SKA Precursors surveys
- an update -

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Two SKA Precursors

- SKA site selection:

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

Two SKA Precursor instruments:

- Fully funded, in construction on the two potential SKA 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 – survey speed

- **Blind 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

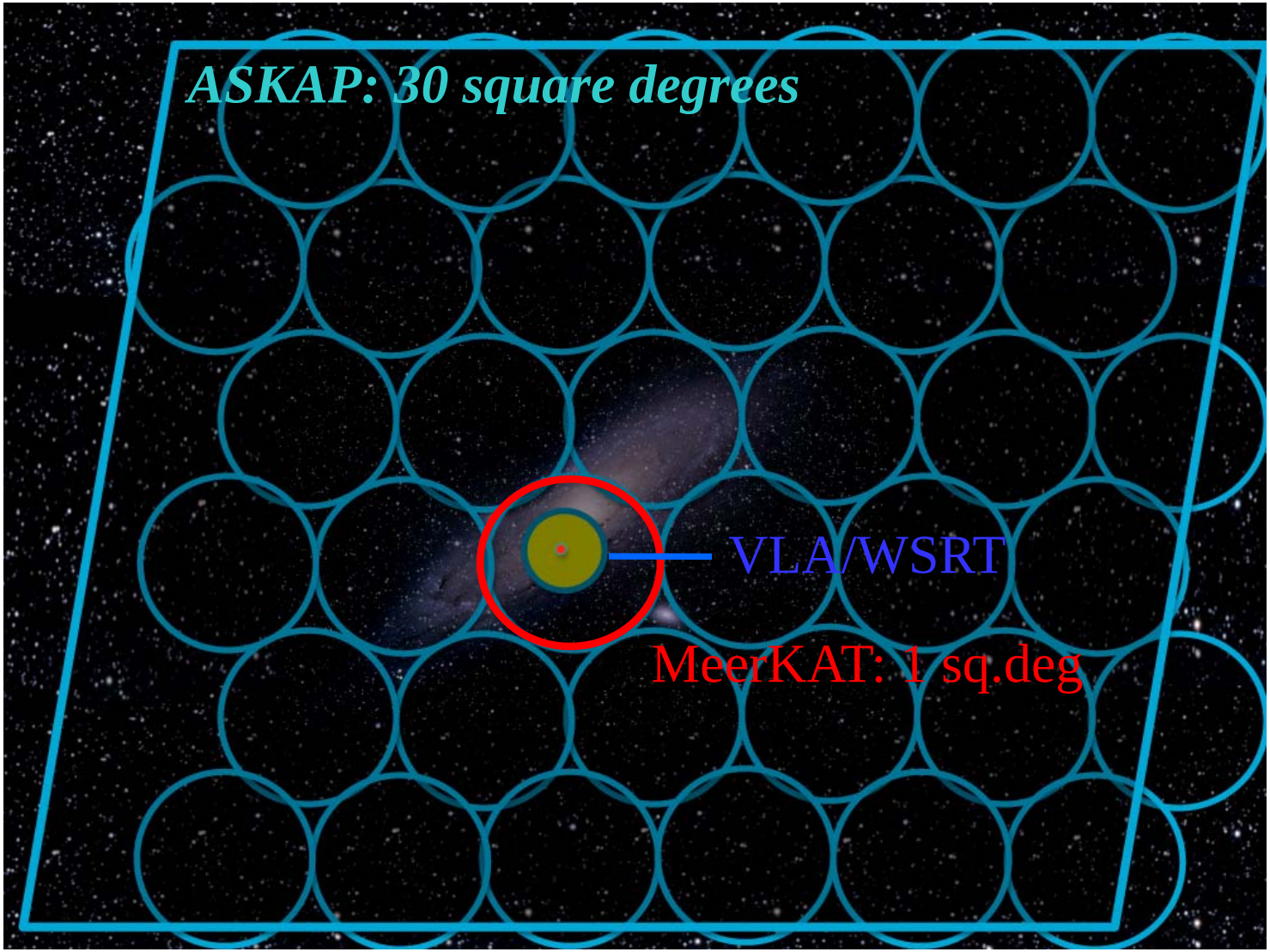
- **Survey speed**: depends on

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

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

SKA Precursors – field-of-view

Mapping the Andromeda galaxy M31



SKA Precursors – survey speeds

Instrument	Relative speed
Parkes multi-beam (single-dish)	1.6
VLA	**1**
WSRT+APERTIF PAF	18
ASKAP	22
MeerKAT	5

SKA Precursors – complementarity

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

