Proposals

1

From Ideas to Publications

- Observing time is generally allocated via a Competitive Peer Review process that aims to approve the most compelling science programmes for execution.
- Oversubscriptions can be very large, up to 10x or more
- An observational programme will need good justification and a carefully constructed case for support which has to be made within the limits specified.
- Typically have 2-4 pages for the case for support, including Figures, Tables, References and technical justification
- Must abide by rules or proposal may not be considered
- Many proposals require anonymised applications

2

Proposal

- Science -driven project
- Science defines the wavelength, resolution, sensitivity required
- Single, or few, interesting object(s) or
- Statistical Sample
  - Need to justify sample size and selection
  - Why this number and not half or twice? Reviewers will question this
  - Probability of significant results
- Technical feasibility – check configurations, availability
- Sensitivity checked with Exposure Time Calculator.
  - What Signal-to-Noise ratio is required? And Why?
- Is time request reasonable?
- Include summary of calibrations; Estimate overheads
- Proposals that test a model or hypothesis preferred over fishing expeditions

3

Observatories

- Most Observatories and space missions have either a six-monthly or annual proposal cycle
- A Call for Proposals is generally issued 1 (or more) months ahead of the proposal deadline
  - Outlines instrument and facility availability
  - Proposal assessment and evaluation process
  - New capabilities, restrictions etc
  - Check even if you are a regular user, there may be changes
- There may be restrictions on who can apply as PI
  - Institute Nationality or Consortium membership
- The best facilities are very oversubscribed
  - Well-structured and thought-out proposals are needed
    - Interesting, well-argued and compelling science case,
    - technically feasible
    - Data analysis plan

4

Service or Visitor Mode

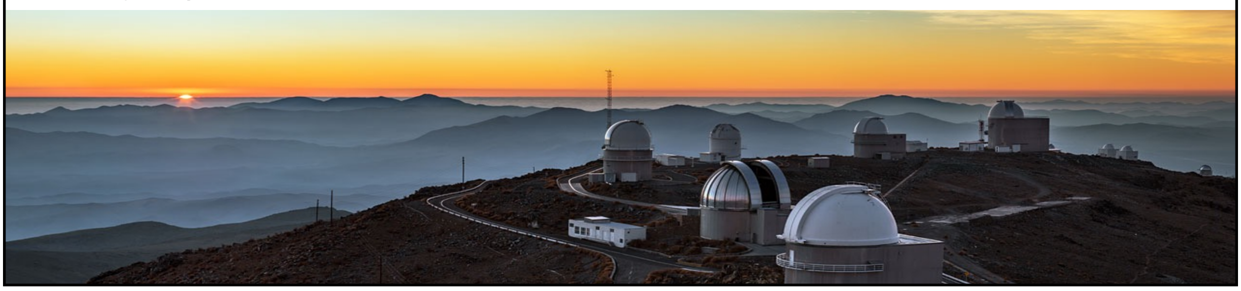
All space observatories (!) and some ground-based facilities (e.g. ALMA) only operate in service mode

- PI defines instrument configuration and observation sequence and properties, including any special calibrations required
- Telescope operator executes the pre-defined programme
- Observations should be made in the conditions specified (seeing, lunar phase, water vapour etc)
- Allows observations to be matched to prevailing conditions – optimised programme
- Ideally suited for programmes spread over large RA range
- Observatory conducts some QA before data are released
- Eavesdropping may be possible to check on progress

5

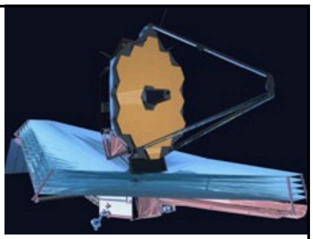
Visitor Mode

- Many observatories offer Visitor mode
  - PI still defines Observing Blocks (configurations & sequences)
  - Observations are scheduled at a defined time, regardless of weather conditions, so conditions may not be optimum
  - PI knows when observations will be attempted
  - Direct experience of instrument/telescope/operation/site
  - Decisions on observing priorities made by observer in real time



