



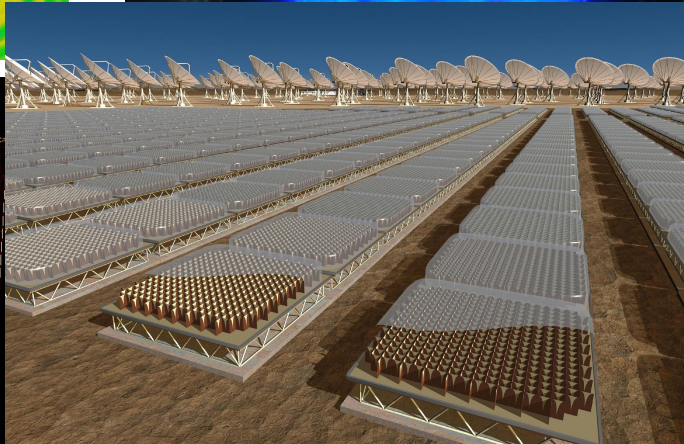
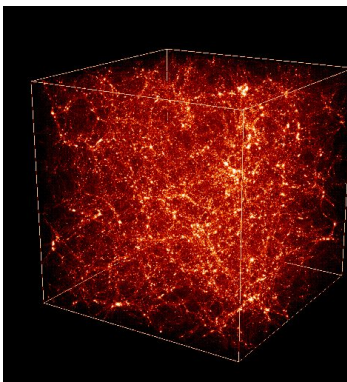
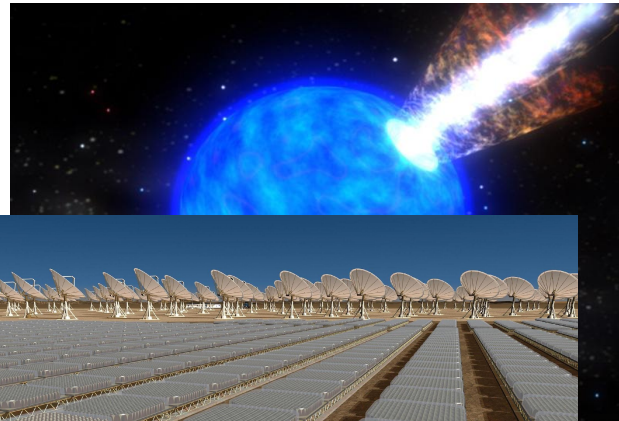
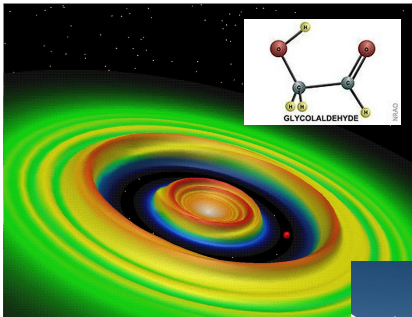
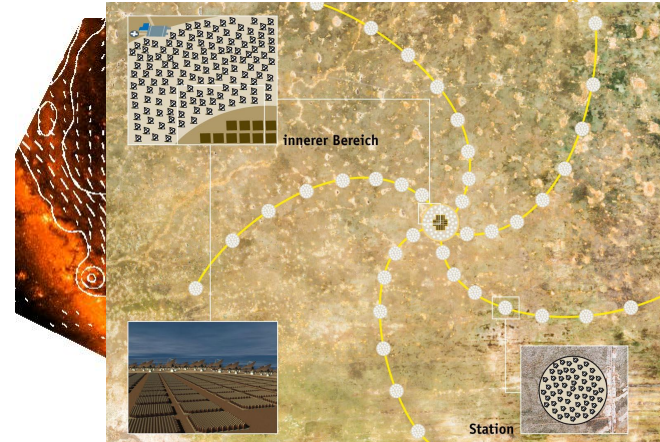
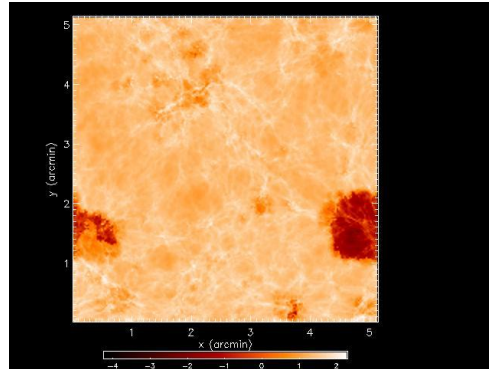
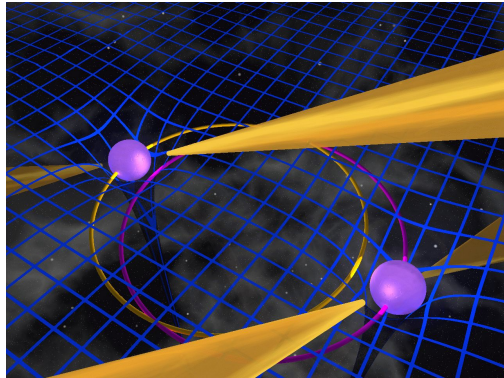
Square Kilometre Array