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

WSRT + APERTIF:
- northern hemisphere, overlap in δ +25°-30° strip only

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

ASKAP and MeerKAT surveys: science drivers

- Detection of a million galaxies in HI out to z~0.2/1
  to understand galaxy formation and gas evolution in the nearby Universe.
- Detection of 50 million galaxies in continuum
  to determine the evolution, formation and population of galaxies
- Detection of polarized radiation from 500,000 galaxies
  to explore the evolution of magnetic fields in galaxies
- Understanding of the evolution of the ISM of our own Galaxy
  and the processes that drive its chemical and physical evolution.
- Characterization of the radio transient sky
- Discovery and timing of up to 1000 new radio pulsars
  find exotic objects and to pursue the direct detection of gravitational waves.
- High-resolution imaging of energetic phenomena through VLBI

ASKAP and MeerKAT surveys: HI science drivers

- Obtain the HI Mass Function up to z ~0.5
- HI content of the Universe, HI out to high redshift (z ~1).
- Identify and quantify gas inflow into galaxies: “cold accretion”
- Group dynamics of galaxies, faint member stats and properties
- Search for the markers of CDM in the HI of nearby galaxies; their dynamics and star formation cycle.
- Map parts of the Cosmic Web in HI
- Identify the Great Attractor in the Zone of Avoidance

SKA Precursors – call for proposals

MeerKAT:
- expected: end of this year

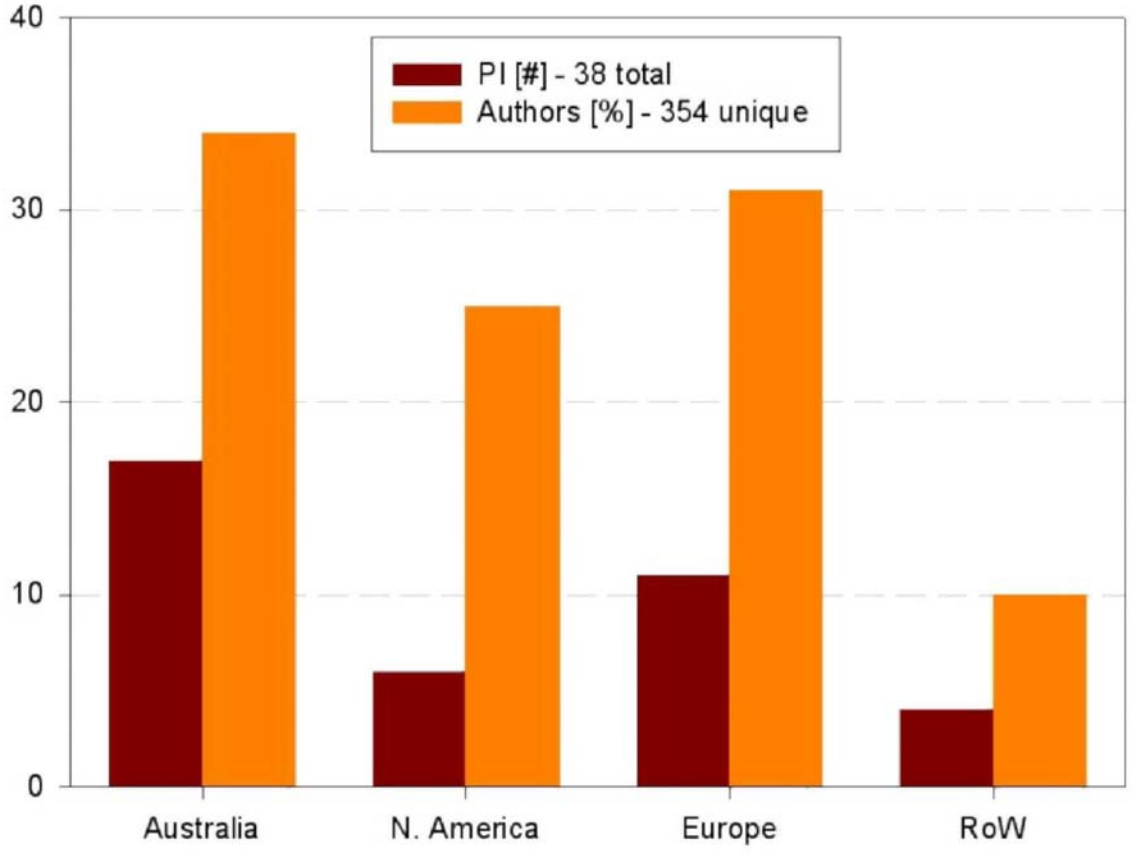
ASKAP:
- call for Expressions of Interest (EoI): 12/2008
  for first 5 years of full telescope operation (2013-2018)
- 38 EoI received, for total of 25 years of telescope time
- EoI merged, etc.: 27 final proposals submitted 15 June
- panel will prioritize the proposals (August)

