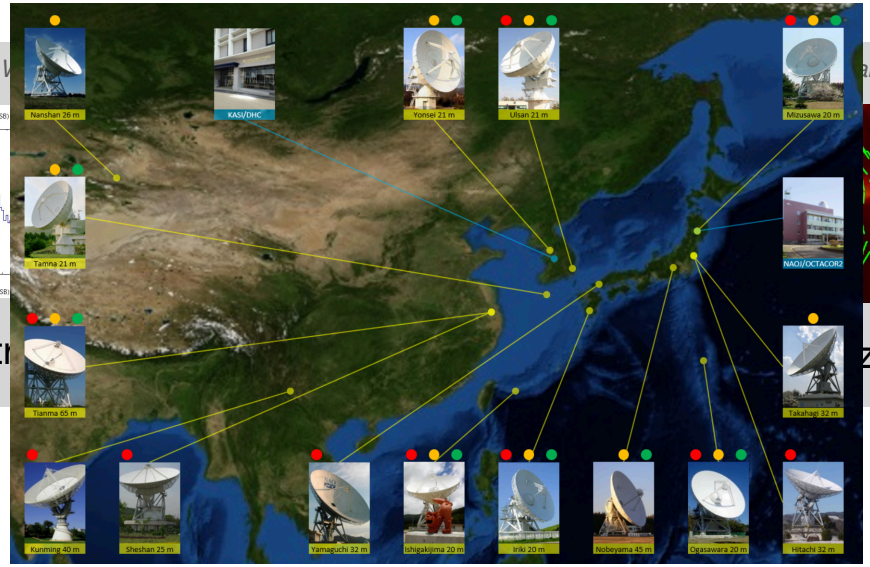
2022 First image of SgrA*

JCMT on Manunakea provides the most critical point of the East West baseline.

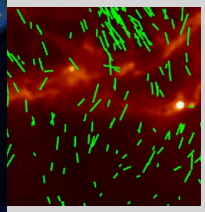
https://eventhorizontelescope.org

Science



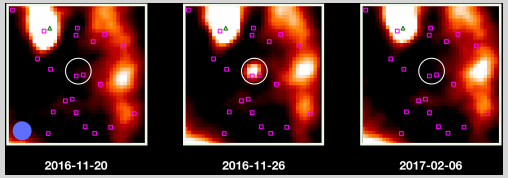


al. 2018



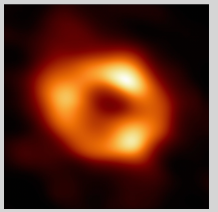
zation

Mairs, S et al. 2019



Variability

*EHT 2022 SgrA**



VLBI

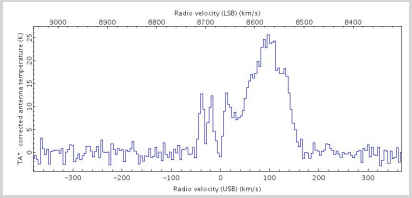
Nāmakanui brings new collaborations:

2022 JCMT joining - EAVN - https://radio.kasi.re.kr/eavn/main.php

2023 JCMT joining - GMVA - Global mm-VLBI Array - https://www3.mpifr-bonn.mpg.de/div/vlbi/globalmm/

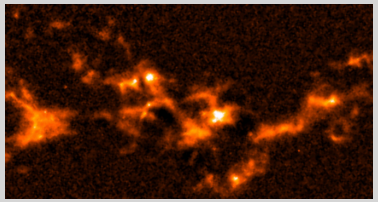
Instrumentation

JCMT Website



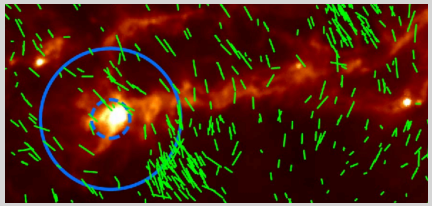
Heterodyne

Mairs, S et al. 2016

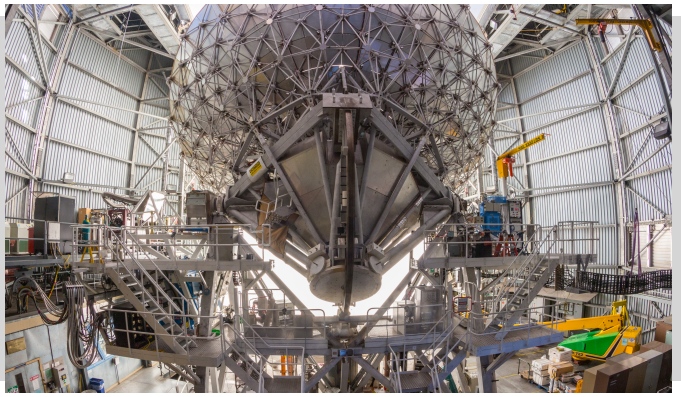


Continuum

Wang, J-W. et al. 2018



Polarization



Heterodyne

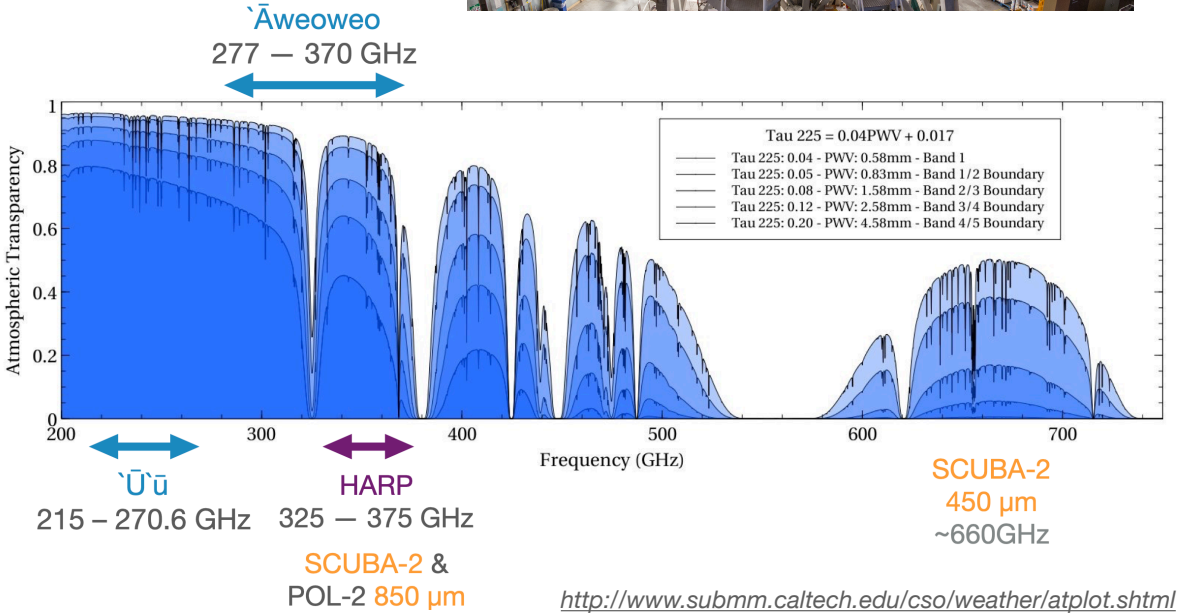
HARP and **Nāmakanui** covering 86GHz, 230GHz and 345GHz windows with **ACSIS** backend spectrometer

Continuum

SCUBA-2 450 and 850 micron simultaneously

Polarization

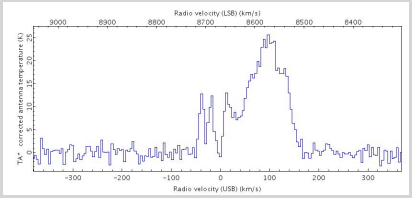
POL-2 (with SCUBA-2) 450 and 850 micron linear polarization simultaneously



http://www.submm.caltech.edu/cso/weather/atplot.shtml

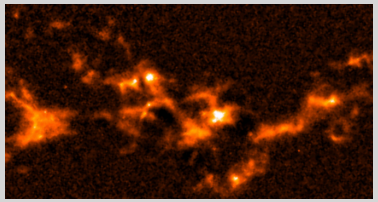
HARP

JCMT Website



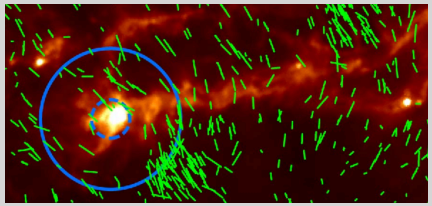
Heterodyne

Mairs, S et al. 2016

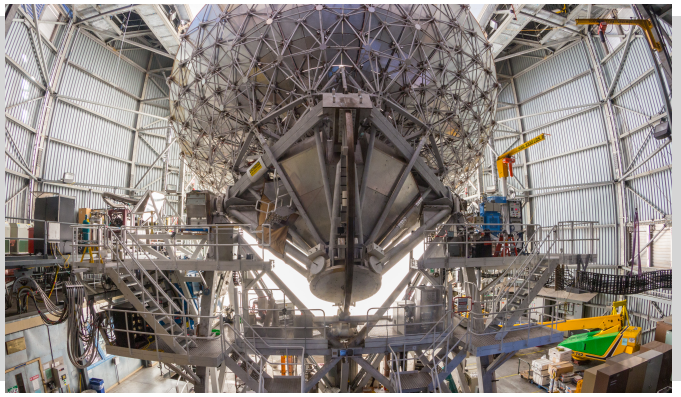


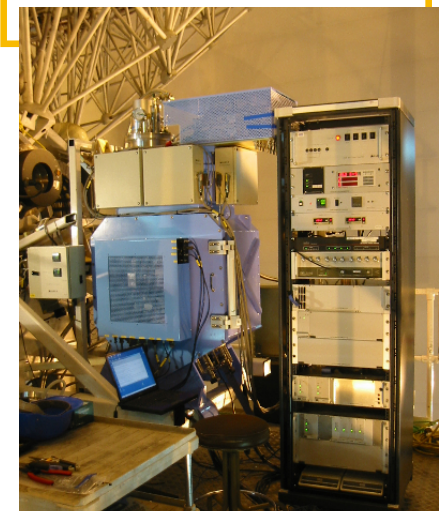
Continuum

Wang, J-W. et al. 2018



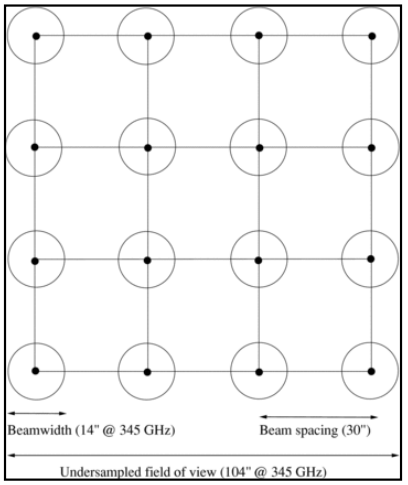
Polarization

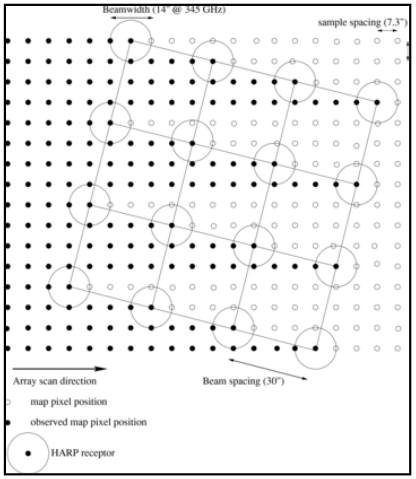




HARP (Heterodyne Array Receiver Programme)

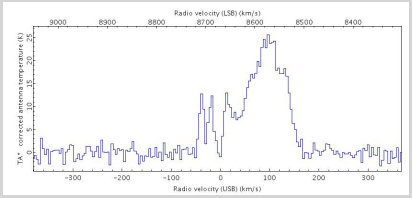
- Single Sideband (SSB) array receiver with 16 SIS mixers
- Tuned between 325 and 375 GHz
- Can be operated in stare, jiggle and scanning mode - great for mapping larger areas



