



MEERKAT & THUNDERKAT UPDATE

**The road to early science
and science commissioning**

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[HTTP://WWW.AST.UCT.AC.ZA/THUNDERKAT](http://www.ast.uct.ac.za/thunderkat)



MeerKAT

ThunderKAT

Updates



- Karoo Array Telescope
- ~~KAT-7, -6, -5, -4~~: technology demonstrator
- MeerKAT: SKA1-MID precursor
 - 64 13.5-m dishes
 - UHF-, L- and **S-band** (0.58-4 GHz)
 - 8 km longest baseline



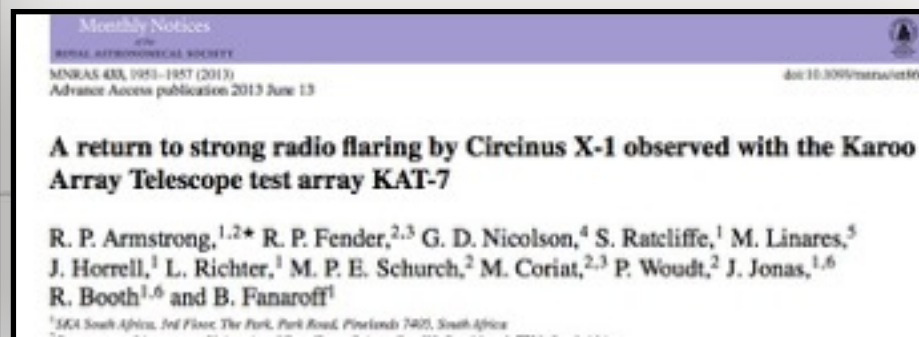
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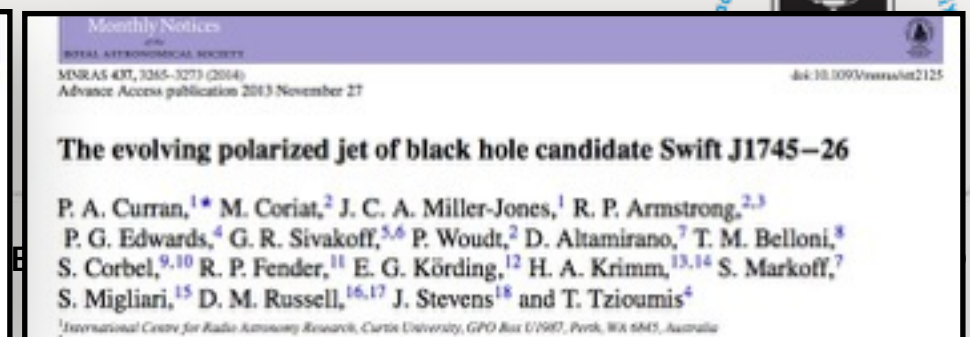
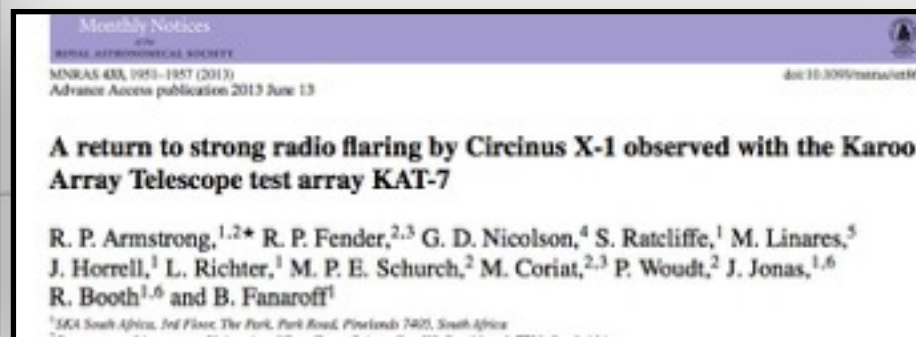
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	JVLA	MeerKAT RfP 2010	MeerKAT 2013	MeerKAT 2014
N_{dish}	27	64	64	64
D_{dish}	25 m	13.5 m	13.5 m	13.5 m
$T_{\text{sys}}/\epsilon_{\text{ps}}$	47.3 K	44.1 K	29.4 K	22.5 K
N_{beam}	1	1	1	1
BW	1 GHz	0.75 GHz	0.75 GHz	0.75 GHz
$A_{\text{e}}/T_{\text{sys}}$	1	0.74 (x1)	1.11 (x1.5)	1.45 (x1.96)
SS	1	1.88 (x1)	4.24 (x2.25)	7.24 (x3.84)

