MEERKAT and SKA

Africa's largest science infrastructure

Space for National Development
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Designed and constructed in South Africa

SARAO (formerly SKA South Africa)

A National Facility of the National Research Foundation

- Science and engineering interface with the international SKAO
- Responsible for South Africa's contribution to the infrastructure and engineering aspects of the SKA Radio Telescope
- Development and management of the Karoo observatory site
- Design, construction and operation of the MeerKAT radio telescope
- Management of all radio astronomy initiatives and facilities in South Africa and African Partner Countries
    - Geodesy and VLBI activities at the HartRAO facility
    - African Very Long Baseline Interferometry Network (AVN)
    - Guest Instruments contributed by international partners
- Human Capital Development to ensure successful operation of all facilities within the organization, scientific exploitation of the facilities, and the commercialization of intellectual property

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NRF National Research Foundation | SARAO South African Radio Astronomy Observatory

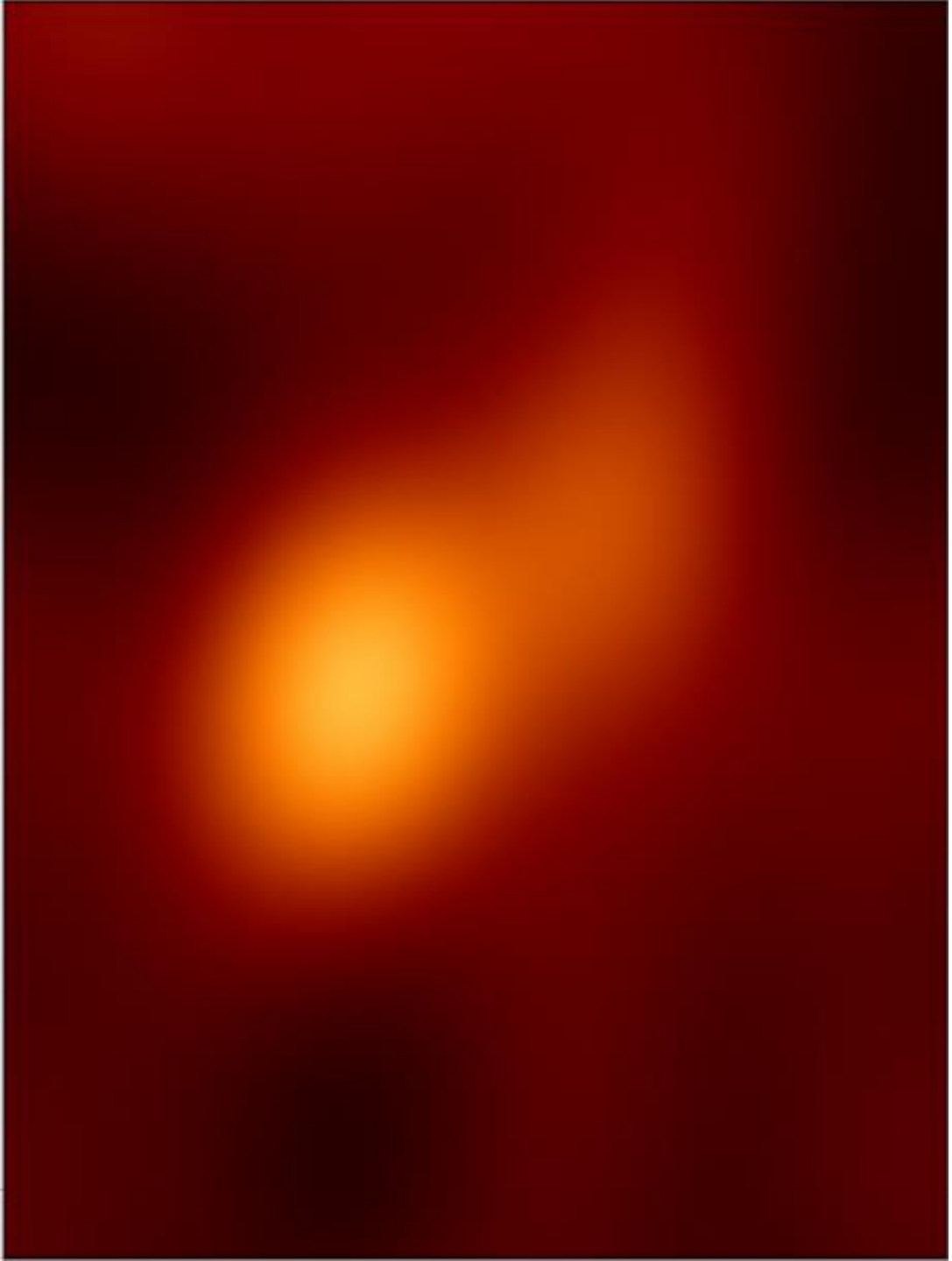
Members of the SKA Organisation
Host Countries: Australia, South Africa, United Kingdom