6

Call for Proposals



- Satellites tend to have a number of calls as launch approaches
  - Early science/ verification
  - Guaranteed time for instrument teams
  - General Observer
  - Note that initial orbit phase is used for check-out and characterization
- JWST was launched in December 2021
  - **General observer Cycle 1 deadline was the previous year:** 24 November 2020
  - **Early Science Call Release deadline was in November 2017**
  - Early data may be publicly available immediately
- Standard programmes usually provide ~1 year proprietary period
- See: https://jwst-docs.stsci.edu/jwst-opportunities-and-policies

Example Proposal Deadlines

Annual Cycles

- Chandra March
- HST Late March
- ALMA April
- Merlin November? (deadline moves around a lot)

6 Month Cycles

- VLA 1 Feb, 1 August (except for VLBI which is done separately)
- ESO Paranal/Silla Late March, Sept
- NOAO Gemini. KPNO, CTIO 30 March, 30 Sep
- PATT ING March 15, Sep 15
- NAOJ Subaru March, Sep
- Keck March, Sep Varying deadlines depending on proposal route
- JCMT Mid-March, Mid- Sep

This is a guide in normal time, but deadlines do move, so always check well ahead. Under current circumstances, expect more variations……

Typical Time Sequence

The observing period typically begins ~6 months after the proposal deadline, so it can be 8 - 20 months before any data are delivered….

- T0 Proposal Deadline
- T+ 3 months Proposal Review & Assessment of Phase I proposals
  - Conducted by specialist panels or by applicants via distributed peer review
    - e.g. ALMA had 18 panels in 2016, reviewing 1700 proposals,
    - ESO panels review 900 per semester
    - Unsustainable effort led to distributed processes
  - Ranked list on scientific merit from panels
  - Schedule developed on the basis of scientific merit, technical feasibility, schedulability
    - Lunar Phase,
    - Telescope or instrument configuration,
    - Oversubscription at particular RA
    - Telescope engineering, instrument commissioning, Guaranteed Time
- Technical feasibility may be assessed before or after scientific review, usually by Observatory staff

Time Allocation and Phase 2

- Observatory Director allocates time
  - proposals may be allocated time in different priority bands,
  - Grade A,
  - Grade B,
  - Grade C (filler)
- T + 4 Months Phase II submission and check
  - Detailed instrument configuration
  - Observing sequences, integration times etc
  - Guide stars
  - Finding Charts or detailed instructions
  - Specify Calibrations
- Observations placed in the Observing Queue
- Fingers Crossed

Other avenues

- For urgent or time-sensitive observations that could not be predicted for the standard proposal route
  - Director's Discretionary Time. e.g. for
    - Transient objects that merit immediate follow-up
    - Verification of interesting results or indications from a regular programme
    - Time critical follow-up because of instrument or configuration constraints
    - Request for a small amount of observing time to test the feasibility of a programme.
    - Generally a defined process/form e.g. ESO
      - https://www.eso.org/sci/observing/policies/ddt_policy.html
  - Fast turn-around time on Gemini
  - Friends & Collaborators with privileged access..
- Data Archives and Catalogues can be a valuable source of additional data, or for developing whole programmes

Substantial Preparatory Work

- Need to understand instrument capabilities and restrictions
  - Instruments and Modes available
  - Sky regions accessible
    - launch date and orbit dependent, sun, moon restrictions etc
    - Telescope longitude & Latitude
    - Lunar Phase seasonal constraints
    - Engineering works etc
  - Acquisition, Pointing & tracking restrictions
  - Target availability – not in guaranteed time projects
  - Sensitivity calculations and overheads
- Judgment on proposal scope and size
- Proposing Team's capabilities for rapid data reduction, analysis and publication of results

Observation Planning

- Optical telescopes on the ground usually operate only at night, and so can only access objects that are above ~2 airmass (Zenith Distance <60deg) between the end and start of twilight
- Where possible, prime targets should be observed at high elevation, where the effects of the atmosphere are minimised
- Observation Planning requires careful attention to the zenith distance of targets and calibrators.
- They should normally be observed at similar airmass and close together in time.