PERFORMANCE @1.420 GHz - NUMBERS FROM JUSTIN JONAS

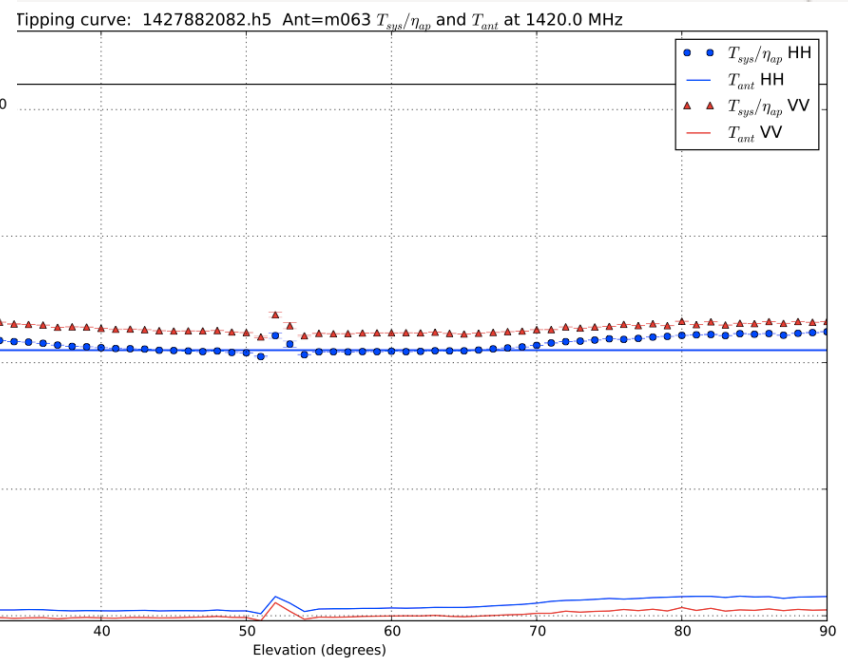
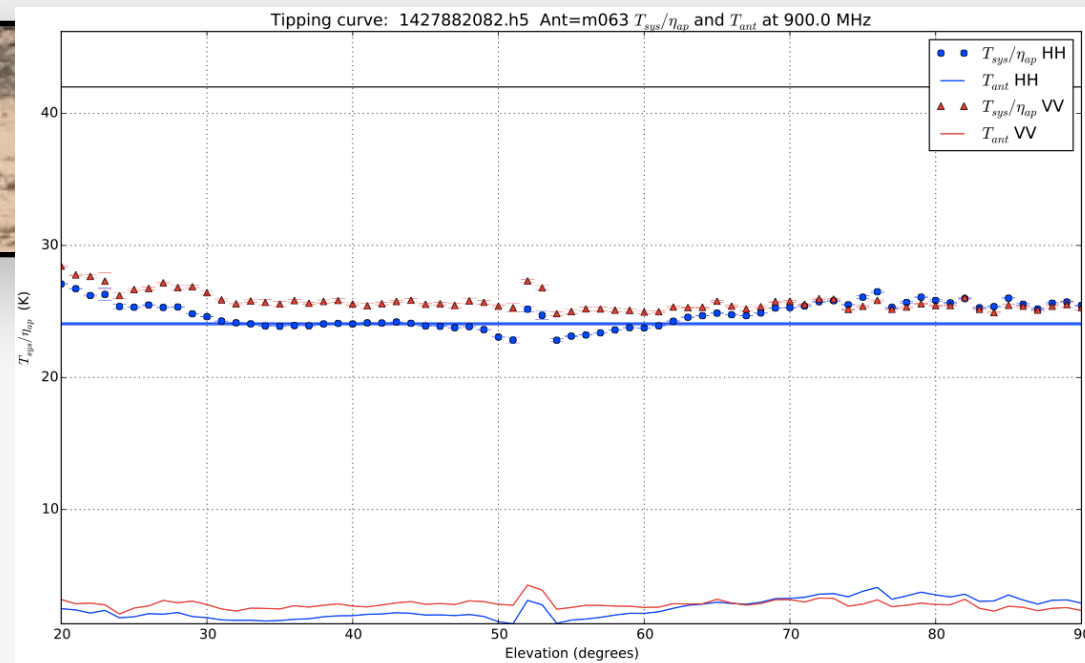
$T_{\text{SYS}} = 18 \text{ K}$