African Partner Countries

SKA Observatory will be established as an Intergovernmental Organisation in 2020, taking over from the SKA Organisation. It will undertake the construction and operation of the telescope.

As of March 2019, confirmed SKA Observatory members are

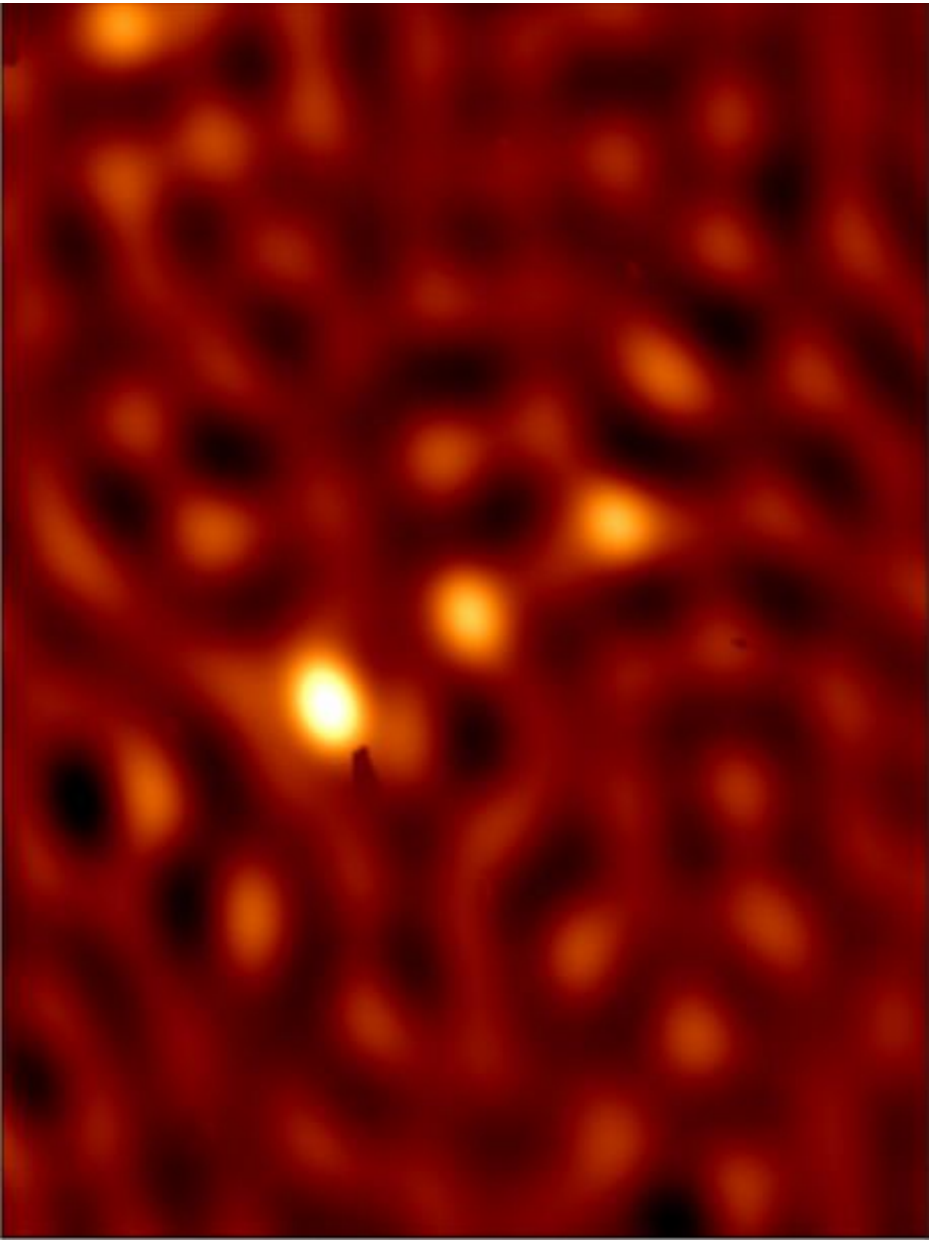

SKA– Key Science Drivers:
The history of the Universe
Cosmic Dawn
(First Stars and Galaxies)
Testing General Relativity
(Strong Regime, Gravitational Waves)
Galaxy Evolution
(Normal Galaxies z~2-3)
Cradle of Life
(Planets, Molecules, SETI)
Cosmology
(Dark Matter, Large Scale Structure)
Cosmic Magnetism
(Origin, Evolution)
Exploration of the Unknown
Broadest science range of any facility on or off the Earth.