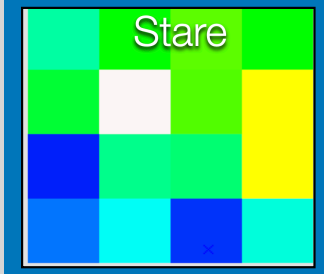


HARP

JCMT Website

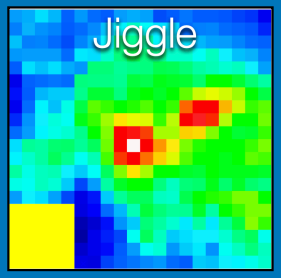


Heterodyne



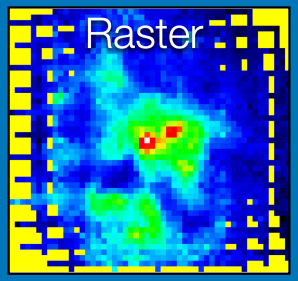
2’ field

30” pixels



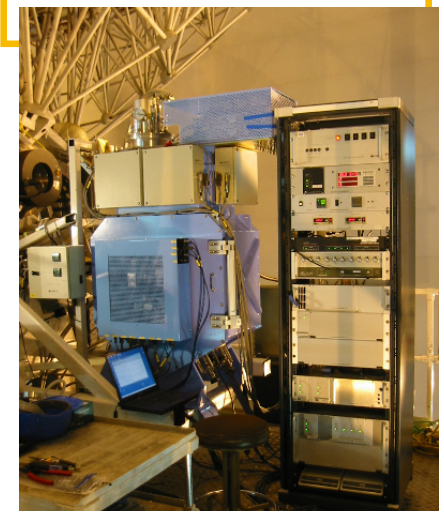
2’ field

6” pixels

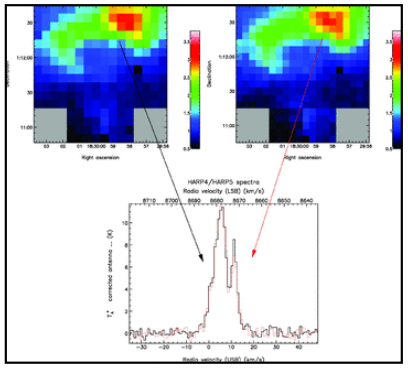


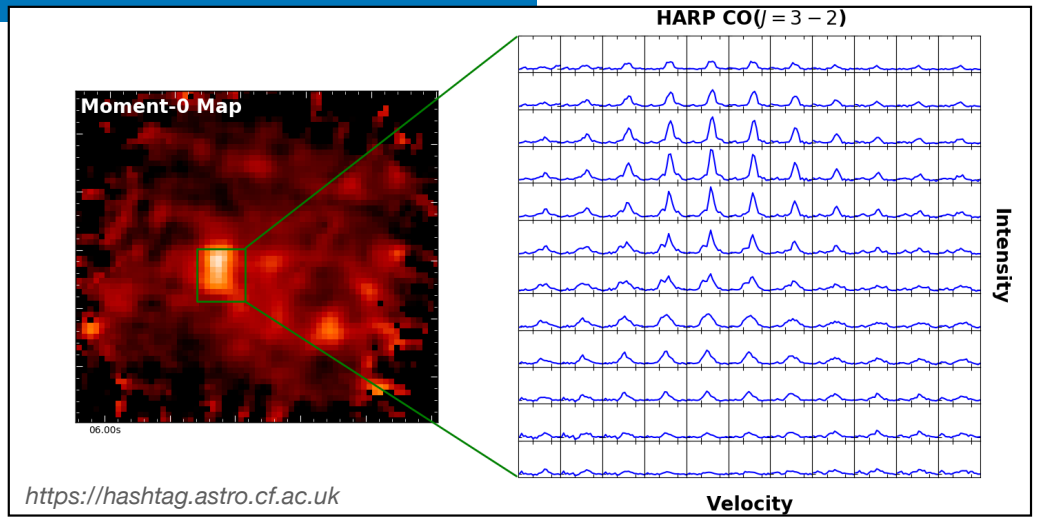
6’ field

7.25” pixels



HARP (Heterodyne Array Receiver Programme)



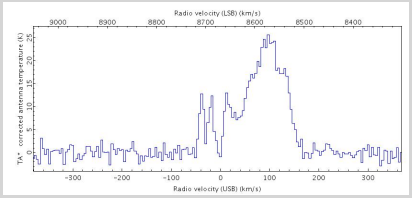


HARP

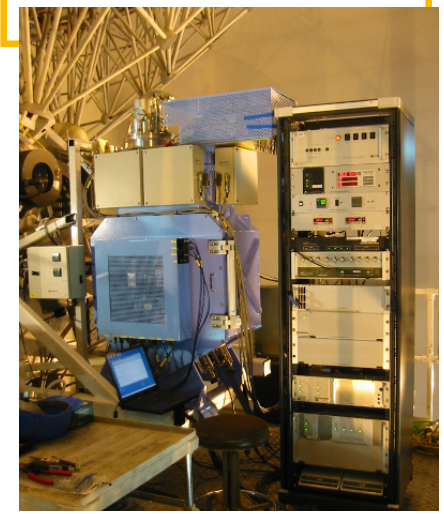
CO (3 – 2) HIGH-RESOLUTION SURVEY OF THE GALACTIC PLANE: R1
Dempsey, Thomas, Currie 2013
https://ui.adsabs.harvard.edu/abs/2013ApJS..209....8D/abstract

First release covers |b| <= 0.°5 between 10.°25 < l < 17.°5 and 50.°25 < l < 55.°25, and |b| <= 0.°25 between 17.°5 < l < 50.°25

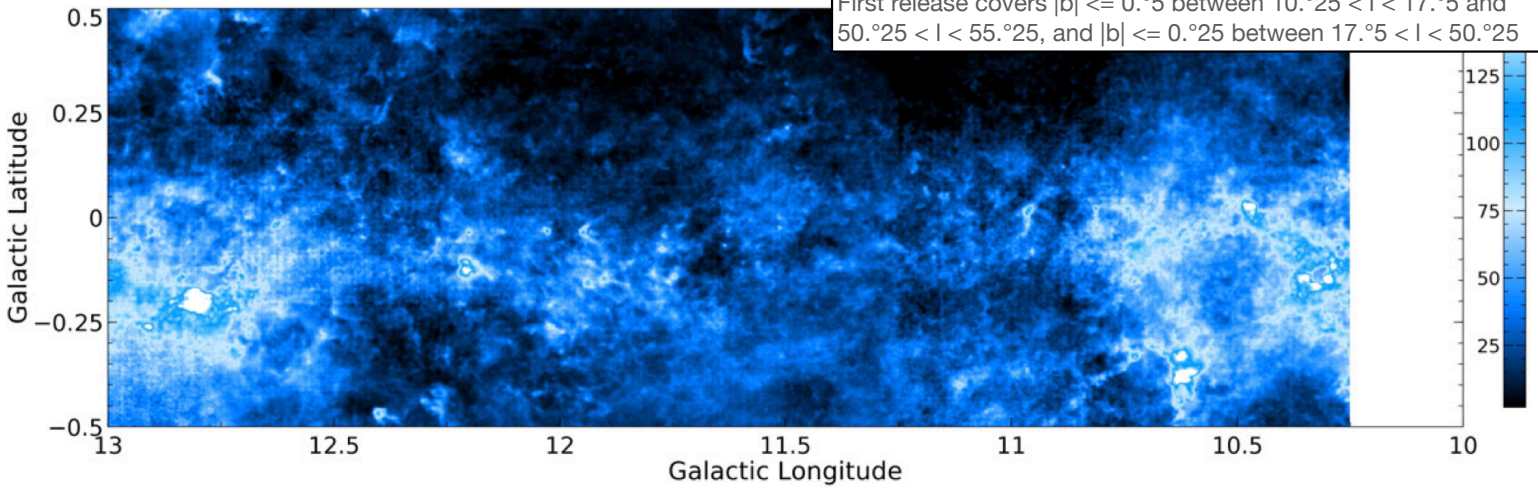
JCMT Website

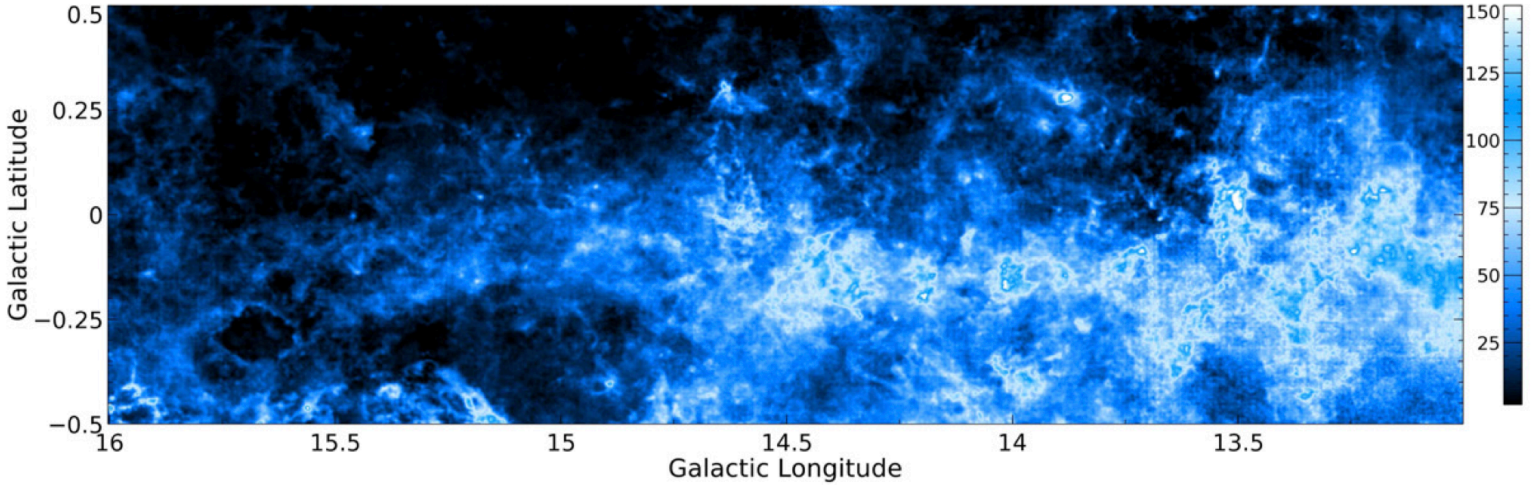


Heterodyne



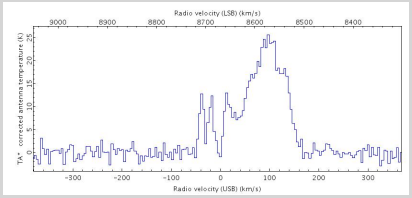
HARP (Heterodyne Array Receiver Programme)





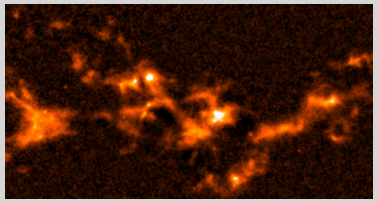
Nāmakanui

JCMT Website



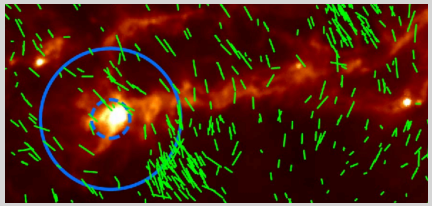
Heterodyne

Mairs, S et al. 2016

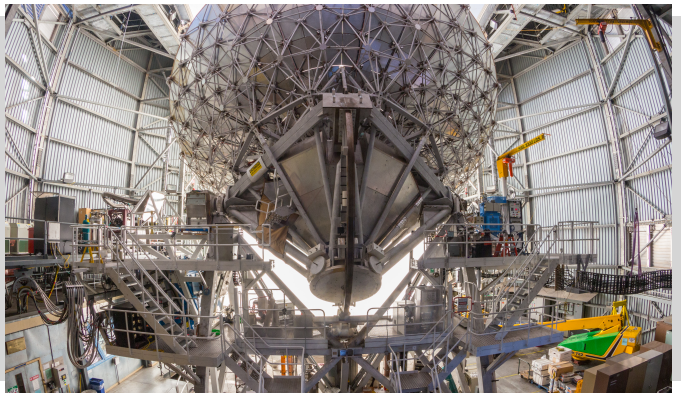


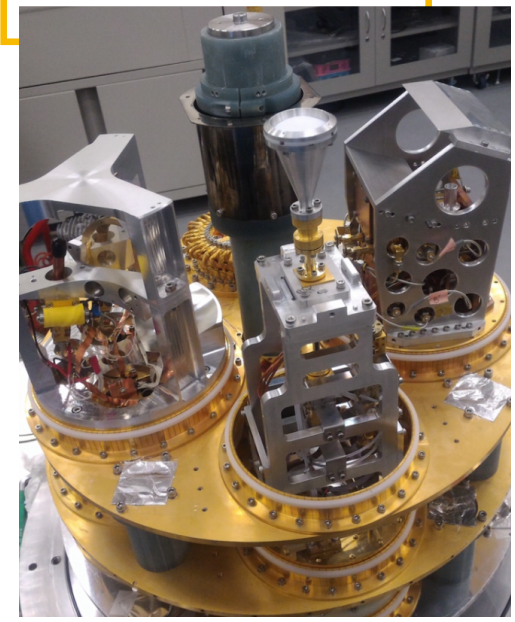
Continuum

Wang, J-W. et al. 2018



Polarization





Nāmakanui was built by ASIAA, Taiwan, and is on loan the to the JCMT as a spare for the Greenland Telescope (GLT).