S.A. Torchinsky
SKADS Project Scientist

www.skads-eu.org

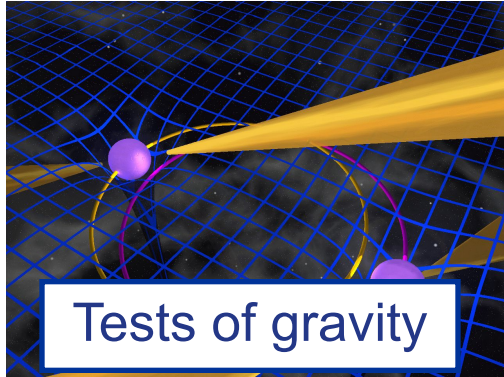


Square Kilometre Array

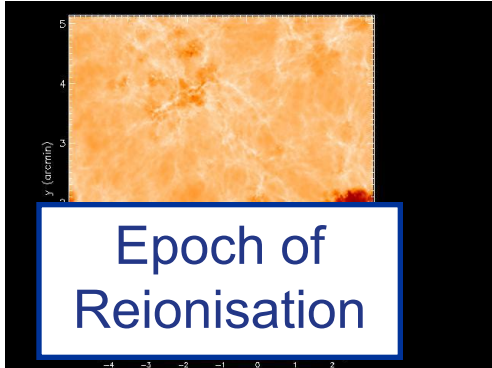




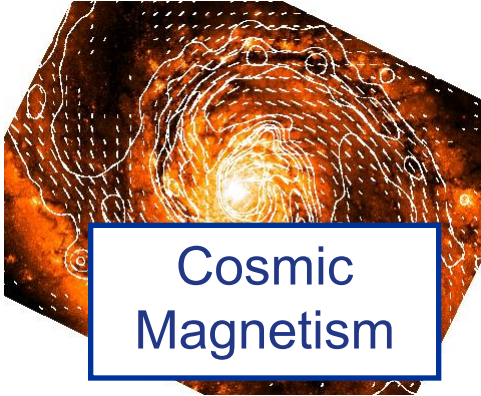
SKA Key Science



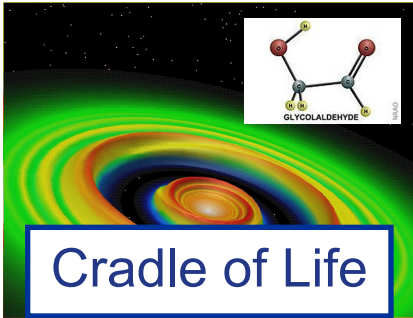
Tests of gravity



Epoch of Reionisation



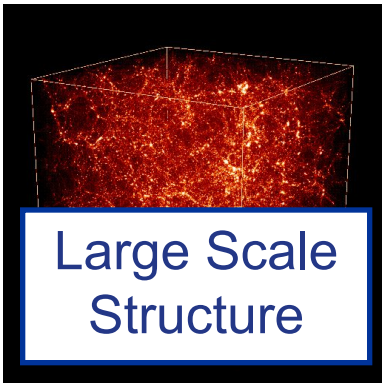
Cosmic Magnetism



Cradle of Life



Transient Universe



Large Scale Structure



