The SKA Precursor instruments

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Forum Pre-SKA, Observatoire de Paris, 09.10.09

The two SKA Precursor instruments

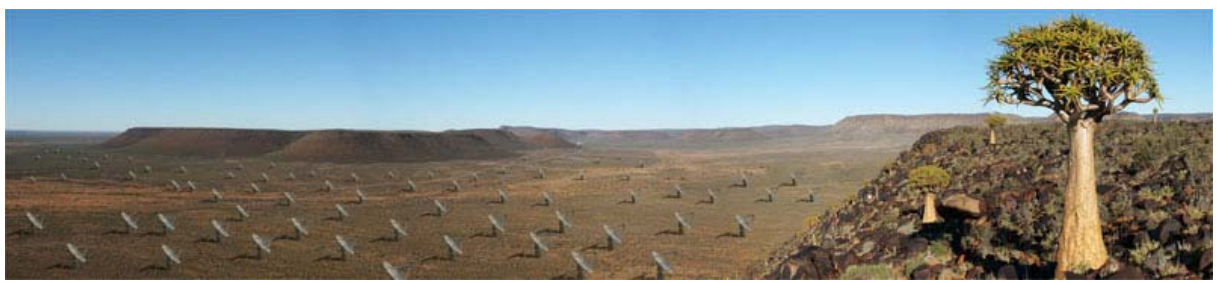
- SKA site selection:

  Australia and South Africa pre-selected in 2006
  final choice will be made in 2011(?)

Two SKA Precursors:

- Fully funded, in construction on the two sites

  ASKAP in Australia
  MeerKAT in South Africa



SKA Precursors - characteristics

- **ASKAP** (Australia)

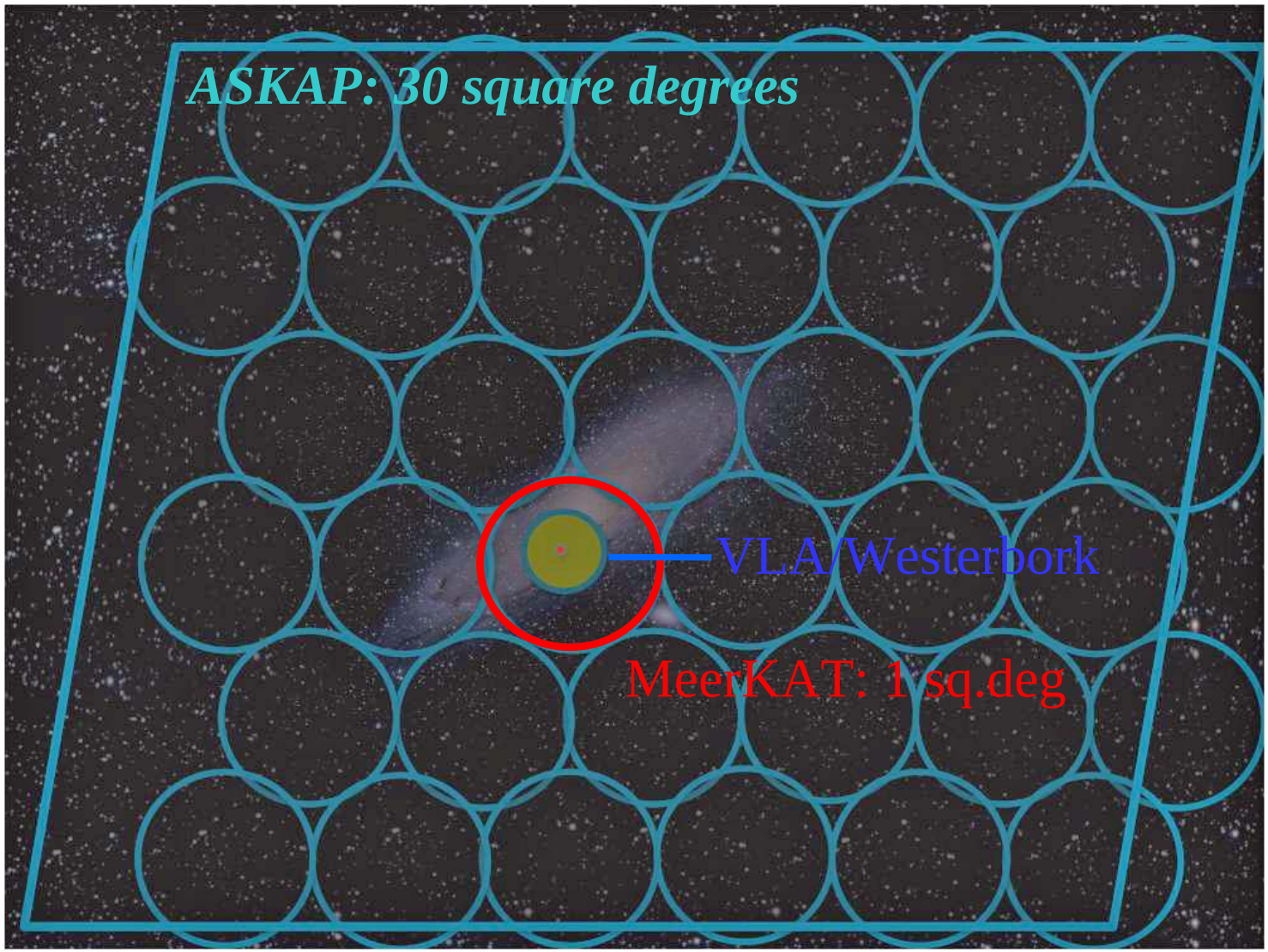
  36 × 12m parabolic antennas: collecting surface 4000 m^2
  multi-beam Phased Array Feeds: field-of-view 30 sq.degrees
  instantaneous bandwidth: 300 MHz
  optimised for 30 arcsec resolution