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 surveys: WALLABY

Widefield ASKAP L-band Legacy All-sky Blind surveY

PI: Bärbel Koribalski (ATNF, AUS), Lister Staveley-Smith (UWA, AUS)
59 others: AUS 26; Europe 23 (FRA 2, GER 4 NL 7, UK 10); USA 6; JAP 2, SA 2

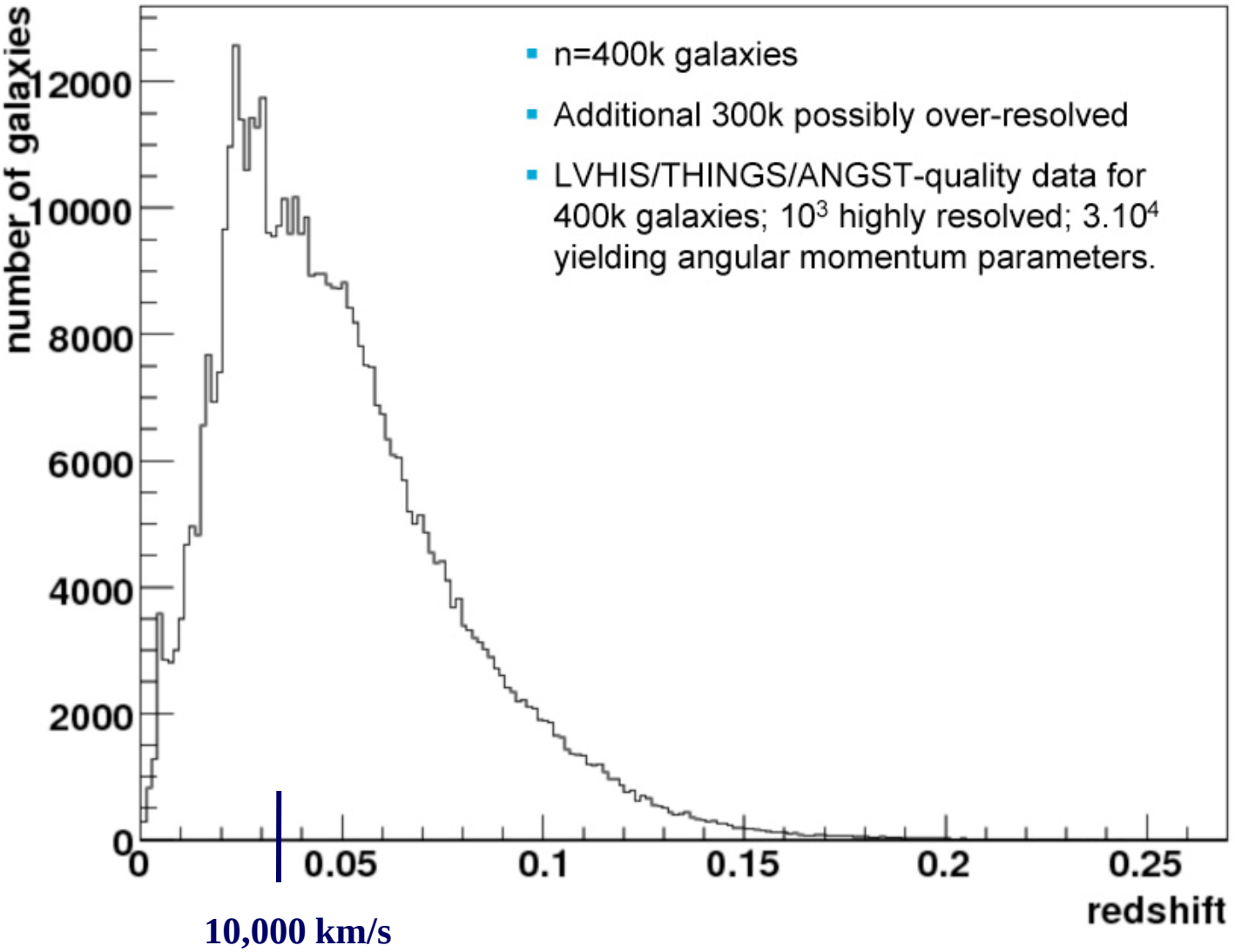
Large-field, relatively shallow HI line survey
δ° -90° to +30°, 30 arcsec beam, resolution 4 km/s

one year of observing time (9600 hours; 1200 pointings)
radial velocity coverage -2,000 to +60,000 km/s
rms noise level 0.7 mJy

Local Group galaxies: HI mass detection limit 5,000 $M_{\odot}$
400,000 galaxies detected; 1000 highly resolved; 30,000 angular momentums

Deep HI survey: DINGO HI out to z~1

ASKAP surveys: WALLABY



ASKAP surveys: EMU

Evolutionary Map of the Universe

PI: Ray Norris (ATNF, AUS), Andrew Hopkins (AAO, AUS)
90 others; 15 working groups

- EMU-wide:

δ° -90° to +30°, 30 arcsec beam, rms 10 μJy; 70 million sources

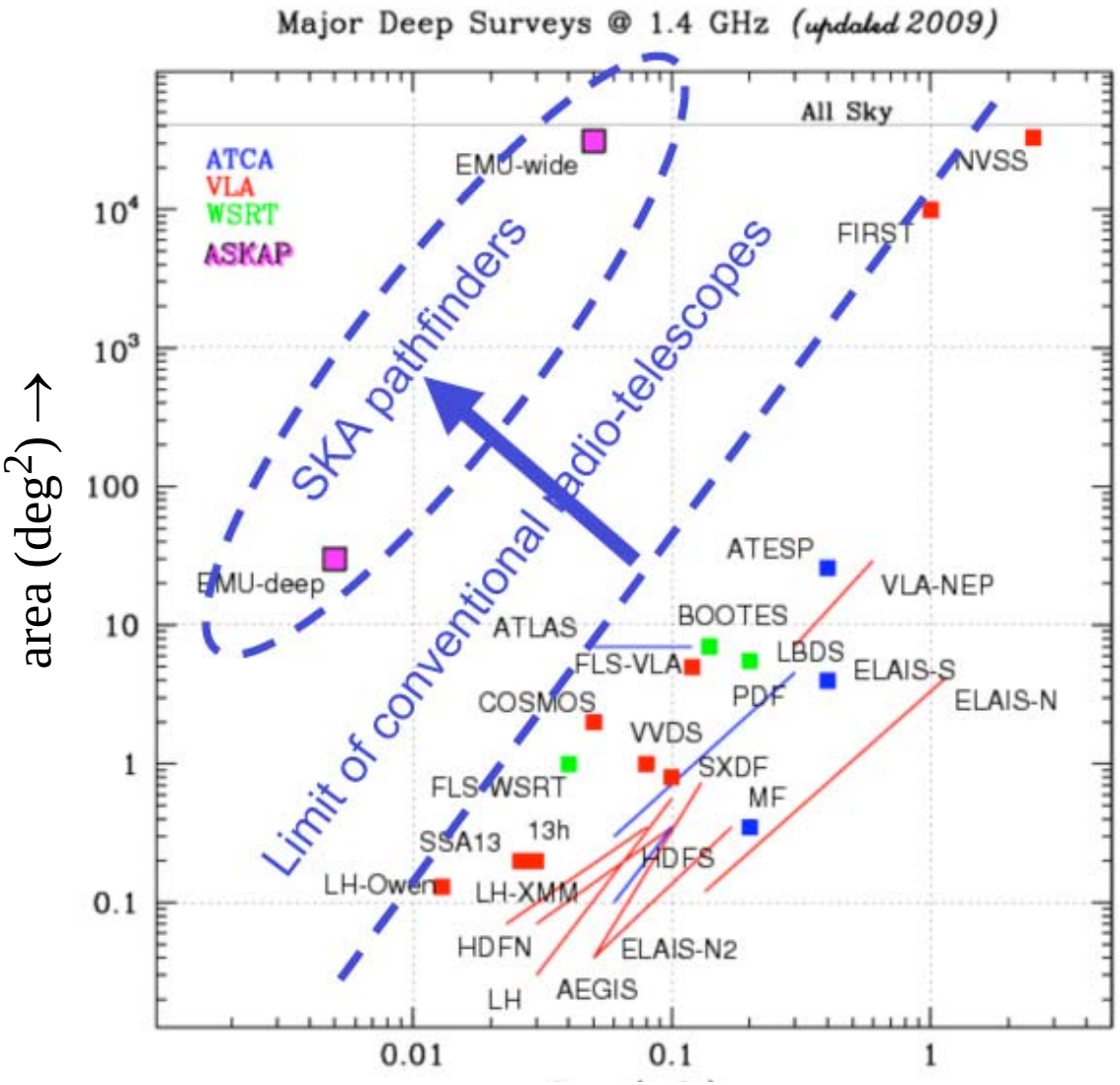
- EMU-deep:

30 sq.degrees, 30 arcsec beam, rms 1 μJy; 0.5 million sources

Two years of observing time

Star-forming galaxy evolution: z<2 (wide), z<5 (deep)
Black hole evolution, relation with star formation

ASKAP surveys: EMU



MeerKAT surveys

Possible HI key surveys:

- Mosaic of nearby group or cluster:
  details and large structures, due to flexible beam size
  e.g., 100 sq.deg Virgo field, limit M_{HI} $5 \cdot 10^6$ $M_\odot$ in 100 days
- MeerKAT Deep field(s):
  HI mass function and HI content out to larger z than ASKAP
- Galaxy portraits + cosmic web:
  deep observations, sub-kpc resolution out to 20 Mpc
- Zone of Avoidance: large scale structure ; Great Attractor

ASKAP and MeerKAT surveys: our possible contributions

- Nearby galaxies (z<0.2):

  - New Generation Virgo Survey for Virgo cluster
  - 3D-NTT Fabry-Pérot Hα velocity fields

- More distant galaxies (z<1):

  - VLT 3D imaging

- Modeling of results:

  - Galaxy mergers, interactions