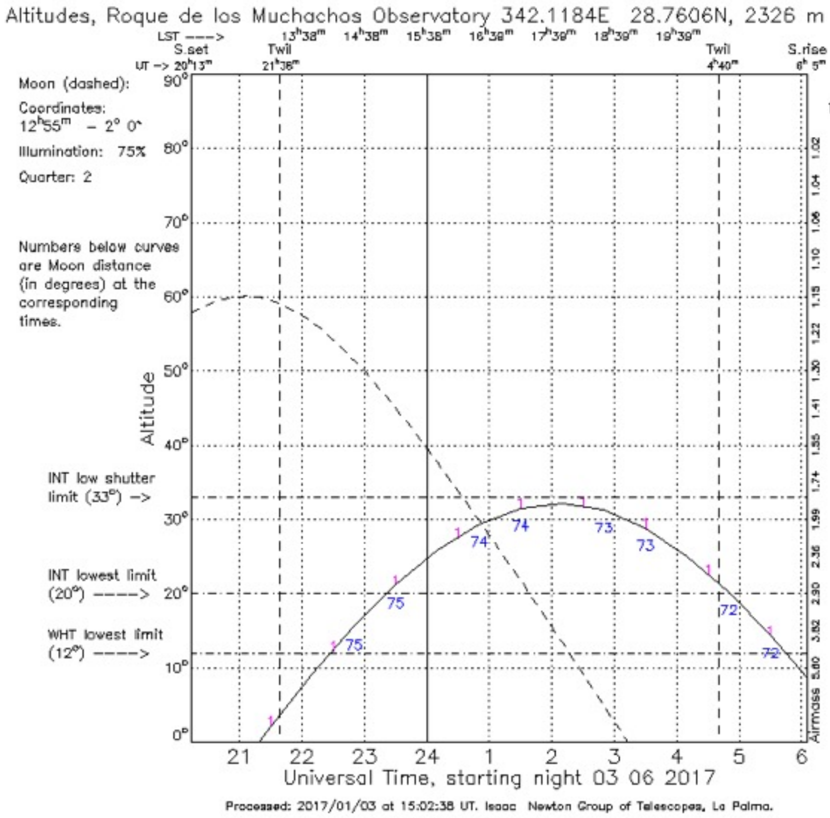
Observation Planning- 2

- May also have to consider other factors
  - Lunar Phase (Bright or Dark time)
  - Moon distance (and/or Earth distance for satellites)
  - Ephemerides for e.g. variable or orbiting systems
  - Instrument configurations, slit angles etc
- Other factors may be important too
  - Seasonal factors – wind, temperature, turbulence
    - Winter nights are longer
    - Winter is colder - lower thermal background
    - On La Palma, summer has better seeing, but is dustier
  - Telescopes with Alt-Az mounts cannot observe at the zenith
  - Guide stars for Adaptive Optics etc

http://catserver.ing.iac.es/staralt/index.php

Object Visibility

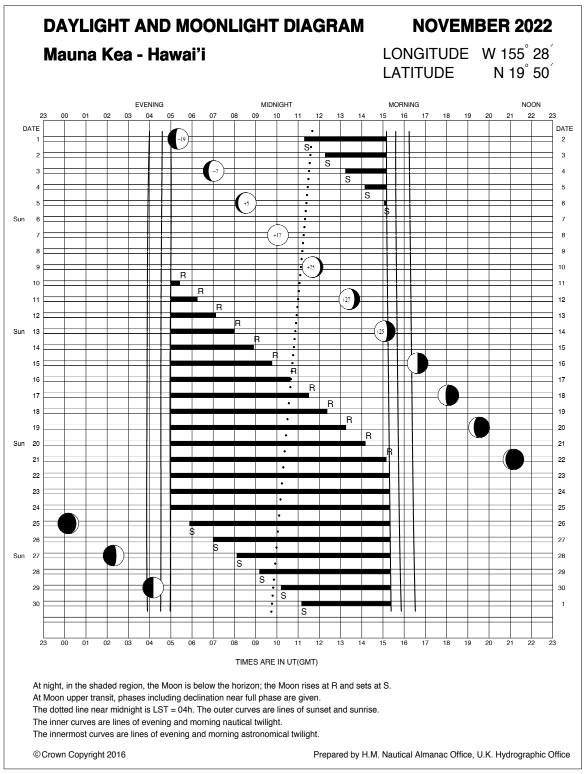
- Elevation plot for the Galactic Centre and Moon from ORM, La Palma on 3 June.
- Note that the GC is at -29° while ORM's latitude is +29°