`Ū`ū:

- 215 – 270.6GHz (sideband separating, single pixel)
- commissioned 2023 (first light October 2019)

`Āweoweo:

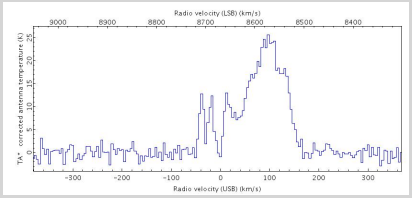
- 277 – 370GHz (sideband separating, single pixel) Some overlap with HARP but greater sensitivity
- shared risk observing (first light October 2021)

`Ala`ihi:

- 77.0–88.5GHz (1-sideband, single pixel) - VLBI only - first light November 2022

Nāmakanui

JCMT Website

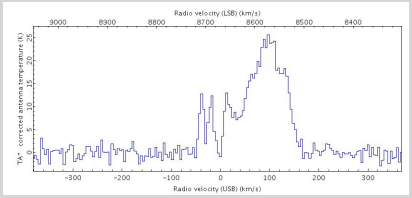


Heterodyne

With support from LLAMA group, ASIAA Taiwan, and SRON LLAMA's 690GHz system will be loaned to JCMT and integrated within the Nāmakanui instrument. Arrival and commissioning expected this summer (2023).

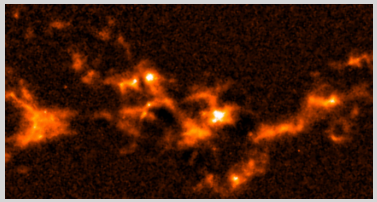
ACSIS

JCMT Website



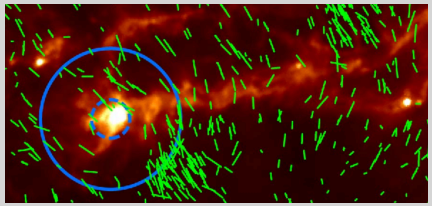
Heterodyne

Mairs, S et al. 2016

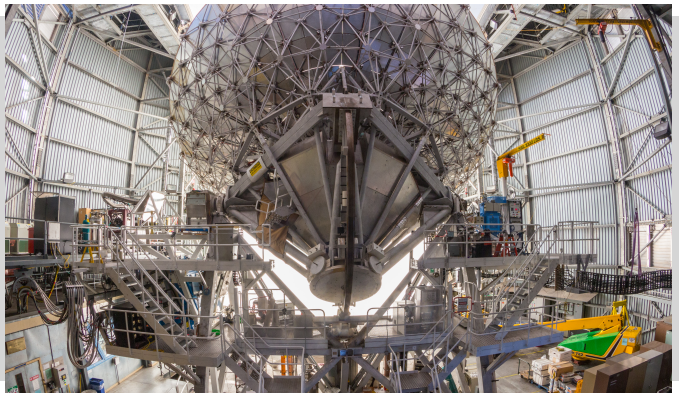


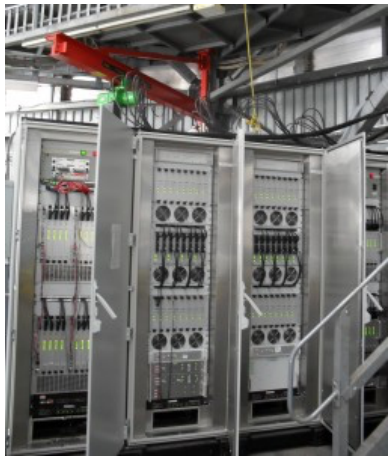
Continuum

Wang, J-W. et al. 2018



Polarization



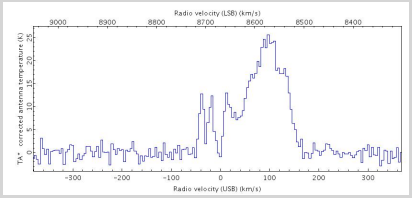


ACSIS (Auto Correlation Spectral Imaging System)

- 4 DCMs/correlators fed from the same IF
- HARP - can be configured with up to two spectral windows
- Nāmakanui - can be configured up to four spectral windows
- Supports a variety of bandwidth modes ranging from 250 to 3200 MHz
- Spectral resolution of ACSIS varies from 30 kHz to ~1 MHz, depending on the configuration used

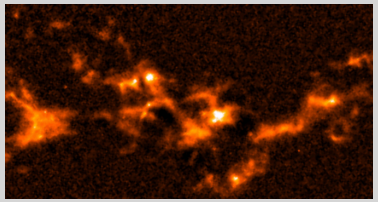
Instrumentation

JCMT Website



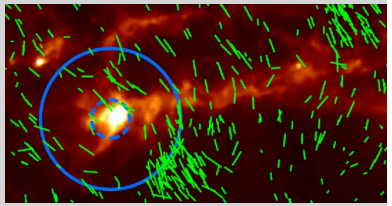
Heterodyne

Mairs, S et al. 2016

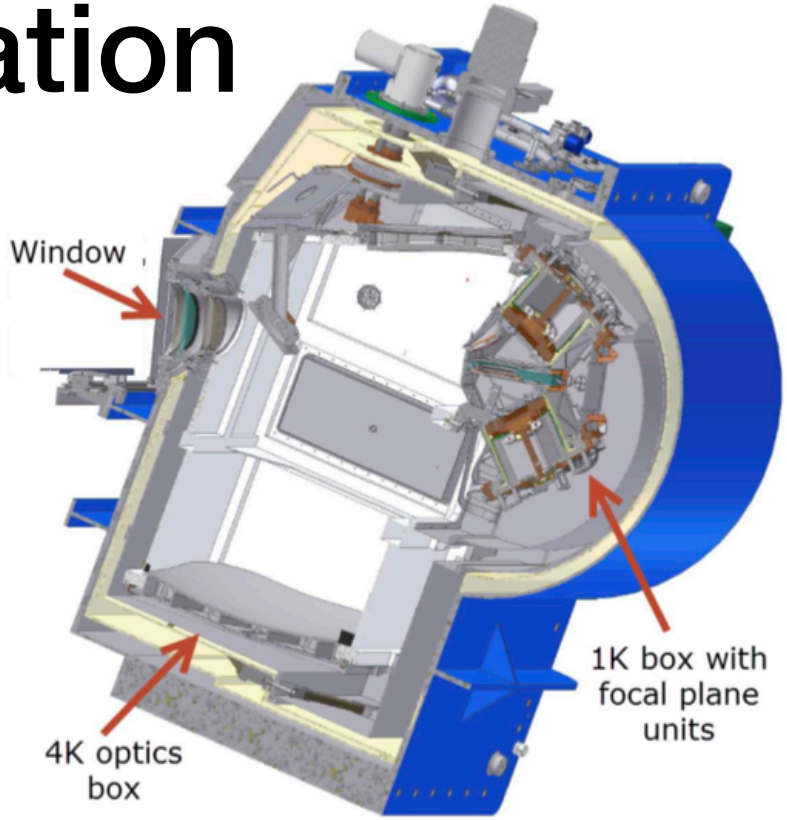


Continuum

Wang, J-W. et al. 2018



Polarization

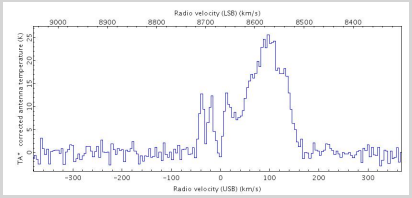


SCUBA-2

- Submillimetre Common-User Bolometer Array 2
- 10,000 pixel bolometer camera (Transition Edge Sensors, TES)
- 850 and 450 micron simultaneous observations
- Bolometers are temp controlled to 75mK
- Beam is 7.9 arcsec at 450 micron and 13.0 arcsec at 850 micron
- Derived confusion limit (depends on a number of factors including Galactic cirrus emission, the extra galactic background):
  - 850 microns = 0.7 mJy/beam
  - 450 microns = 0.5 mJy/beam

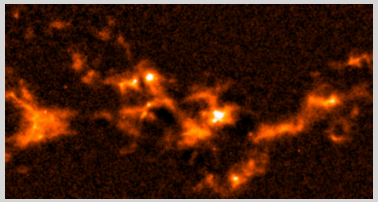
Instrumentation

JCMT Website



Heterodyne

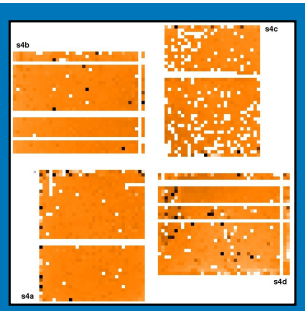
Mairs, S et al. 2016

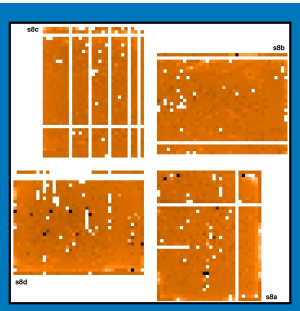


Continuum

SCUBA-2

- Two observing modes: CV Daisy for point sources - compact sources, Rotating Pong pattern for larger scale mapping
- SCUBA-2 removes atmospheric noise in the data processing stage (not by chopping), making SCUBA-2 less sensitive to large scale structure.