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0.9 GHZ: 20 - 90° ELEVATION

1.4 GHZ: 20 - 90° ELEVATION

TIPPING CURVE: RESPONSE AS A FUNCTION OF ELEVATION
(NOTE GREGORIAN OFFSET DESIGN OF RADIO DISHES)

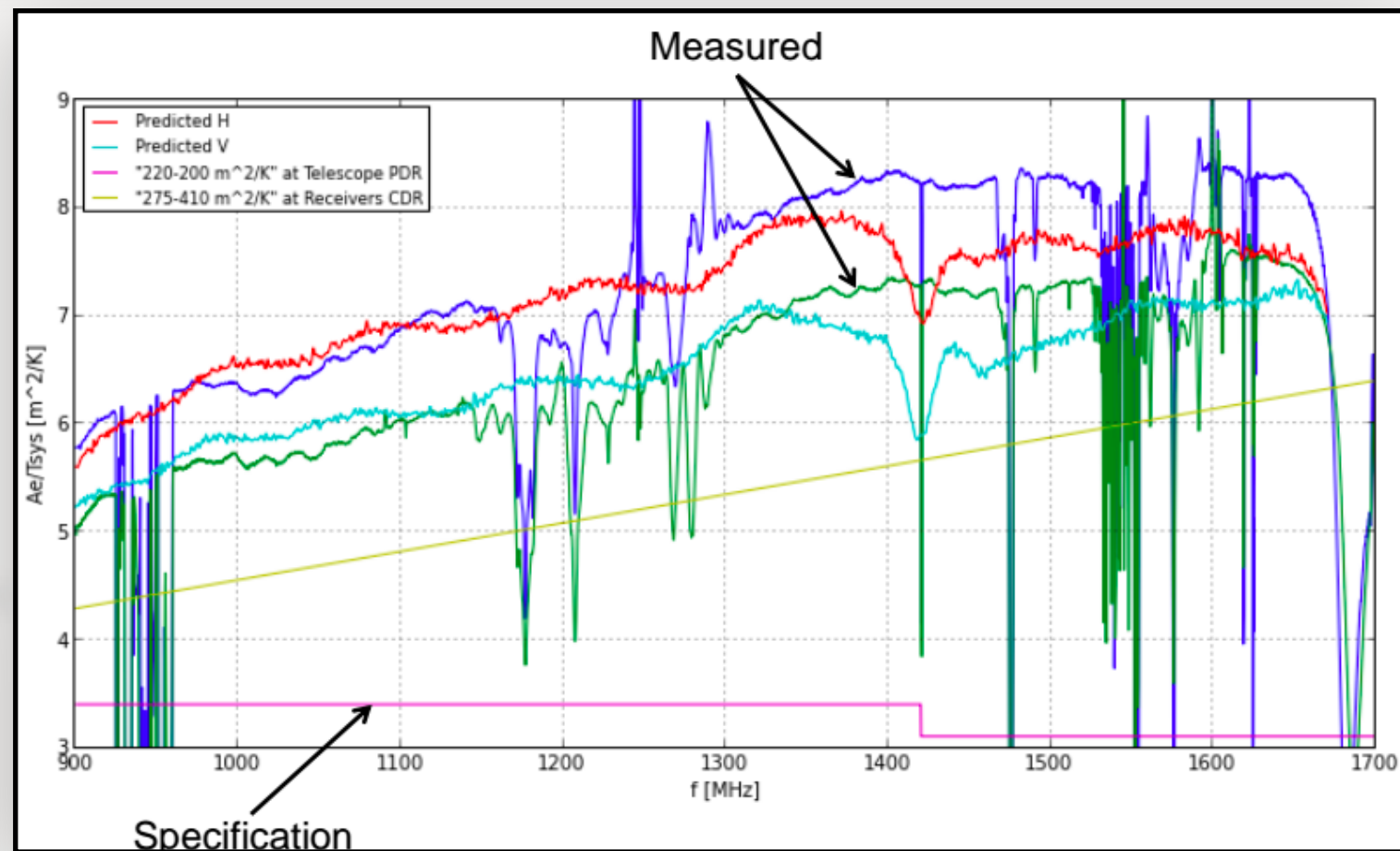
L-BAND (0.9-1.7 GHZ) PERFORMANCE - FIGURE FROM JUSTIN JONAS