- **MeerKAT** (South Africa)

  80 × 12m parabolic antennas: collecting surface 8000 m^2
  single-pixel feeds: field-of-view 1 sq.degree
  instantaneous bandwidth: 1 GHz
  versatile in resolution: 6-80 arcsec

Both: construction started, fully operational early 2013

SKA Precursors – fields-of-view



ASKAP: Phased Array Feeds 30 sq.degrees; MeerKAT 1 sq.degree

Building up survey speed

- **Blind radio line survey**: complete sampling of

  - an area on the sky
  - down to a certain flux density (mJy)
  - out to a certain radial velocity (km/s) $\rightarrow$ space volume

- **Survey speed**: depends on

  field-of-view of telescope
  sensitivity: collecting area and system temperature
  bandwidth (radial velocity coverage)

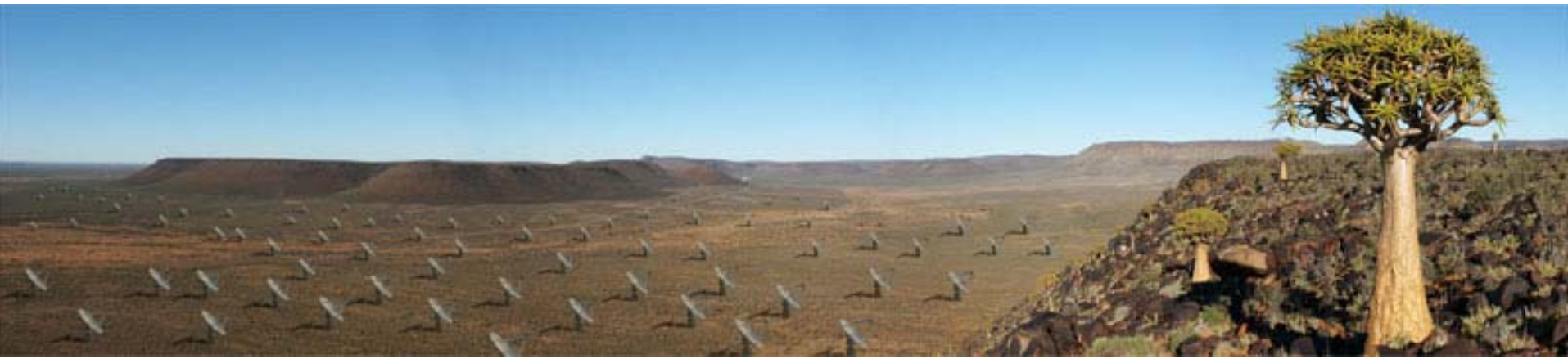
- Commensal observations (piggy-back / using same data)
  different lines + continuum: versatile back-end (correlator)