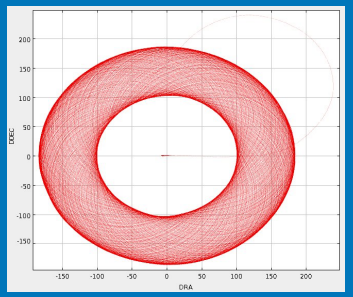


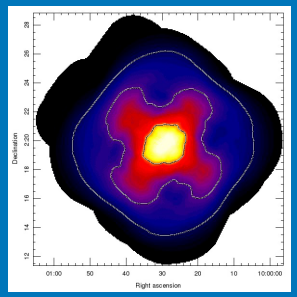


Focal Plane arrays

450 and 850 micron

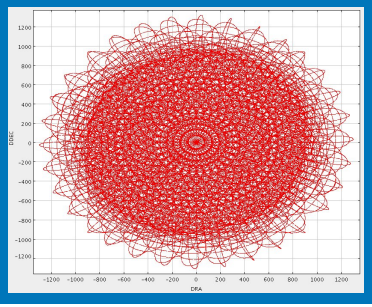
Each wavelength has four sub-arrays containing 32x40 TES bolometers

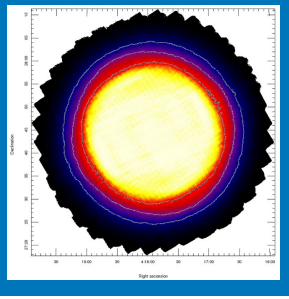




CV Daisy

Use: point sources/compact sources of order 3-arcmin or less, although there is significant exposure time in the map out to 12-arcmin



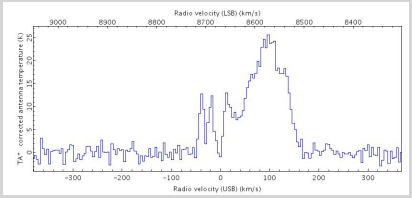


Rotating Pong pattern

Use: larger scale mapping - diameters 900″, 1800″, 2700″, 3600″ and 7200″ available

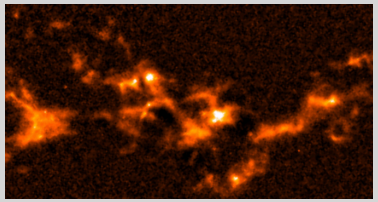
Instrumentation

JCMT Website



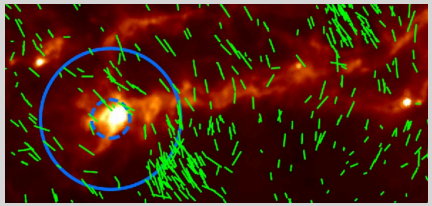
Heterodyne

Mairs, S et al. 2016

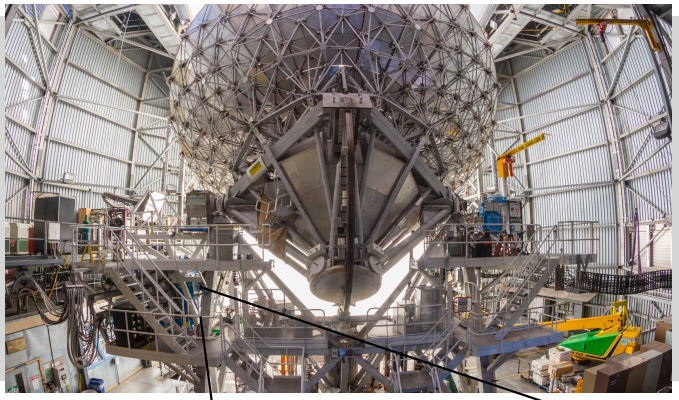


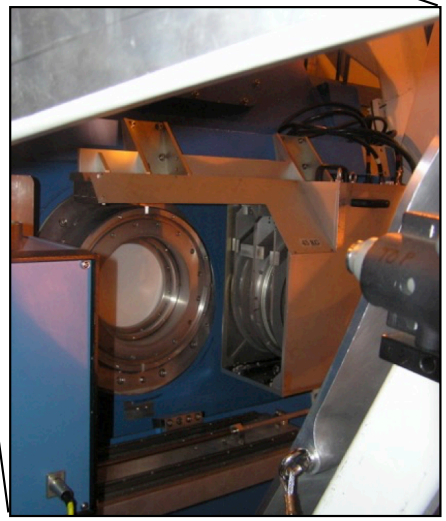
Continuum

Wang, J-W. et al. 2018



Polarization





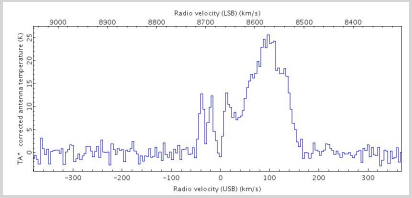
POL-2

- linear polarimiter (obtaining stokes I, Q and U vectors)
- requires SCUBA-2 (not a detector in itself)
- 11′ diameter maps
- scanning at 8″/second
- 3 optical components in “blades”: Calibrator (~100% polarization), Half-wave plate (HWP). Continuous rotation of this modulates polarization, allowing removal of atmospheric effects. Transmission at 850μm ~ 86%, and Analyser
- Total effective 850μm transmission ~ 74%

.

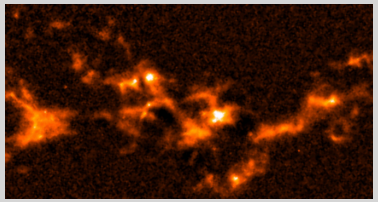
Instrumentation

JCMT Website



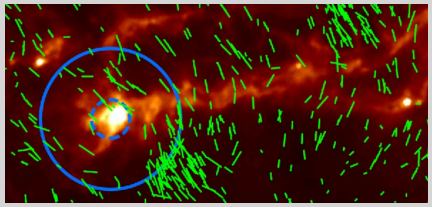
Heterodyne

Mairs, S et al. 2016

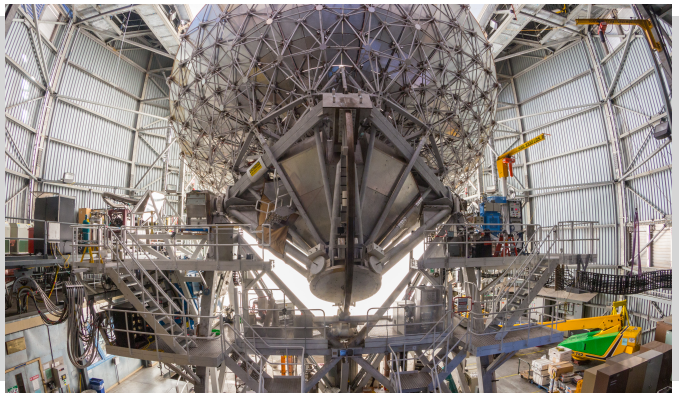


Continuum

Wang, J-W. et al. 2018



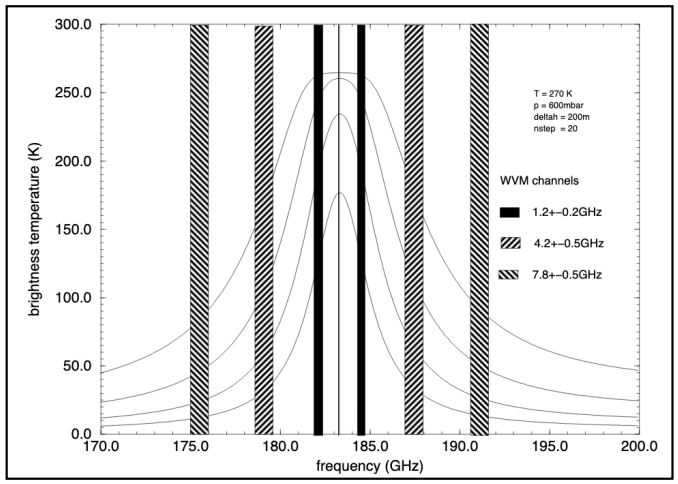
Polarization



Ancillary

Water Vapor Monitor

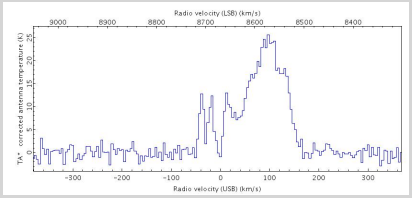
- In-cabin line-of-sight 183 GHz radiometer
- Critical for Nāmakanui and SCUBA-2
- Used for determining sky opacity for Flexible Observing
- The WVM works by obtaining measurements of the 183 GHz water line in three double side band frequency channels



https://www.eaobservatory.org/jcmt/instrumentation/wvm/

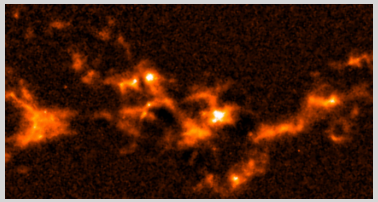
Instrumentation

JCMT Website



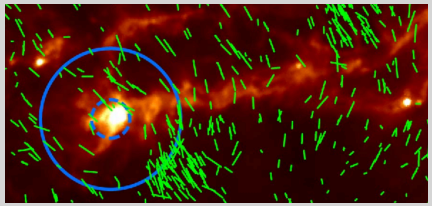
Heterodyne

Mairs, S et al. 2016

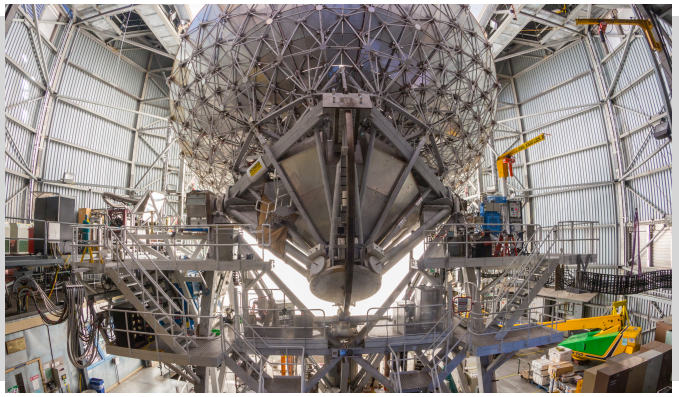


Continuum

Wang, J-W. et al. 2018



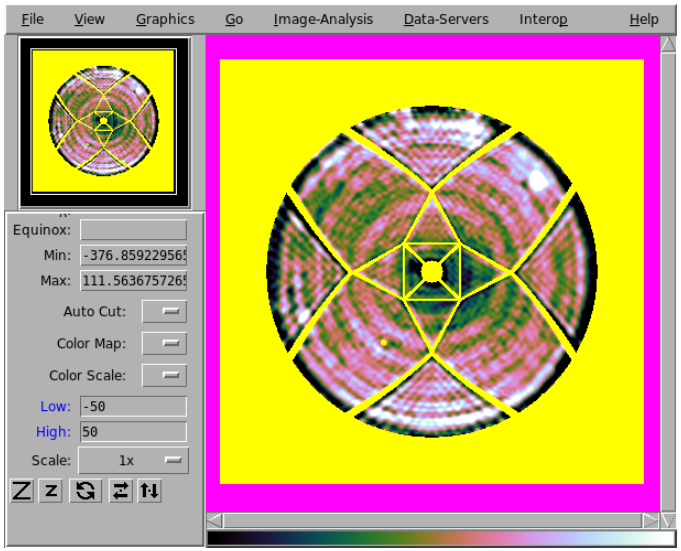
Polarization



Ancillary

Holography system (RxH3)

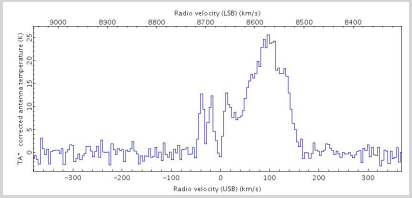
- JCMT dish 276 panels moved by 3 motorized adjusters.
- A 2-channel source located inside the UKIRT dome and a 4-channel receiver (two frequencies at orthogonal polarizations) in the JCMT receiver cabin.
- Two frequency operation at 80 and 160GHz
- 80GHz for monitoring (50 mins per map)
- 160GHz for adjustments (110 minutes per map)



https://www.eaobservatory.org/jcmt/observing/jcmt-surface/
http://starlink.eao.hawaii.edu/devdocs/sun272.pdf