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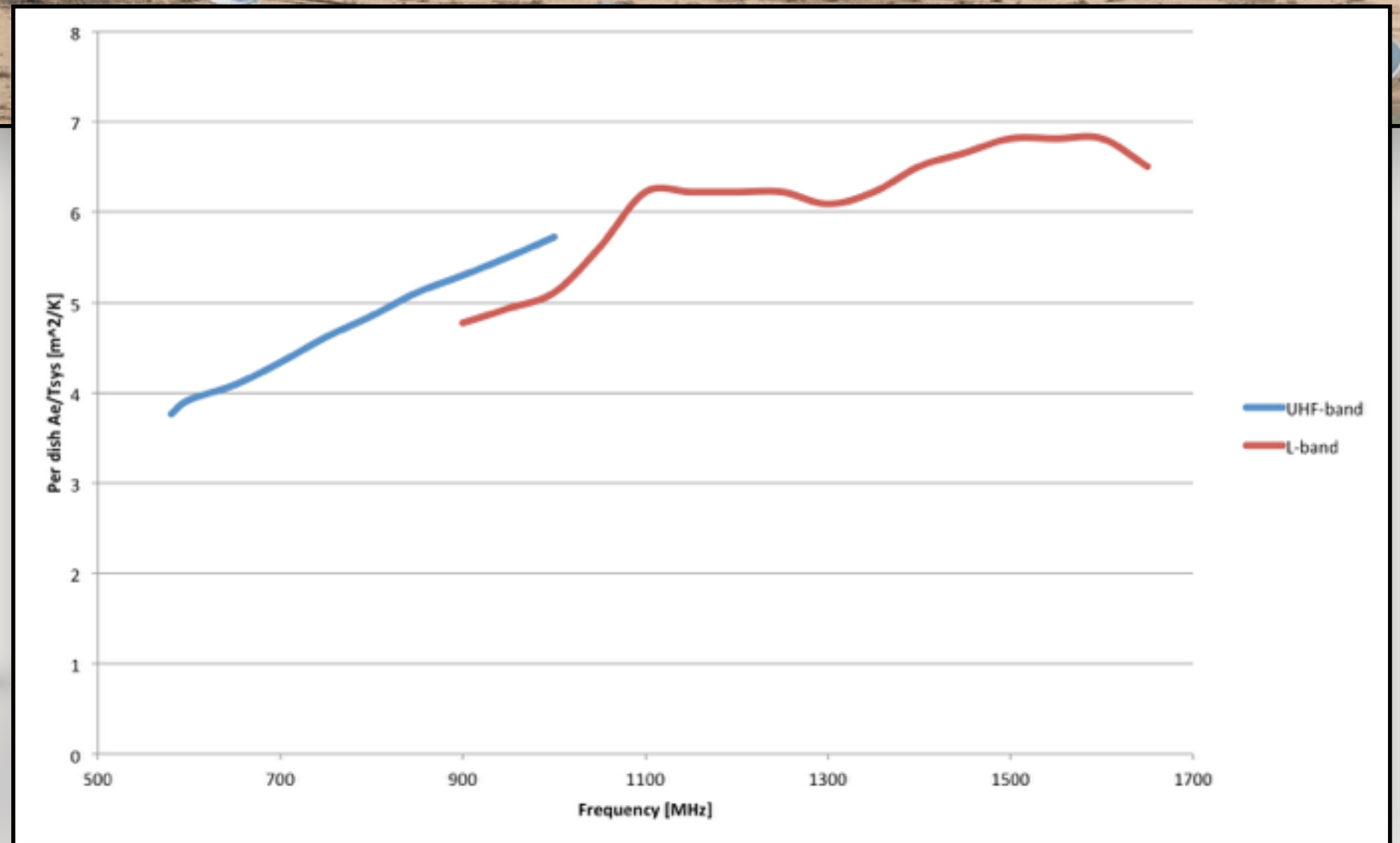
L-BAND (0.9-1.7 GHz) PERFORMANCE - FIGURE FROM JUSTIN JONAS



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MEERKAT SENSITIVITY (UHF AND L BAND) - FIGURE FROM JUSTIN JONAS
- PRELIMINARY -