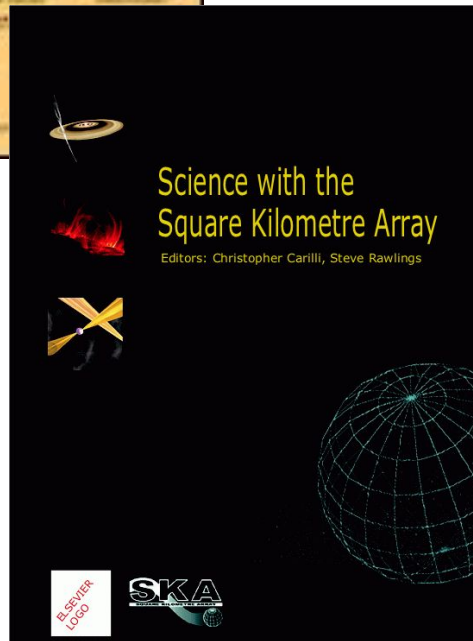
The Unknown



SKA Science Book



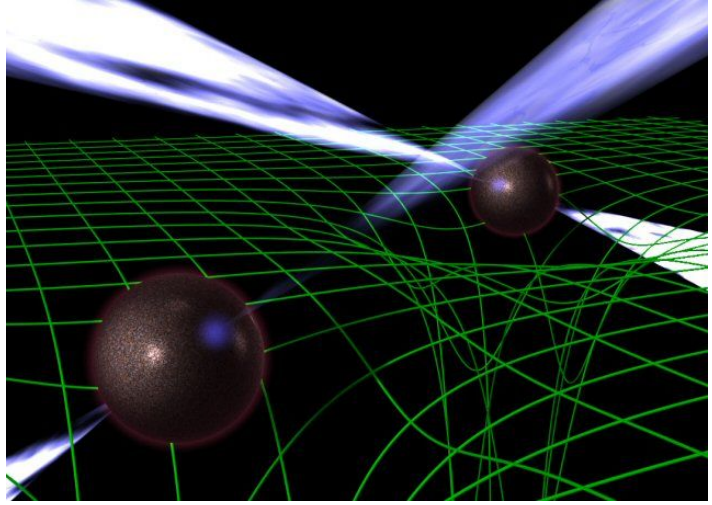
Chris Carilli & Steve Rawlings,
New Astronomy Reviews,
Vol.48, Elsevier, Dec. 2004



http://www.skads-eu.org/p/SKA_SciBook.php



Strong Field Tests of Gravity

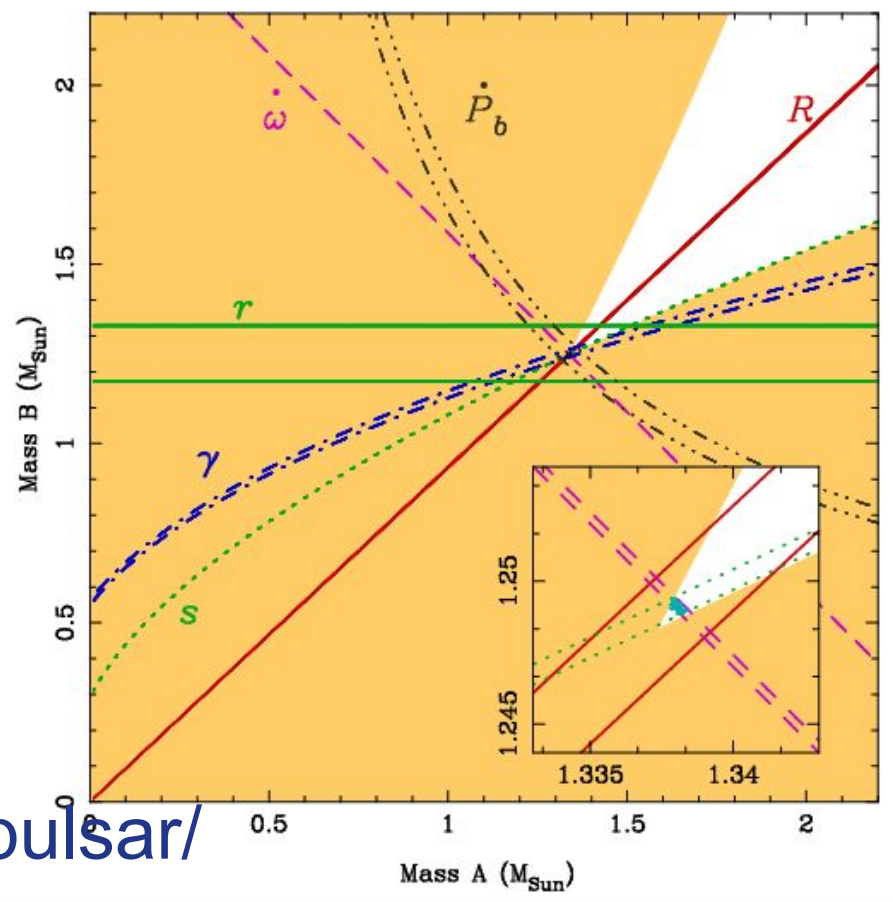


Binary orbit permits determination of masses

Relativistic effects permit (re) determination of masses.