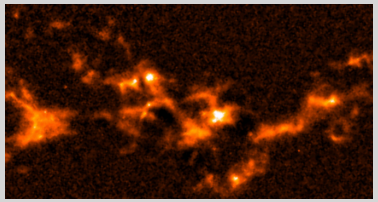
Maunakea Weather

JCMT Website



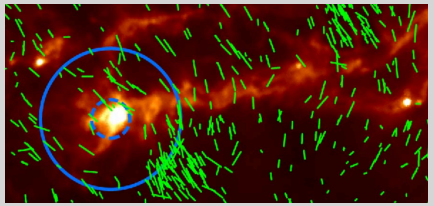
Heterodyne

Mairs, S et al. 2016



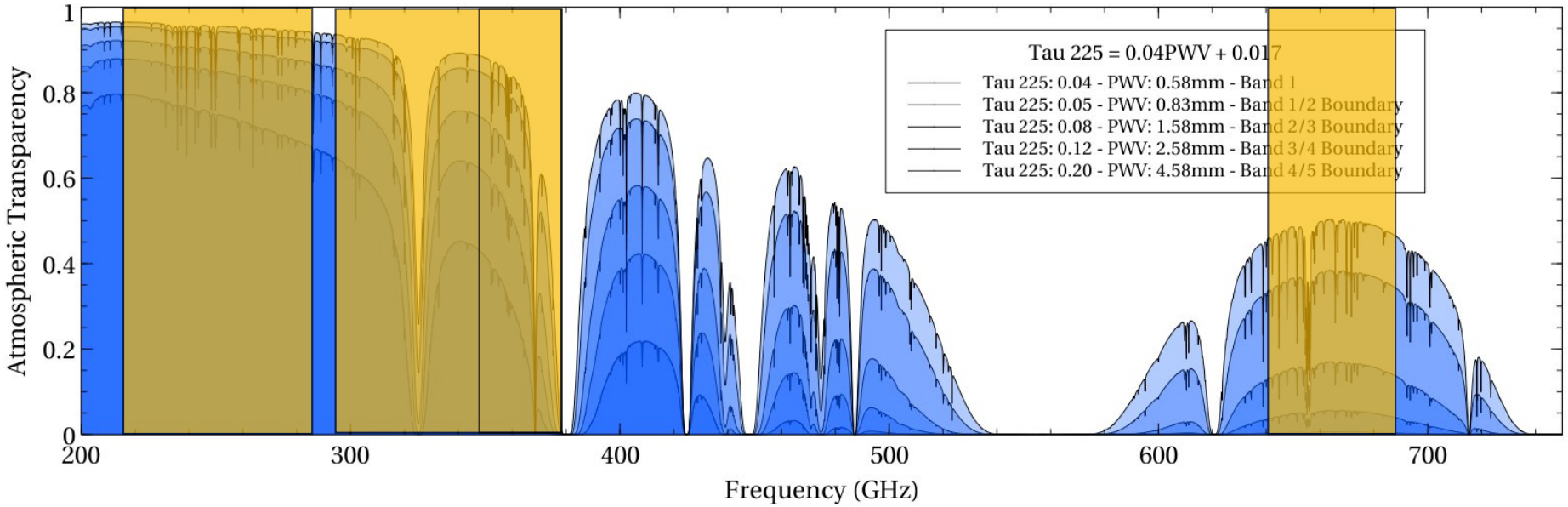
Continuum

Wang, J-W. et al. 2018



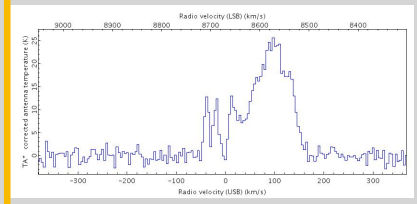
Polarization

Weather Grades are arbitrary cuts in opacity. Transmission is key. But for now operations based on weather Grades.



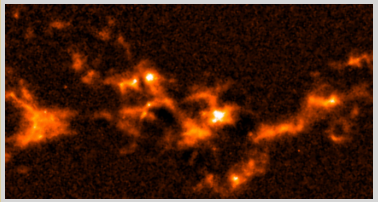
Maunakea Weather

JCMT Website



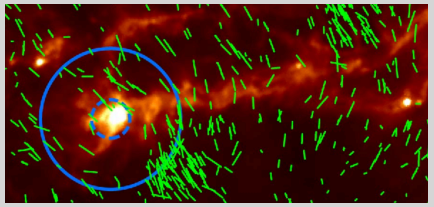
Heterodyne*

Mairs, S et al. 2016



Continuum

Wang, J-W. et al. 2018



Polarization

Weather Grades are arbitrary cuts in opacity. Transmission is key. But for now operations based on weather Grades.

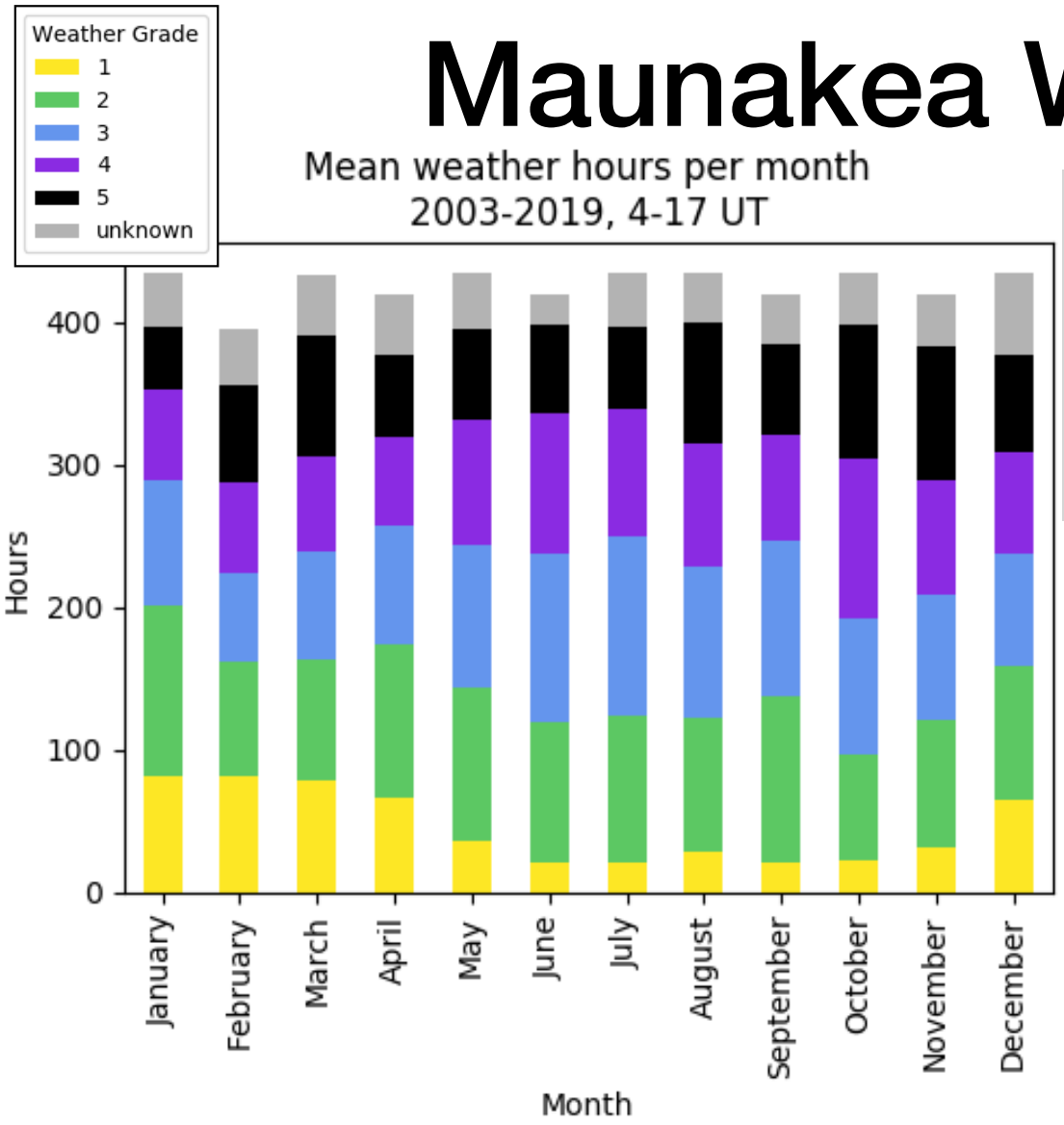
Heterodyne*	Continuum	Polarization
Grade 1	Grade 1 (450,850)	Grade 1 (450, 850)
Grade 2	Grade 2 (450,850)	Grade 2 (850)
Grade 3	Grade 3 (850)	
Grade 4		
Grade 5		

* dependent on molecule/frequency

13CO/C18O (3-2): Grade 1/2

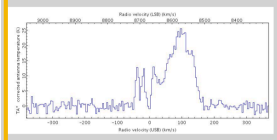
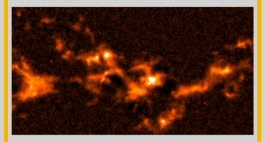
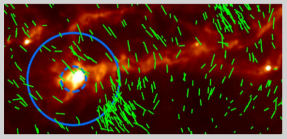
`Ū`ū = workhorse in Grades 4/5

Maunakea Weather



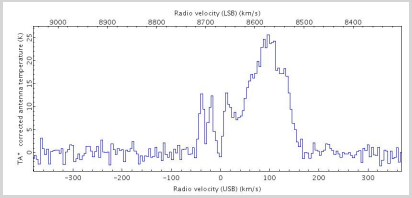
Weather Grades are arbitrary cuts in opacity. Transmission is key. But for now operations based on weather Grades.

* large year-to-year variation on hours obtained in any given weather Grade

	JCMT Website	Mairs, S et al. 2016	Wang, J-W. et al. 2018
	 Heterodyne*	 Continuum	 Polarization
Grade 1	Grade 1	Grade 1 (450,850)	Grade 1 (450, 850)
Grade 2	Grade 2	Grade 2 (450,850)	Grade 2 (850)
Grade 3	Grade 3	Grade 3 (850)	
Grade 4	Grade 4		
Grade 5	Grade 5		

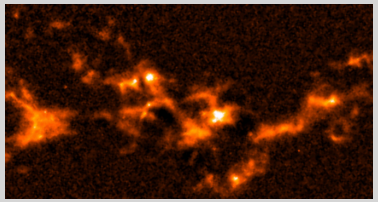
Flexible Observing

JCMT Website



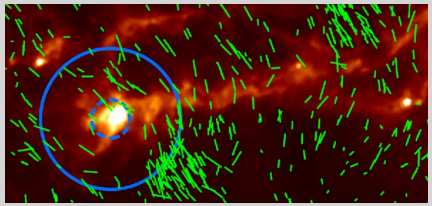
Spectral line

Mairs, S et al. 2016



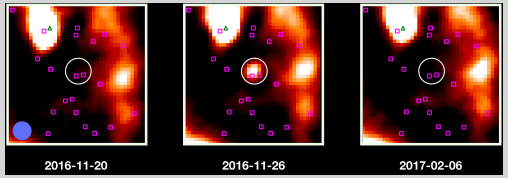
Continuum

Wang, J-W. et al. 2018



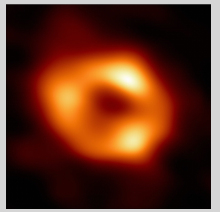
Polarization

Mairs, S et al. 2019



Variability

*EHT 2022 M87**



VLBI

Science programs observed based on weather, instrumentation and science raking

Aim: Maximizing science time since 2003

https://www.eaobservatory.org/jcmt/observing/guidelines-for-flexible-observing/

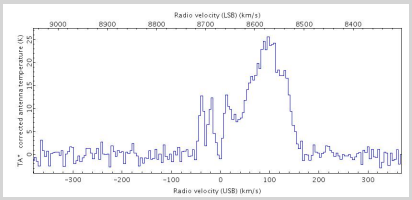
https://ui.adsabs.harvard.edu/abs/2014SPIE.9149E..1FD/abstract

Enabled by

- Automatically managed by telescope software
- Telescope operator makes final call (adjusting for trends in weather availability overrides etc)
- Single Time Allocation Committee (TAC) ranks programs
- Nights allocated to a queue: 50-50 split in time between Large Program and PI queue.
- Queue switching (between PI and LAP if holes exist at RAs) provides redundancy.