http://astro.ukho.gov.uk/nao/online/

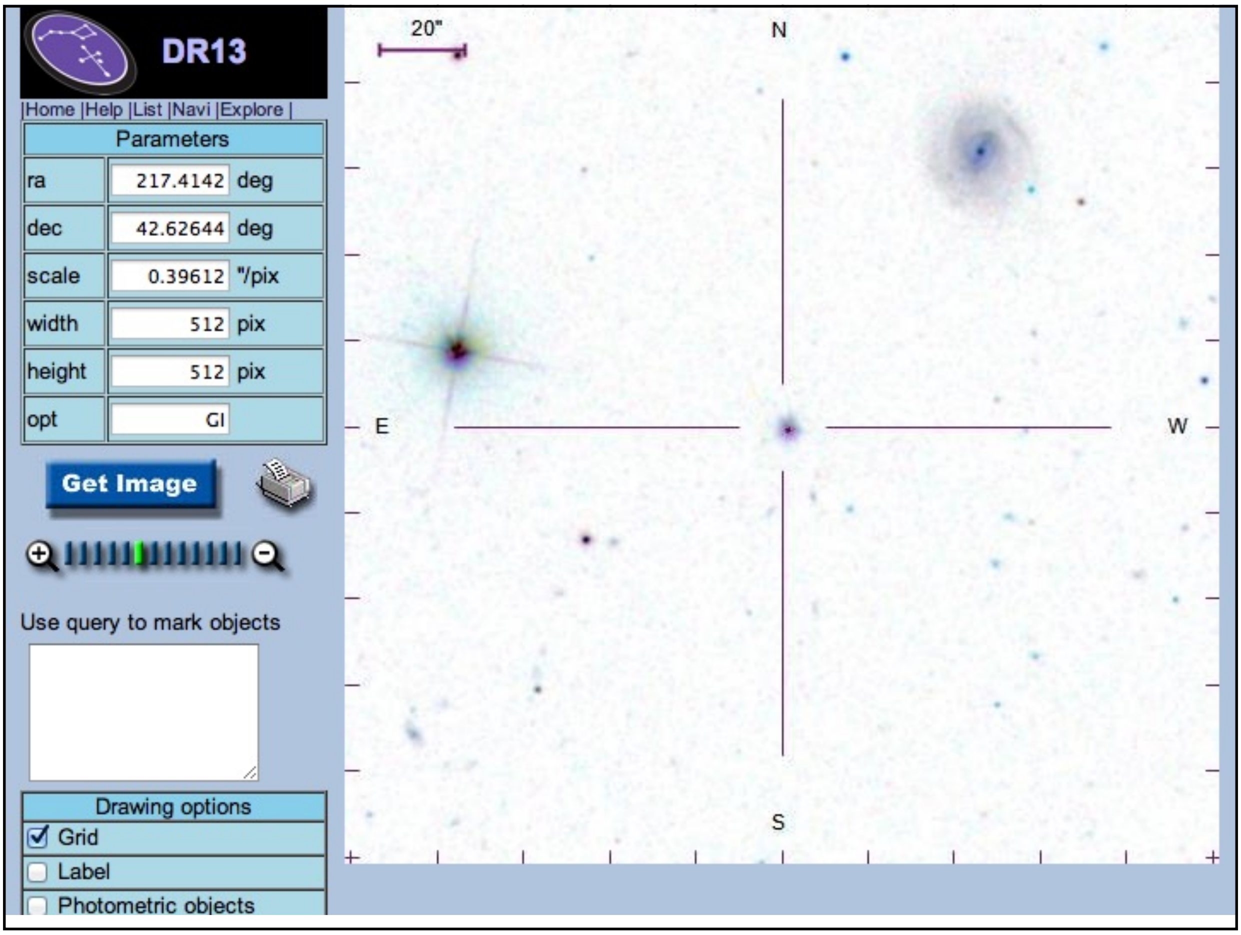
The phases, rise and set times of the moon shown graphically for Mauna Kea in November

Note – full moon tonight and the moon is up all night.