SKA Precursors – survey speeds

Instrument	coll. surface	FoV	Relative speed
VLA	13,000 m^2	0.25 deg^2	1
WSRT +PAF	7000 m^2	8 deg^2	18
ASKAP	3600 m^2	30 deg^2	22
MeerKAT	8000 m^2	1 deg^2	5

Built for large surveys – e.g. galaxies in HI:
now 20,000 → SKA (>2020) a billion;
Precursors (>2013) a million

Playing with array configurations



Many 12m parabolic dishes:
ASKAP 36, MeerKAT 80

Configure array for maximum sensitivity

- for one resolution, optimized: 30", ASKAP
- for a range of resolutions, equalized: 6"-80", MeerKAT

SKA Precursors – complementarity

ASKAP:
- large fields/all-sky, relatively shallow surveys

MeerKAT
- smaller fields, deeper surveys, higher/lower resolution

Westerbork + APERTIF: PAF
- northern hemisphere, overlap in δ +25°-30° strip only …*if funded*

EVLA:
- deep integration of small fields, down to δ -40 ° only

+ LOFAR, ALMA, E-ELT, …

ASKAP and MeerKAT surveys: science drivers

- Detection of a million galaxies in HI out to z~0.2/1
- Detection of 70 million galaxies in continuum
- Detection of polarized radiation from 500,000 galaxies
- Understanding of the evolution of the ISM of our own Galaxy
- Characterization of the radio transient sky
- Discovery and timing of up to 1000 new radio pulsars
- High-resolution imaging of energetic phenomena through VLBI