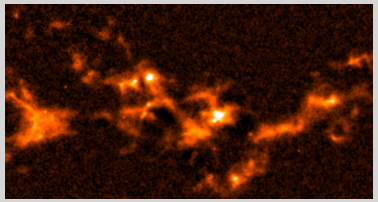
Flexible Observing

JCMT Website



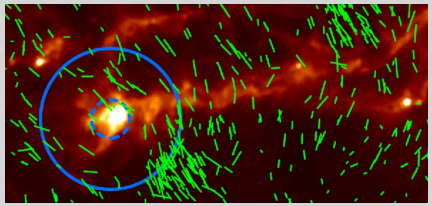
Spectral line

Mairs, S et al. 2016



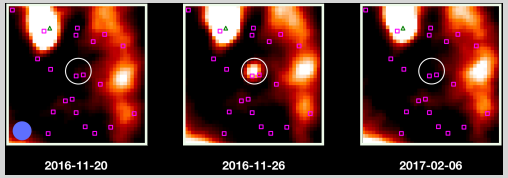
Continuum

Wang, J-W. et al. 2018



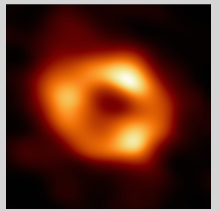
Polarization

Mairs, S et al. 2019



Variability

*EHT 2022 M87**



VLBI

Benefits to observatory

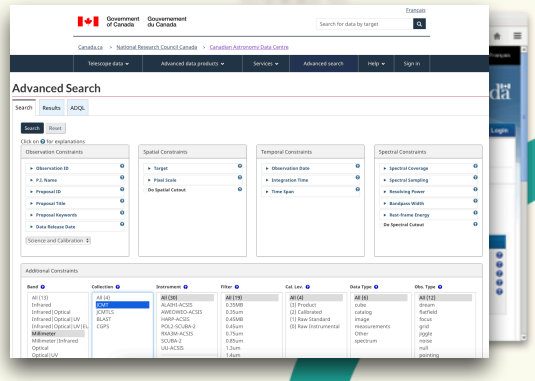
- No requirement for observes
- Flexibility with instrumentation (e.g. faults)
- Flexibility with weather
- Best science prioritized (along with regional contributions)

Benefits to community

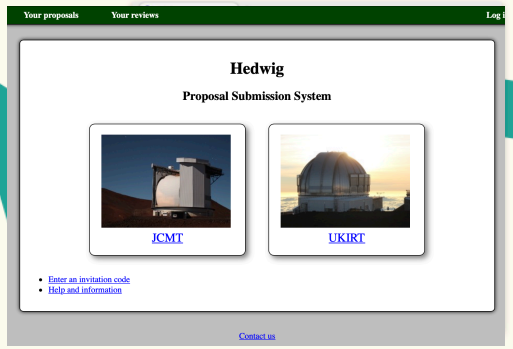
- No requirement to visit telescope
- Program automatically scheduled
- Program data automatically collected, PI/COIs notified
- Data available <24 hours via CADC
- Flexibility with program