ALL MUST AGREE

<http://www.jb.man.ac.uk/~pulsar/>

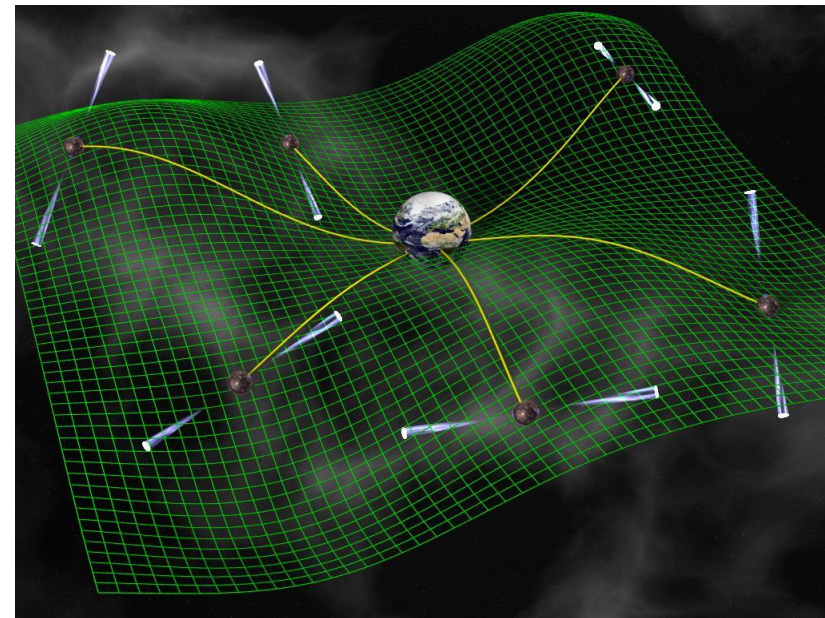




Strong Field Tests of Gravity



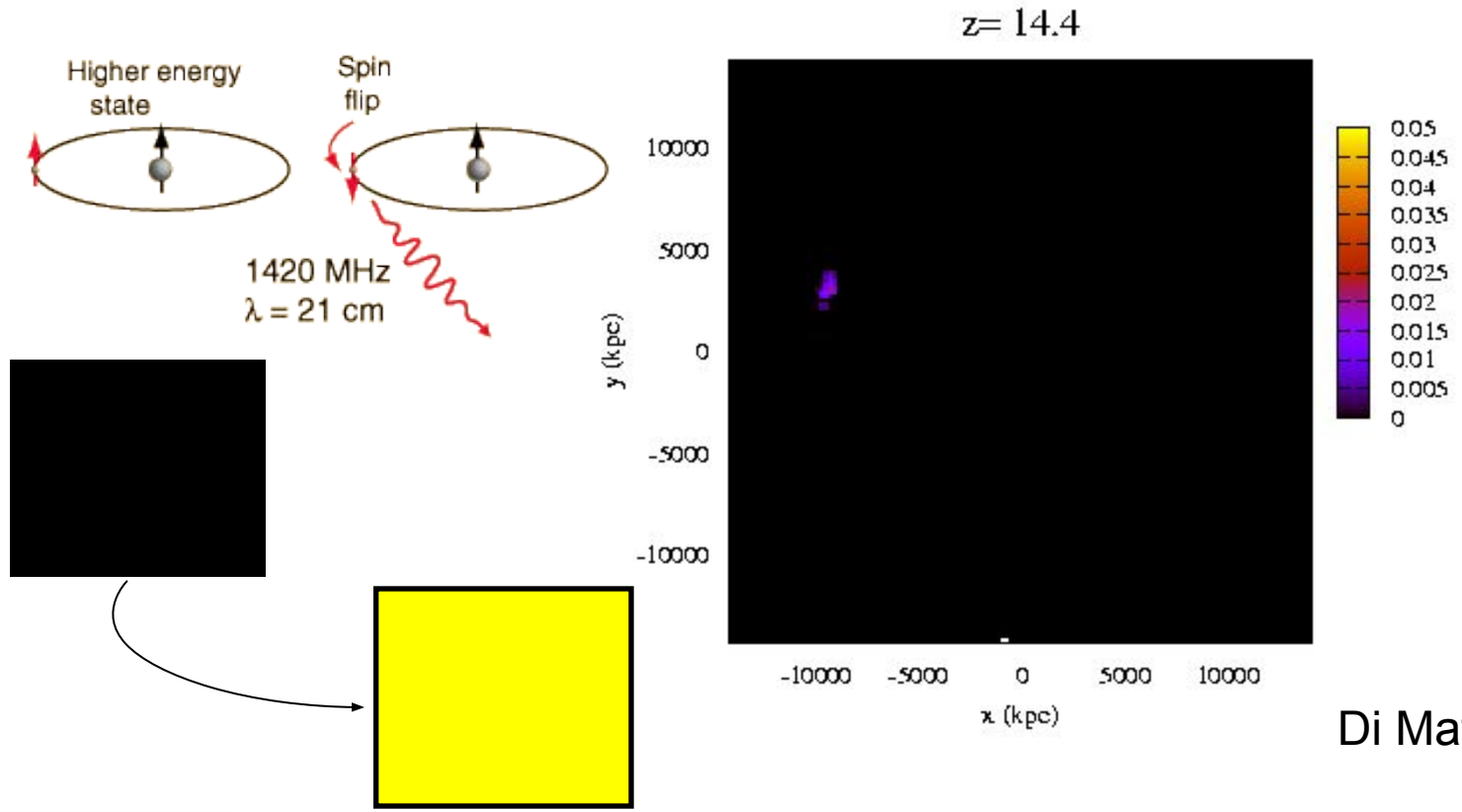
- Large surveys will find exotic binaries
 - ~20 000 pulsars in the galaxy
 - Nearly edge-on Pulsar – Black-hole binary (at least one)
 - Probe eg. Frame dragging, cosmic censorship, no hair theorem
- Pulsar timing array
 - Gravitational wave background