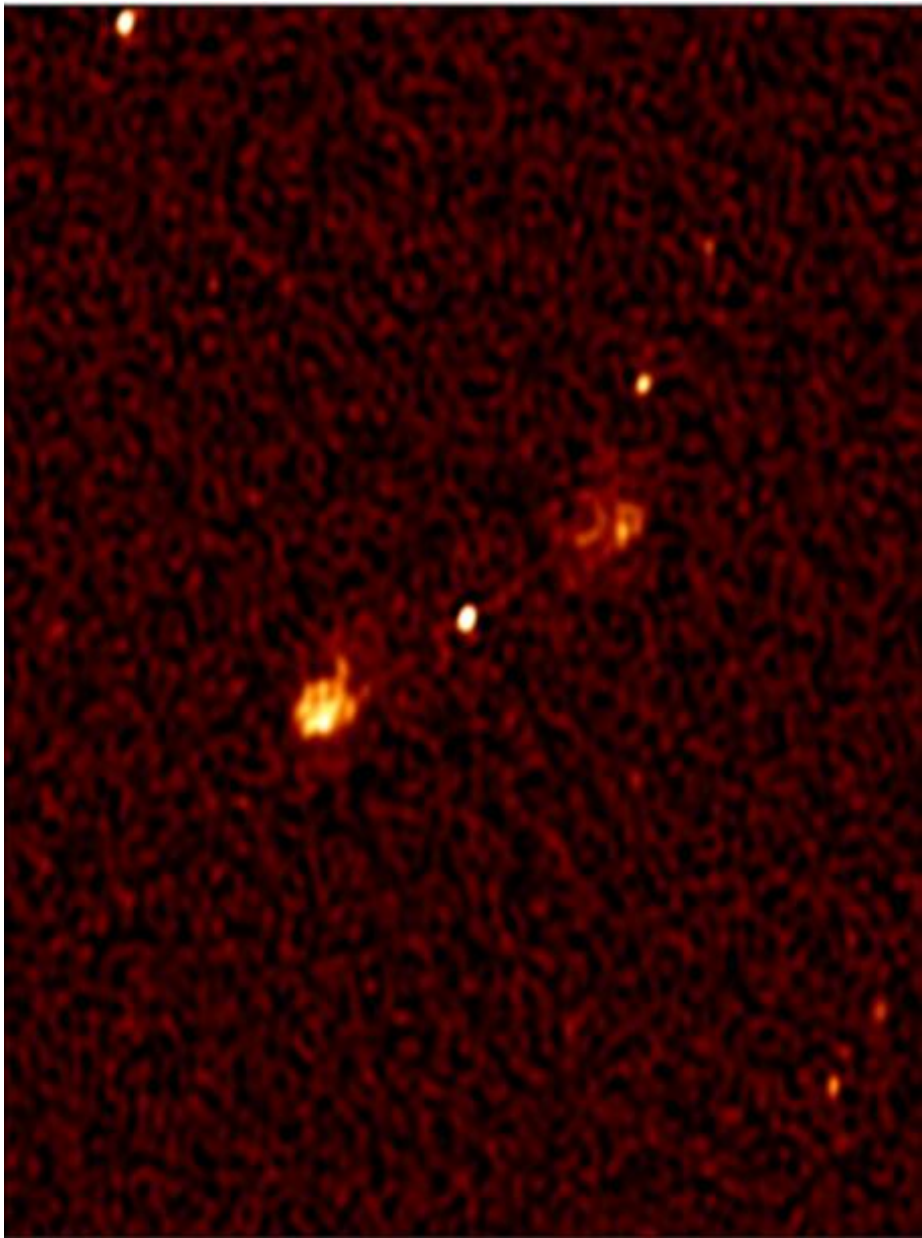
KAT 7 in 2012

MeerKAT

4-dish Array



16-dish Array

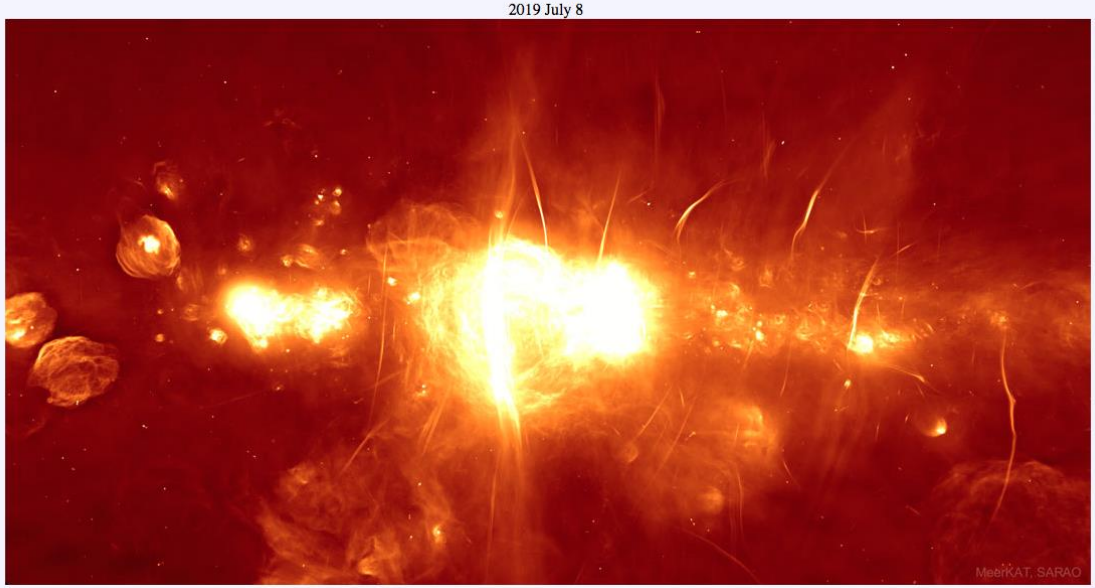


MeerKAT 64-dish Array

Astronomy Picture of the Day

Discover the cosmos! Each day a different image or photograph of our fascinating universe is featured, along with a brief explanation written by a professional astronomer.