Flexible observing from a user perspective

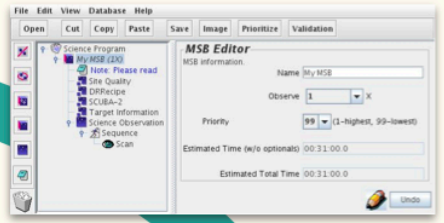
CADC

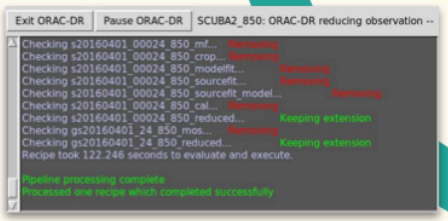


Hedwig



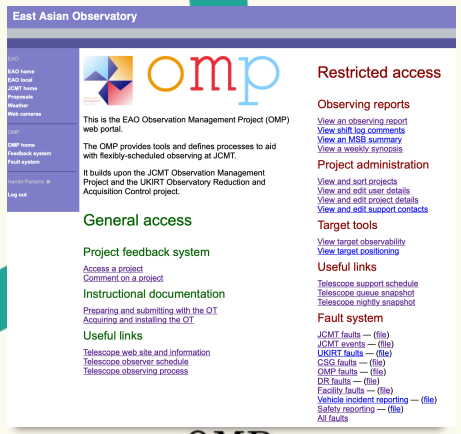
JCMT-OT





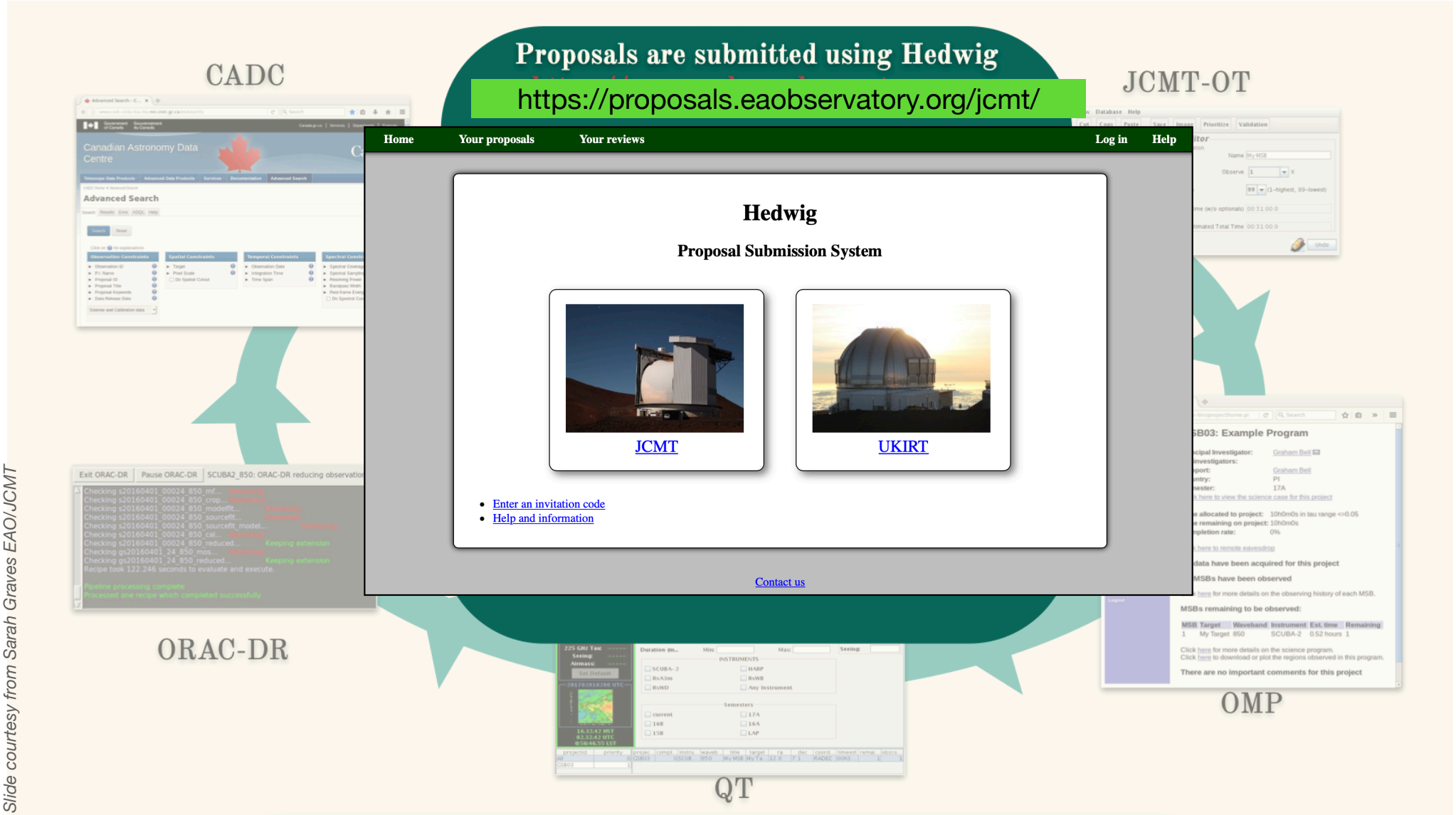
ORAC-DR

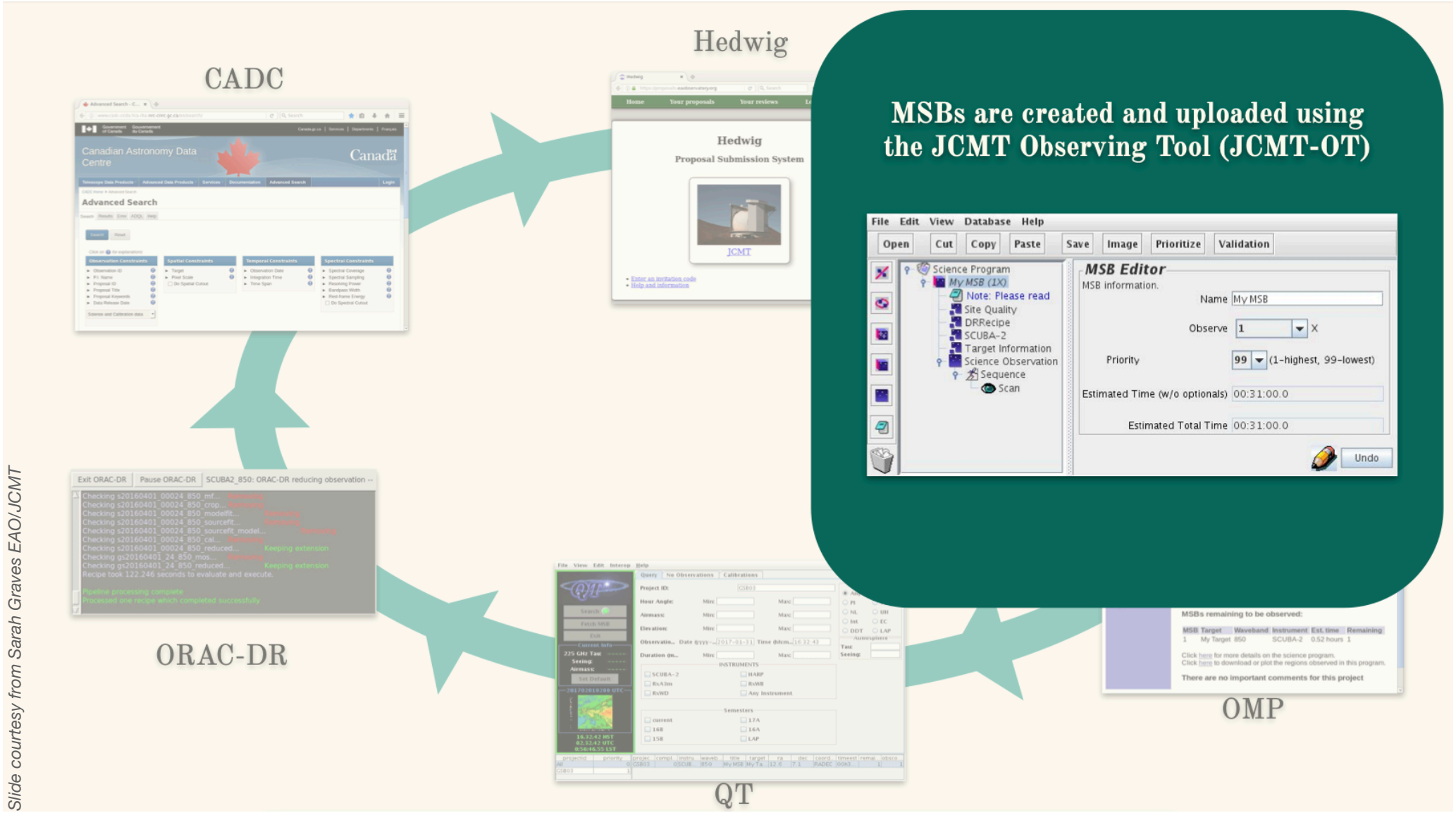
QT



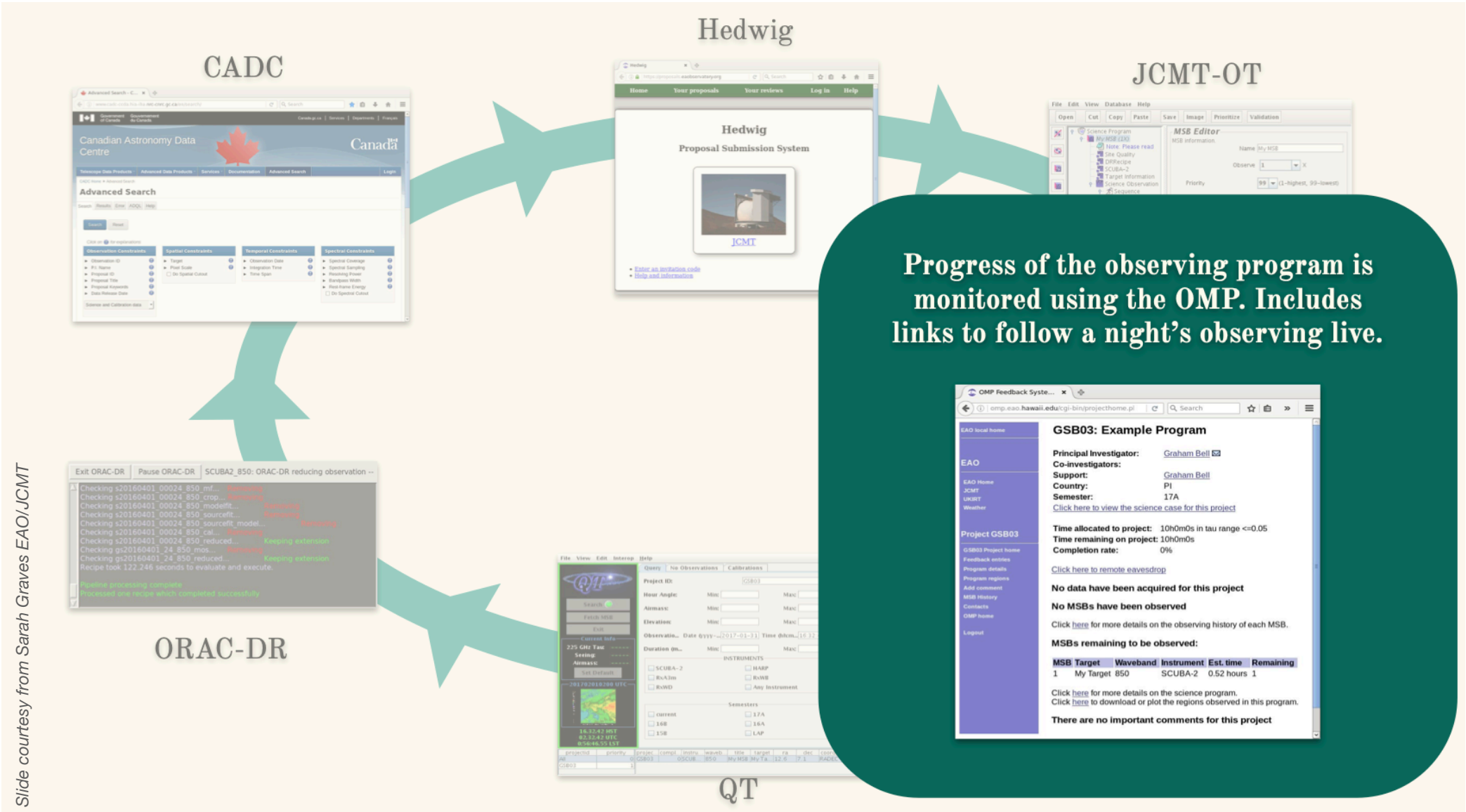
OMP

Slide courtesy from Sarah Graves EAO/JCMT

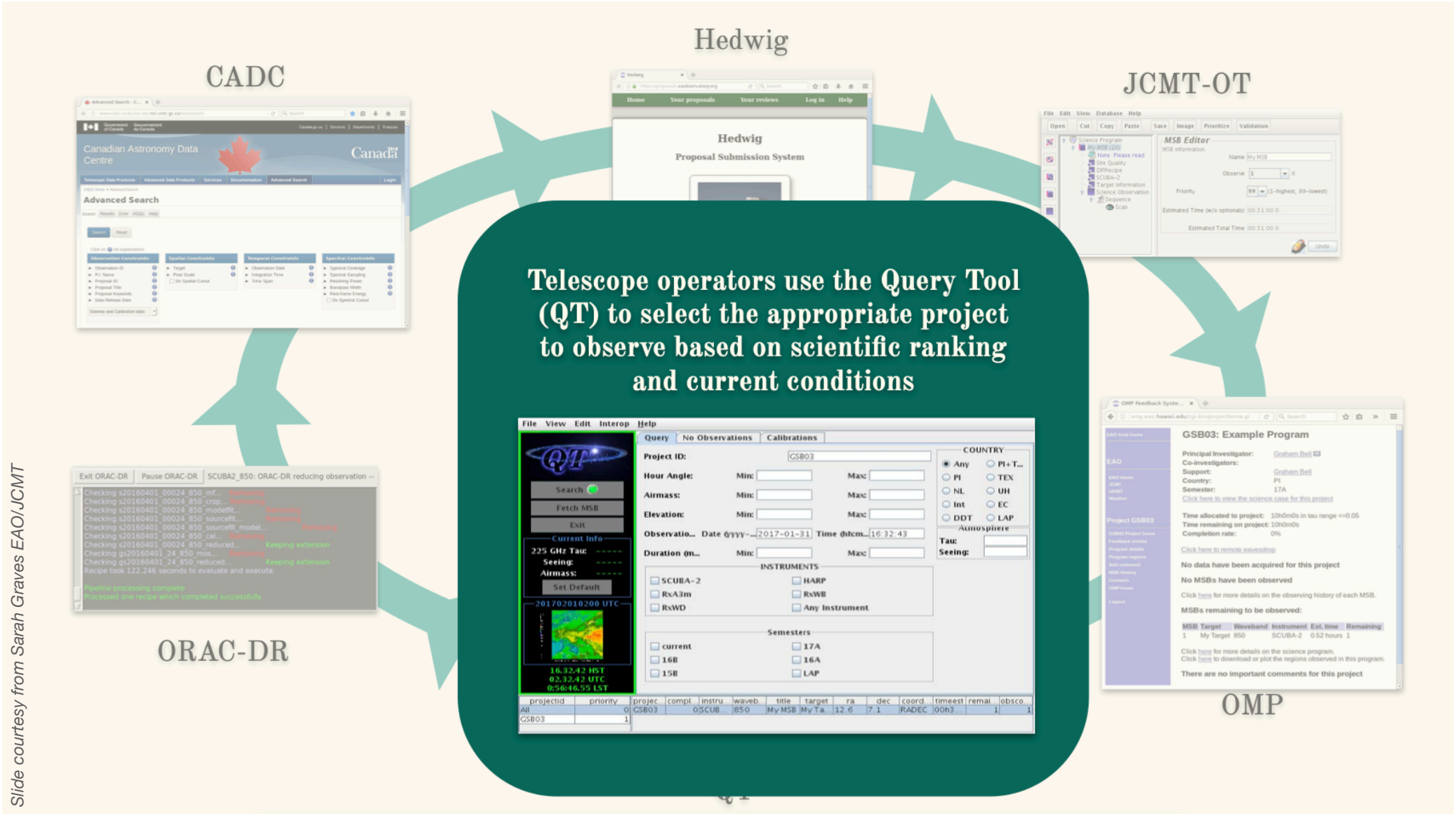

Proposals are submitted using Hedwig
https://proposals.eaobservatory.org/jcmt/
CADC
JCMT-OT
Canadian Astronomy Data Centre
Advanced Search
Home
Your proposals
Your reviews
Log in
Help
Hedwig
Proposal Submission System
JCMT
UKIRT
Enter an invitation code
Help and information
Contact us
ORAC-DR
QT
OMP
Slide courtesy from Sarah Graves EAO/JCMT

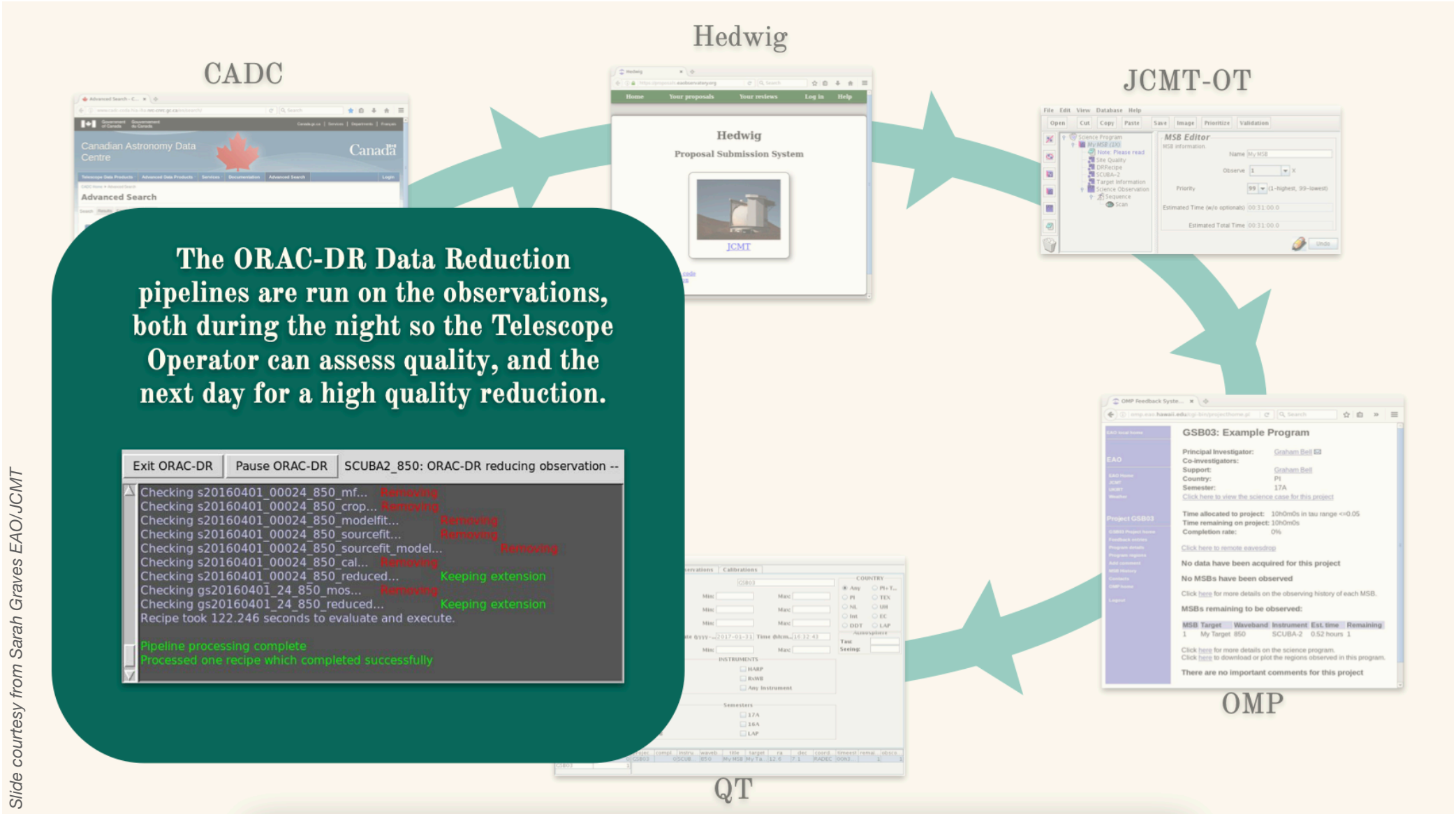


Slide courtesy from Sarah Graves EAO/JCMT



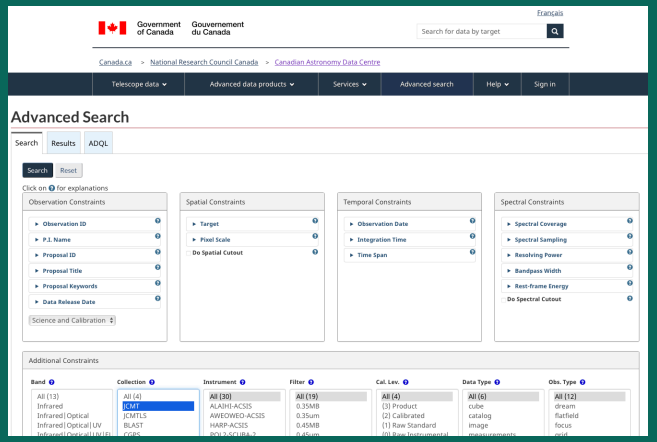
Slide courtesy from Sarah Graves EAO/JCMT


Hedwig
CADC
JCMT-OT
Telescope operators use the Query Tool (QT) to select the appropriate project to observe based on scientific ranking and current conditions
ORAC-DR
OMP
Slide courtesy from Sarah Graves EAO/JCMT

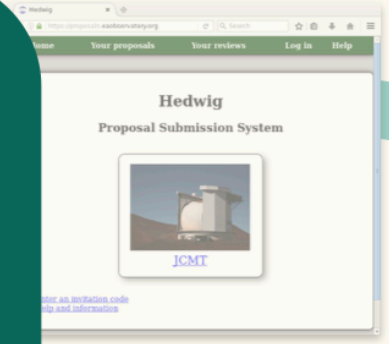


Slide courtesy from Sarah Graves EAO/JCMT

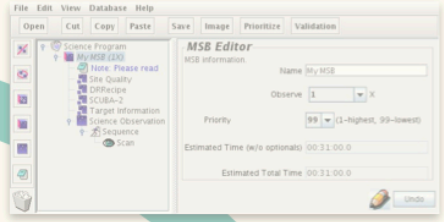
Raw and Reduced data are uploaded within 24 hours to the JCMT Science Archive at CADC.