SKA Precursors – calls for proposals

MeerKAT:
- expected: end of this year

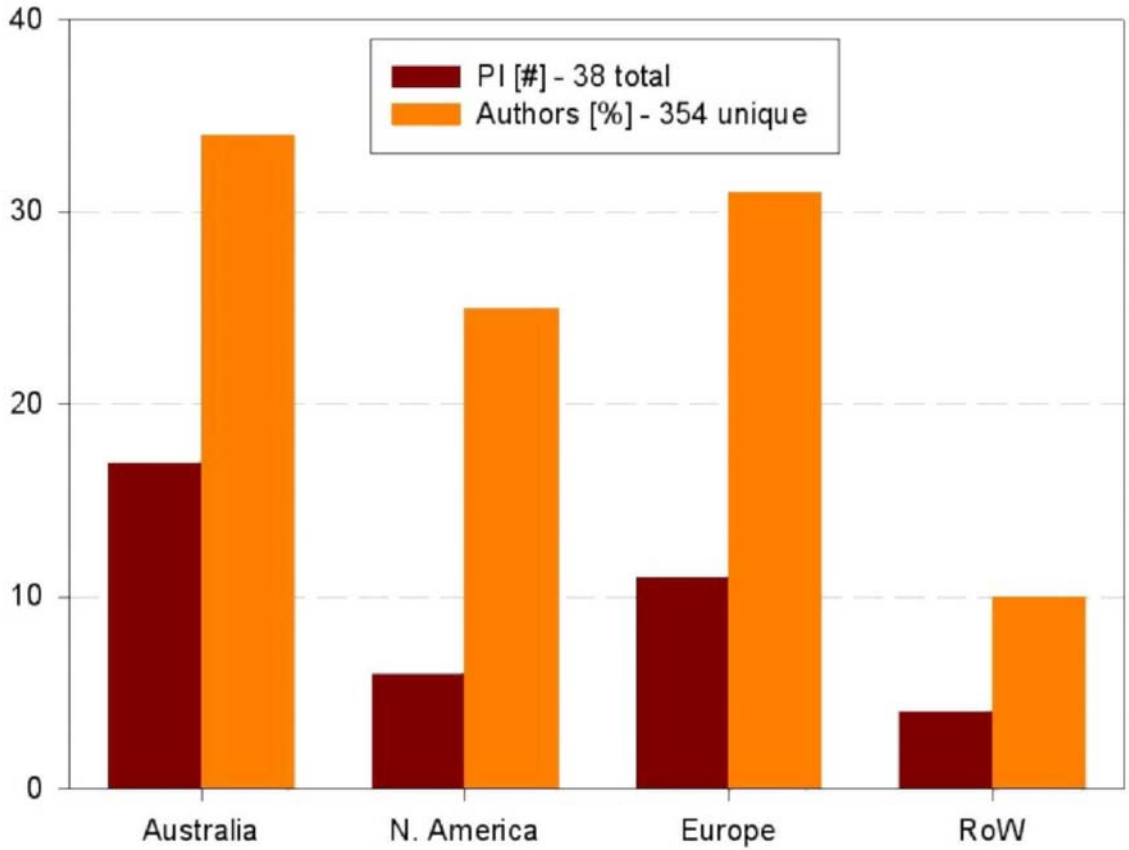
ASKAP:
- call for Expressions of Interest (EoI): 12/2008
  for first 5 years of full telescope operation (2013-2018)
- 38 EoI received, for total of 25 years of telescope time
- EoI merged, etc.: 27 final proposals submitted 15 June
- Proposals selected and prioritized in September 2009

Proposal teams still open for collaboration…

Both: access to instrument during deployment phase
Public data release
Concertation on surveys started between ASKAP and MeerKAT

SKA Precursors – ASKAP call for pre-proposals

Science areas:
1. Extragalactic spectral line
2. Continuum
3. Polarization
4. Galactic spectral line
5. Slow transients
6. Fast transients
7. Pulsars
8. VLBI



Participation in proposals remains open…

ASKAP Survey Science Projects – priorities 1.

A Group: ATNF will provide full support

EMU: all-sky/deep field continuum
WALLABY: all-sky HI line survey

A- Group: ATNF will make all reasonable efforts to support

DINGO: deep HI line
ASKAP-FLASH: HI absorption line survey
VAST: variables and slow transients
GASKAP: Galactic spectral lines
POSSUM: polarization, magnetism
CRAFT: fast transients, commensal

ASKAP Survey Science Projects – priorities 2.

Strategic Priorities Group : ATNF will work to ensure that capabilities defined by these SSPs are enabled to the extent possible.

- The High Resolution Components of ASKAP: Meeting the Long Baseline Specifications for the SKA

- COAST: Compact Objects with ASKAP: Surveys and Timing

ASKAP Survey Science Projects – A Group.

EMU: all-sky/deep field continuum

Two years of observing time

EMU-wide: δ° -90° to +30°, rms 10 μJy; 70 million sources

EMU-deep: 30 sq.degrees, rms 1 μJy; 0.5 million sources

Star-forming galaxy evolution: z<2 (wide), z<5 (deep)

Black hole evolution, relation with star formation

WALLABY: all-sky relatively shallow HI line survey

one year of observing time (9600 hours; 1200 pointings)

δ° -90° to +30°, 30" beam, resolution 4 km/s

radial velocity coverage -2,000 to +60,000 km/s

rms noise level 0.7 mJy

400,000 galaxies detected; 1000 highly resolved