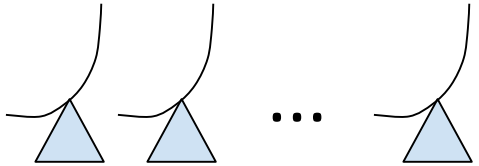
2019 July 8



The Galactic Center in Radio from MeerKAT
Image Credit: MeerKAT, SARAO

Explanation: What's happening at the center of our galaxy? It's hard to tell with optical telescopes since visible light is blocked by intervening interstellar dust. In other bands of light, though, such as radio, the galactic center can be imaged and shows itself to be quite an interesting and active place. The featured picture shows the inaugural image of the MeerKAT array of 64 radio dishes just completed in South Africa. Spanning four times the angular size of the Moon (2 degrees), the image is impressively vast, deep, and detailed. Many known sources are shown in clear detail, including many with a prefix of Sgr, since the Galactic Center is in the direction of the constellation Sagittarius. In our Galaxy's Center lies Sgr A, found here just to the right of the image center, which houses the Milky Way's central supermassive black hole. Other sources in the image are not as well understood, including the Arc, just to the left of Sgr A, and numerous filamentary threads. Goals for MeerKAT include searching for radio emission from neutral hydrogen emitted in a much younger universe and brief but distant radio flashes.

MeerKAT: Data Processing and Archive



64 dishes

2 Tbps
(SKA SA)

Karoo Array Processor Building
(CSP + SDP + some archive)

20 Gbps
(SANReN)

Other Tier 2
Centres

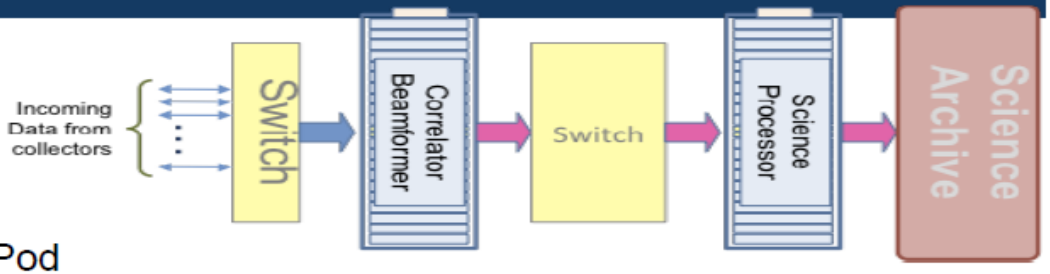
CHPC
MeerKAT archive
(10-12 racks & some access to CPUs)

10 Gbps

IDIA Tier 2
storage & science analysis support

The SKA Big Data Challenge

	MeerKAT	SKA1-Mid+	SKA2-Mid*
Into Correlator	2 Tbps (2k x office network) (700k x 32 GB / day)	50 Tbps (50k x office network) (17m x 32 GB / day)	up to 5 Pbps (5m x office network) (1.8b x 32 GB / day)
Into Science Processor	0.7 Tbps (240k x 32 GB / day)	20 Tbps (7m x 32 GB / day)	up to 500 Tbps (172m x 32 GB / day)
Into Archive	20 Gbps** (7k x 32 GB / day)	300+ Gbps (100k x 32 GB / day)	up to 2 Tbps (700k x 32 GB / day)
Compute load	200 TFlops	30+ PFlops	3+ EFlops



\+ Prior to rebaselining
* Data rates indicative only
** Sustained
32 GB –> large flash drive / mid iPhone / iPod