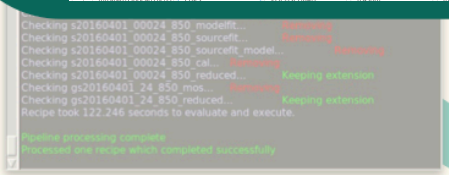


Hedwig

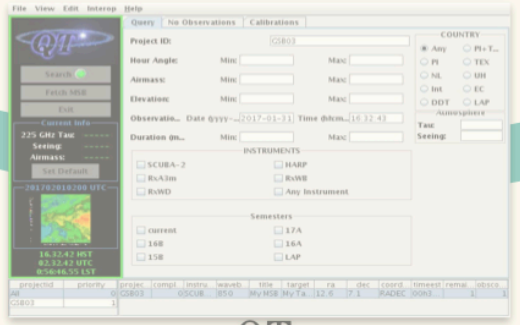


JCMT-OT

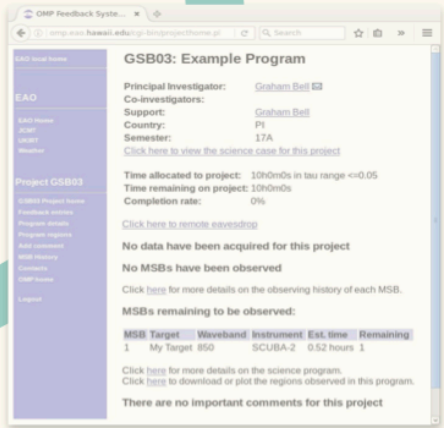




ORAC-DR



QT

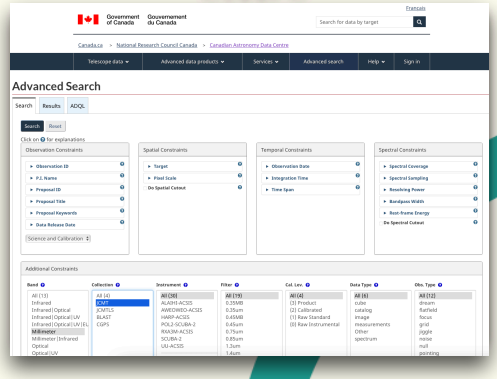


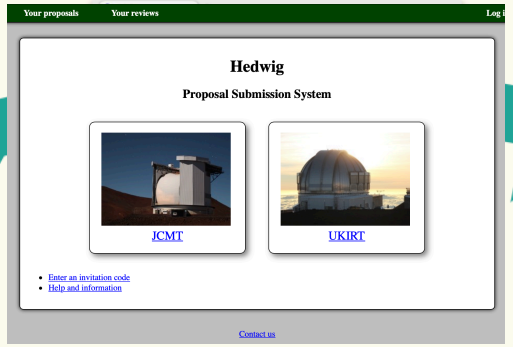
OMP

Slide courtesy from Sarah Graves EAO/JCMT

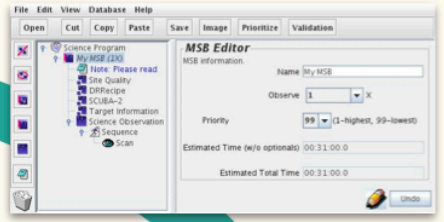
Hedwig

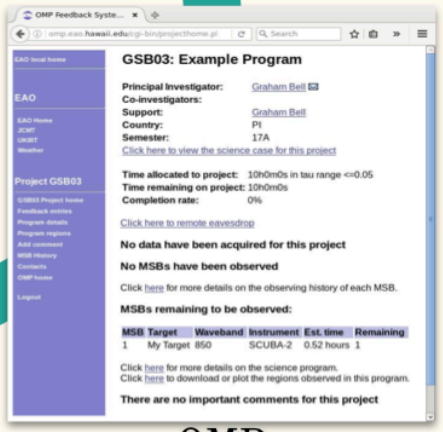
CADC





JCMT-OT





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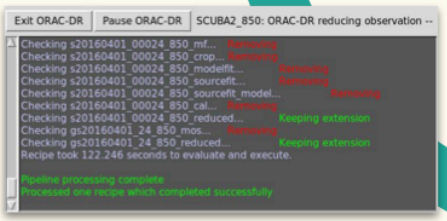


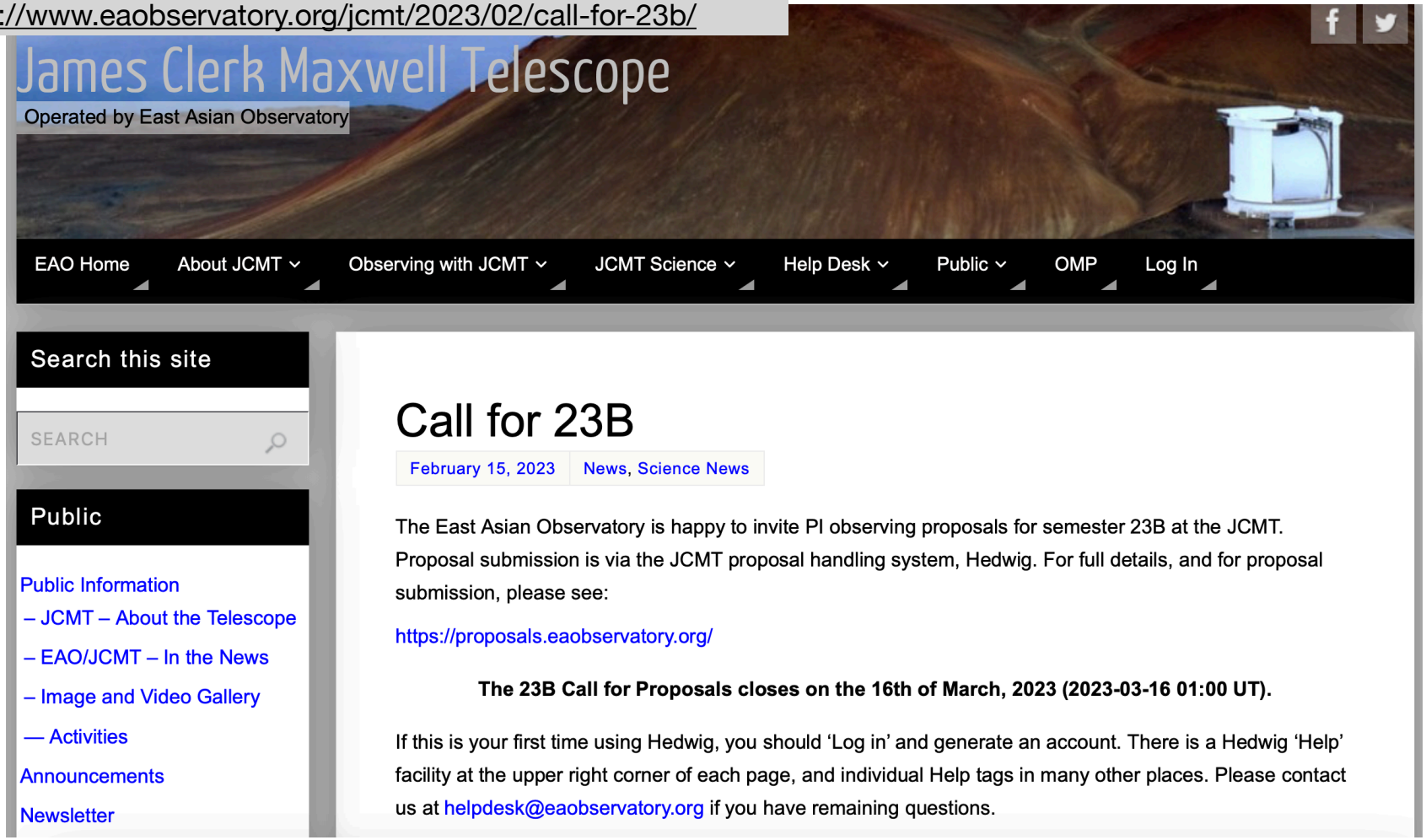
ORAC-DR

QT

Slide courtesy from Sarah Graves EAO/JCMT

23A Call for Proposals

https://www.eaobservatory.org/jcmt/2023/02/call-for-23b/



23B Call for Proposals

https://www.eaobservatory.org/jcmt/2023/02/call-for-23b/

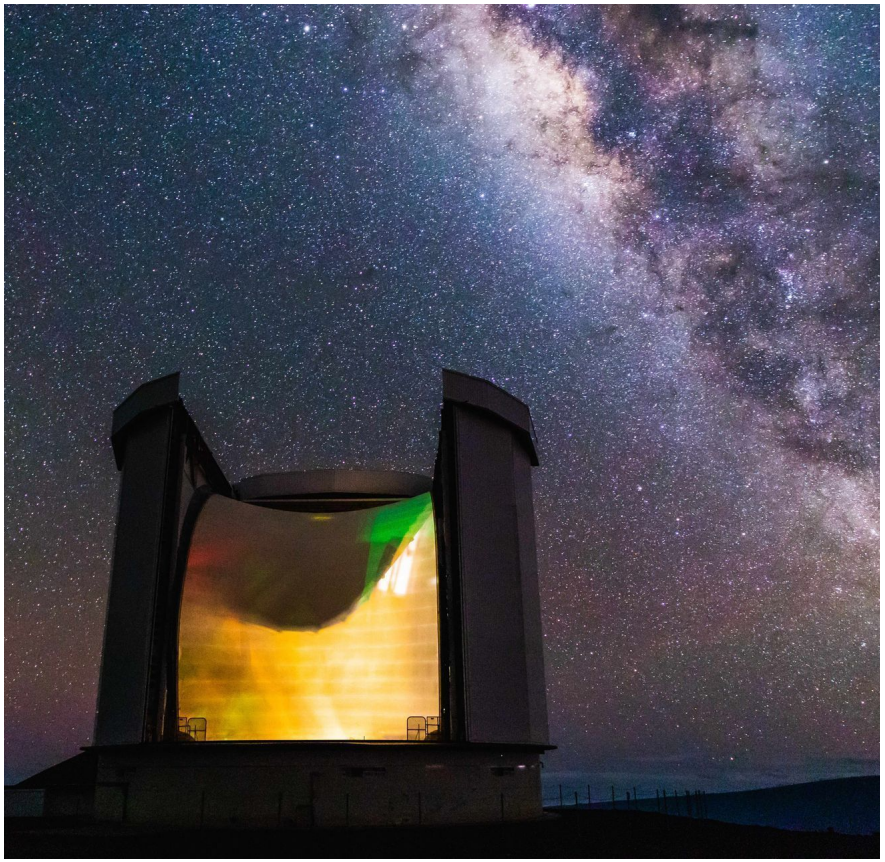
The Expanding Partner Program

PIs from Thailand, Malaysia, Vietnam, Indonesia, India, **Brazil** and **Argentina** requesting <15 hours will be automatically approved*** for time under the “Expanding Partner Program” – a program to encourage astronomers from new JCMT partners to make use of the JCMT.

*** *approval reliant upon the program being technically feasible, without clashing with existing proprietary data (as per observatory requirements), dependent on weather/instrument pressures and with adjustments in line with recommendations by the TAC. Under the “Expanding Partner Program” priority will be given to new users of the JCMT.*

Homework

- Start thinking about PI Science for 23B - Decline March 15th - the LLAMA (Brazil/Argentina) community qualifies for JCMT time under Expanding partner Program (guaranteed time*).
- Sign up for Hedwig account: https://proposals.eaobservatory.org/jcmt/
- Sign up to JCMT_Users email list by sending an e-mail to jcmt_users+subscribe@eaobservatory.org
- For information or assistance, please contact helpdesk@eaobservatory.org



JCMT Users Meeting