Observations Planning - 3

- Most observations are carried out in service mode, where all preparation must be done ahead of time, but some observations are made in Visitor mode. It is very important to plan and be prepared for both good and poor observing conditions.
- Time on Large telescopes is very expensive ($10,000/hr) and *much* more on space facilities. You cannot waste observing time
- Careful and accurate preparation is essential.
- Check coordinates thoroughly, both numbers and epoch. Is the accuracy good enough?
- Objects may have multiple, and sometimes confusing identifiers
- Many recent publications use well-defined reference frames (e.g. SDSS, 2MASS etc) and so coordinates should be accurate with well-identified uncertainties, but others may have large uncertainties or errors.
- Is the target obvious or is a finding chart required?



Essential sites

- Simbad : http://simbad.u-strasbg.fr/simbad/
- NED : Nasa Extragalactic Database
  http://ned.ipac.caltech.edu
- NASA Space Data Center
  http://nssdc.gsfc.nasa.gov/astro/
- Canadian Astronomy Data centre
  http://www.cadc-ccda.hia-iha.nrc-cnrc.gc.ca/en/
- IRSA/IPAC Infrared Science Archive
  http://irsa.ipac.caltech.edu/frontpage/
- NRAO VLA Sky Survey
  http://www.cv.nrao.edu/nvss/

Useful Books

Arthur Cox Allen's Astrophysical Quantities

George Rieke **Measuring the Universe -**A Multiwavelength Perspective

Ian McLean**,** Electronic Imaging in Astronomy: Detectors and Instrumentation, Second Edition, 2008

C.K. Walker**,** Terahertz Astronomy

Jonathan M. Marr, Ronald L. Snell, Stanley E. Kurtz Fundamentals of Radio Astronomy: Observational Methods

Bevington, P. R., and Robinson, D. K. 2002, Data Reduction and Error Analysis for the Physical Sciences

Useful Reviews

- **M Bessell,** Standard Photometric Systems, ARAA, 43, 293, 2005
- **G Rieke,** Infrared Detector Arrays for Astronomy, ARAA, 45, 2007
- **Davies and Kaspar,** Adaptive Optics for Astronomy, ARAA, 50, 305, 2012

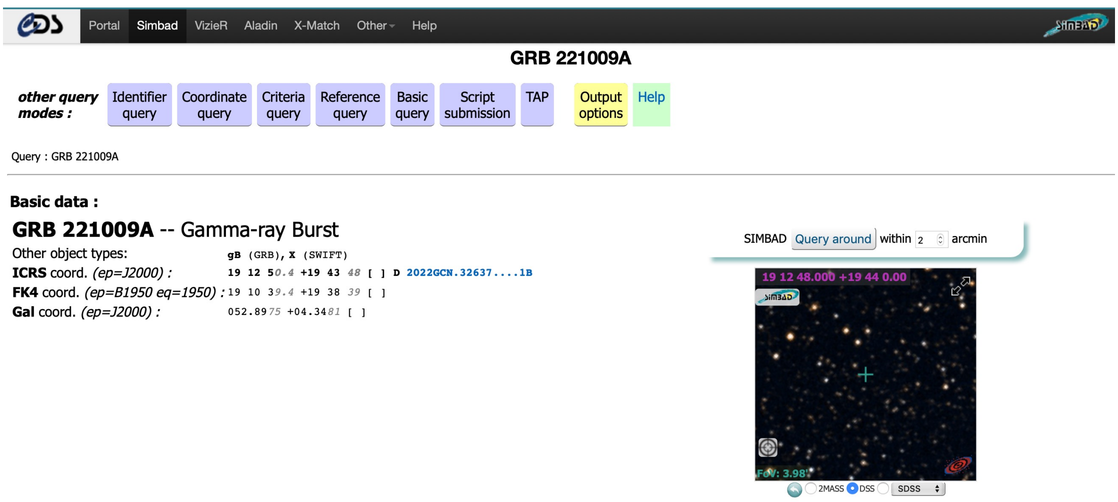
I have collected references + pdf handouts of these talks at:

https://www.physics.ox.ac.uk/our-people/rochep/teaching

GRB221009A

- Right Ascension : $19^h\ 13^m\ 03.5$
  Declination: $+19^\circ\ 46'\ 24.1''$
- Mauna Kea, Hawaii latitude +19.8°, Paranal -24.6
- Object passes overhead at MKO and maximum elevation is 47° at Paranal (minimum zenith distance = +19.75 - -24.6)
- Object transits at midnight when Siderial Time = 19h 13m
- 24 hours at midnight occurs at the Autumn Equinox – Sep 22,
- So May – Sep is prime observing time, and the target was setting in the early evening at the time of discovery

http://simbad.u-strasbg.fr



- ESO instruments are described at: https://www.eso.org/sci/facilities/paranal/instruments.html
- Exposure Time Calculators are at: http://www.eso.org/observing/etc/
- https://www.eso.org/sci/observing/tools.html

See also Object Observability - Airmasses - Daily Almanac - Ephemerides

Almanac

Paranal Observatory (VLT)
Mon, November 7, 2022

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CST/CDT Daylight Savings Time used before 2 AM
2022 Mar 13 and after 2 AM 2022 Oct 9; standard zone =   4 hrs W

For the night of: Mon, 2022 Nov 7 ---> Tue, 2022 Nov 8
Local midnight = 2022 Nov 8,  3 hr UT, or JD 2459891.625
Local Mean Sidereal Time at midnight =   1 27 32.7

Sunset ( 2635 m horizon):   20 08 CDT; Sunrise:   6 42 CDT
Evening twilight:  21 23 CDT;  LMST at evening twilight:  22 50
Morning twilight:   5 28 CDT;  LMST at morning twilight:   6 56
12-degr twilight: 20 53 CDT -->  5 57 CDT; night center:   1 25 CDT

Moonrise:  19 21 CDT
Moon at civil midnight: illuminated fraction 0.999
0.3 days until full moon, RA and dec:   2 38 29, +15 48.1

The sun is down for 10.6 hr;  8.1 hr from eve->morn 18 deg twilight.
Bright all night (moon up from evening to morning twilight).
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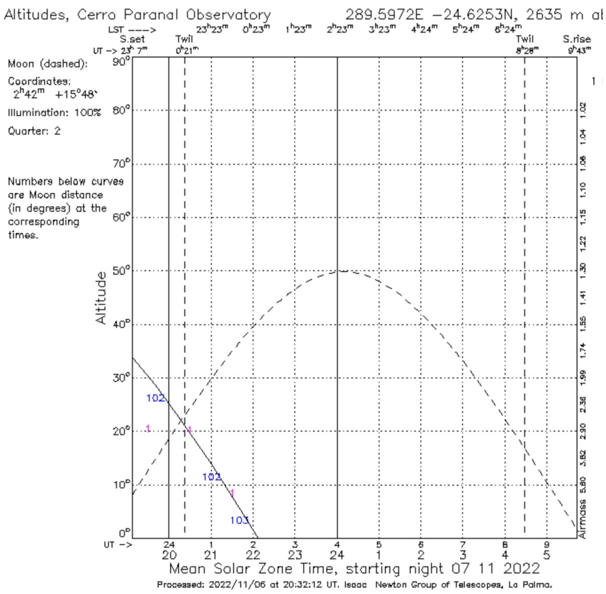
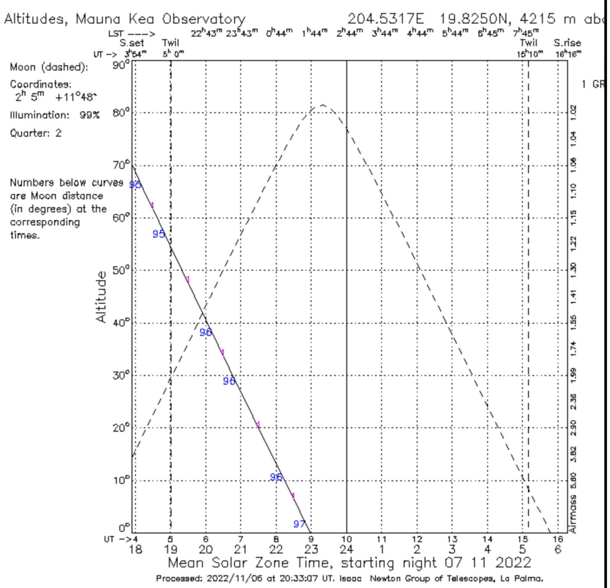
SkyCalc provided by courtesy of John Thorstensen, Dartmouth College. *John.Thorstensen@dartmouth.edu*