MeerKAT HPC Infrastructure – 1st Tier

Realtime Mesos Cluster : Karoo

100 TFLOPs, 6TB RAM

Batch Cluster : Karoo

1.5 PFLOPs, 4TB RAM, 1 PB scratch
(Largest single-precision computer in

Object Storage : CHPC – Cape Town

cluster1: 5.4 PiB – production – 1 PiB
cluster3: 12.2 PiB – ready for

CEPH Archive and Tape Library at CHPC
Innovation in mass data storage

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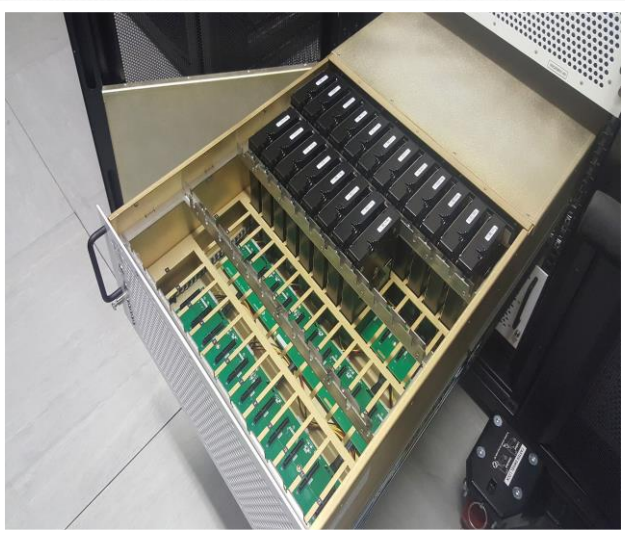

Innovation in Big Data
Radio Astronomy is a driver of the 4IR

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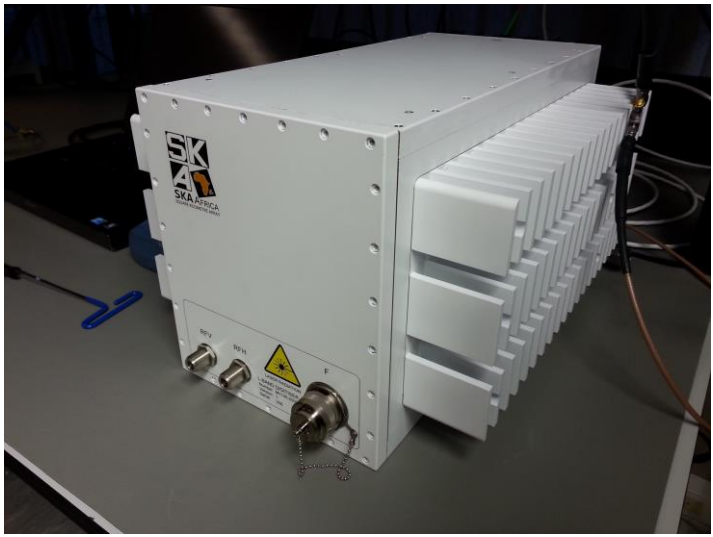

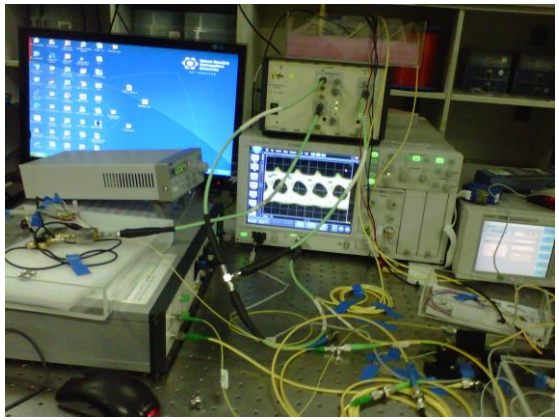

Cost Benefits

	Operating System	Storage & Data Processing	Databases	Monitoring	Logging
Proprietary Option	Microsoft Windows R 7,657,440.00	Red Hat Installation R 116,250,000	Oracle R 5, 465,160	Data Dog R 3,245,760	Splunk R1,044, 000
Open Source Alternative	Ubuntu GNU/Linux R0	Storage system: Ceph R 28,368,640	PostgreSQL R2, 349, 060	Prometheus R0	Elastic Search R0
Cost Saving	R 7,657,440.00	R 87, 881,360.00	R 3,116,100.00	R 3, 245,760.00	R 1,044,000.00
Total Cost Saving	**R102, 944 660.00 /annum**				

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Thank You