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Time line



- **MeerKAT: SKA1-MID precursor**
 - 4 dishes on the ground (+1 in shed)
 - First antenna release mid-2016 (≤ 16)
 - Early science commissioning 2016+
 - Full array science ready: end of 2017



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Time line



- MeerKAT Large Survey Projects (LSPs)
 - Call in 2009
 - 10 MLSPs established in 2010
 - 98% of time allocated over 5 years
(**70% available for MLSPs**)
 - Increased sensitivity is driving review of time allocation (2016):
MeerKAT Science conference



MeerKAT Large Survey Project	UHF	L	S	X	Nominal Time allocation (43140 h)
Radio Pulsar Timing					7860 h
Testing Einstein's theory of gravity and gravitational radiation - Investigating the physics of enigmatic neutron stars through observations of pulsars					
LADUMA					5000 h
An ultra-deep survey of neutral hydrogen gas in the early universe					
MESMER					6500 h
Searching for CO at high red-shift ($z>7$) to investigate the role of molecular hydrogen in the early universe					
MeerKAT Absorption Line Survey					4000 h
Survey for H and OH lines in absorption against distant continuum sources; OH line ratios may give clues about changes in the fundamental constants					
MHONGOOSE					6000 h
Investigations of different types of galaxies; dark matter and the cosmic web					
MeerKAT HI Survey of Fornax					2450 h
Galaxy formation and evolution in the cluster environment					
MeerGAL					3300 h
Galactic structure and dynamics, distribution of ionised gas, recombination lines, interstellar molecular gas and masers					
MIGHTEE					1950 h
Deep continuum observations of the earliest radio galaxies					
TRAPUM					3080 h + commensal (timing)
Searching for, and investigating new and exotic pulsars					
ThunderKAT					3000 h + commensal (imaging)
Study of explosive radio transients with MeerKAT; accretion-induced outflow from compact stellar remnants, e.g. relativistic jets and (super)novae					

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Early activities



- **ThunderKAT workshops:**
2011 Arniston
2012 Oxford
2013 Kruger Park
2015 Oxford
- **Early science papers with KAT-7**
- **MeerLICHT (concept & funding)**



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Updates

- New science (CVs, FRBs, TDEs, ...)
- Real-time analysis developments
- MeerKAT Science conference
- Opportunities:
Future of KAT-7 unclear (AMI in south?)
- Commensal observing SKA

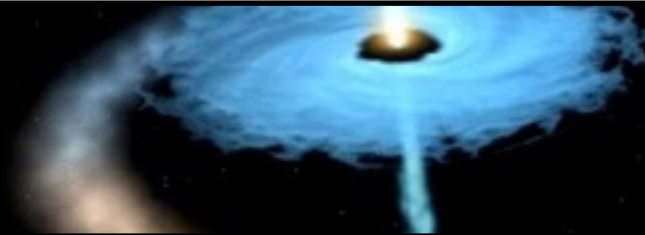


A large radio telescope dish, part of the MeerKAT array, is shown against a dark, starry sky. The dish is a complex metal structure with a large, curved surface.

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MeerKAT Science conference



The South African MeerKAT office and the South African SKA Science Committee are coordinating a review of the MeerKAT large survey projects. The intent is to review each project within the framework of

- 1) the updated technical specifications of MeerKAT,
- 2) the evolution of the science since the time of the original proposal,
- 3) current or planned large programs on other facilities that affect the international context of the project.
- 4) incorporation of MeerKAT with SKA-mid.

In addition each project will be asked to detail any plans for early shared-risk science with initial MeerKAT arrays and project data plans.

We will be holding a MeerKAT Science workshop during the first part of 2016 where each large survey project will be asked to present updated plans and project designs. It is intended that the workshop will result in a proceedings with papers from each project.

Following the workshop a time allocation committee will review the time allocations for each project. Note that this will be purely a review of time allocations. It is not the intention to remove any of the survey projects.

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Time lines



- MeerKAT early science (2016+)
- MeerLICHT commissioning (2016+)
- Input from this workshop essential in shaping ThunderKAT science over the next few years.



Goals and outcome of this week



- Overview of ThunderKAT science 2015
- Input for MeerKAT science review
- Thoughts on commensal / sub-array
- MeerLICHT/MeerKAT integration
- Early science opportunities