Send comments to <usd-help@eso.org>

Object Visibility : GRB221009A Today





ALMA Interferometer Configurations

Table A-1: Angular Resolutions (AR) and Maximum Recoverable Scales (MRS) for the Cycle 7 Array configurations

Config	Lmax		Band 3	Band 4	Band 5	Band 6	Band 7	Band 8	Band 9	Band 10
	Lmin		100 GHz	150 GHz	183 GHz	230 GHz	345 GHz	460 GHz	650 GHz	870 GHz
7-m Array	45 m	AR	12.5″	8.4″	6.8″	5.4″	3.6″	2.7″	1.9″	1.4″
	9 m	MRS	66.7″	44.5″	36.1″	29.0″	19.3″	14.5″	10.3″	7.7″
C43-1	161 m	AR	3.4″	2.3″	1.8″	1.5″	1.0″	0.74″	0.52″	0.39″
	15 m	MRS	28.5″	19.0″	15.4″	12.4″	8.3″	6.2″	4.4″	3.3″
C43-2	314 m	AR	2.3″	1.5″	1.2″	1.0″	0.67″	0.50″	0.35″	0.26″
	15 m	MRS	22.6″	15.0″	12.2″	9.8″	6.5″	4.9″	3.5″	2.6″
C43-3	500 m	AR	1.4″	0.94″	0.77″	0.62″	0.41″	0.31″	0.22″	0.16″
	15 m	MRS	16.2″	10.8″	8.7″	7.0″	4.7″	3.5″	2.5″	1.9″
C43-4	784 m	AR	0.92″	0.61″	0.50″	0.40″	0.27″	0.20″	0.14″	0.11″
	15 m	MRS	11.2″	7.5″	6.1″	4.9″	3.3″	2.4″	1.7″	1.3″
C43-5	1.4 km	AR	0.54″	0.36″	0.30″	0.24″	0.16″	0.12″	0.084″	0.063″
	15 m	MRS	6.7″	4.5″	3.6″	2.9″	1.9″	1.5″	1.0″	0.77″
C43-6	2.5 km	AR	0.31″	0.20″	0.16″	0.13″	0.089″	0.067″	0.047″	0.035″
	15 m	MRS	4.1″	2.7″	2.2″	1.8″	1.2″	0.89″	0.63″	0.47″
C43-7	3.6 km	AR	0.21″	0.14″	0.11″	0.092″	0.061″	0.046″	0.033″	0.024″
	64 m	MRS	2.6″	1.7″	1.4″	1.1″	0.75″	0.56″	0.40″	0.30″
C43-8	8.5 km	AR	0.096″	0.064″	0.052″	0.042″	0.028″	N/A	N/A	N/A
	110 m	MRS	1.4″	0.95″	0.77″	0.62″	0.41″			
C43-9	13.9 km	AR	0.057″	0.038″	0.031″	0.025″	0.017″	N/A	N/A	N/A
	368 m	MRS	0.81″	0.54″	0.44″	0.35″	0.24″			
C43-10	16.2 km	AR	0.042″	0.028″	0.023″	0.018″	0.012″	N/A	N/A	N/A
	244 m	MRS	0.50″	0.33″	0.27″	0.22″	0.14″			