Probing the Dark Ages

- When did the first luminous objects form?
- How did they form and over what period of time?
- SKA will detect the **Epoch of Reionisation** and map the evolution history of the first luminous objects



Di Matteo et al

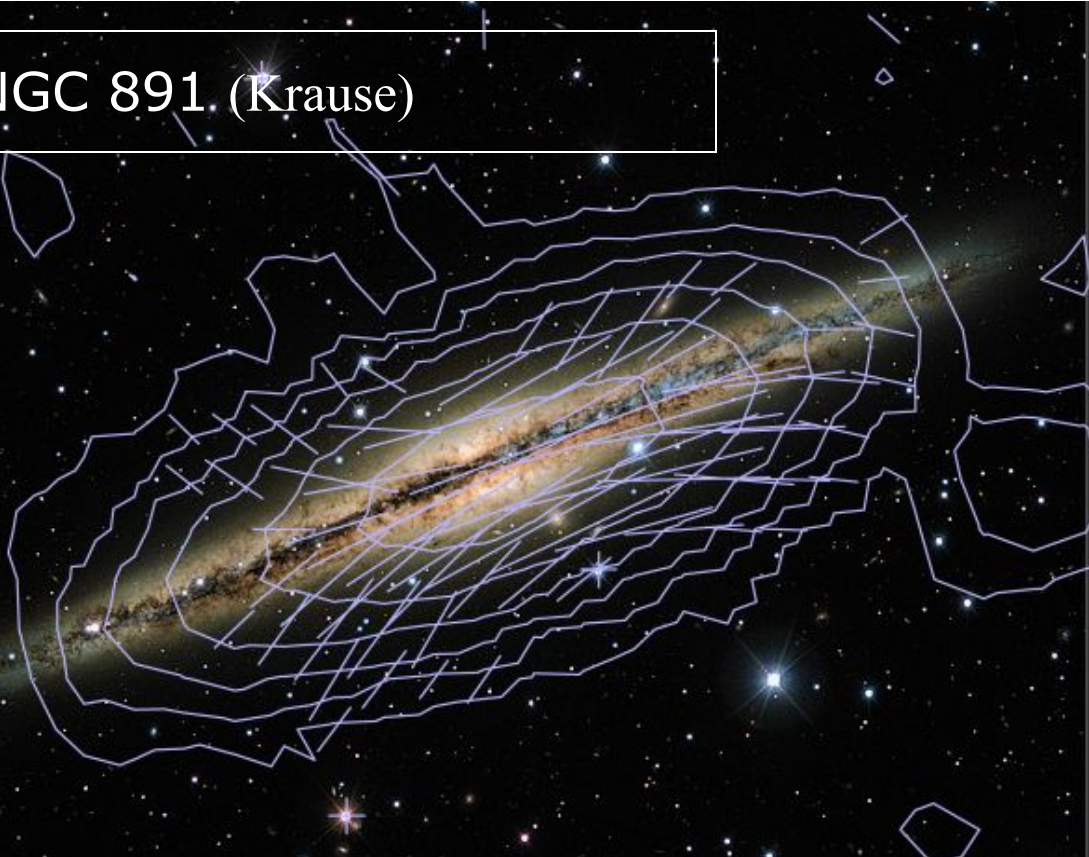


Cosmic Magnetism

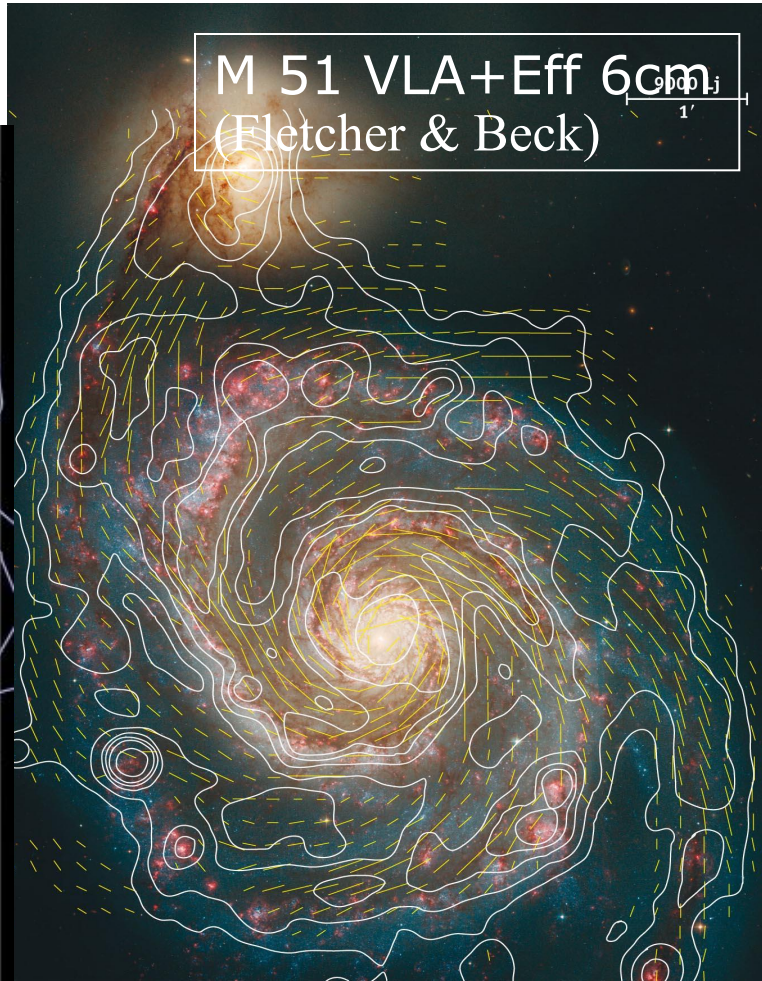


- Origin of magnetic fields
 - Dynamo?
 - Primordial?

NGC 891 (Krause)

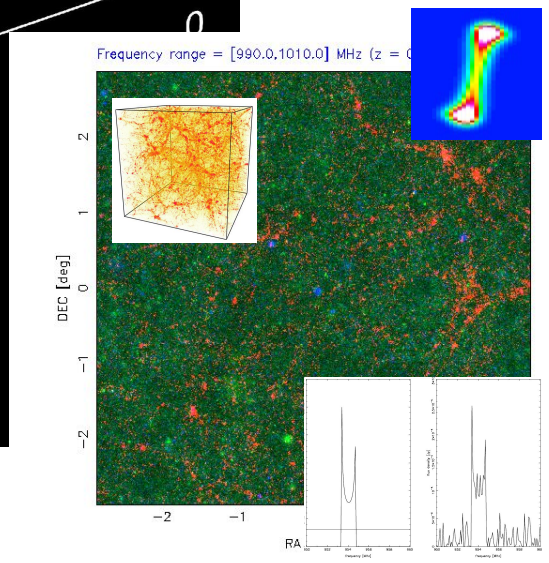
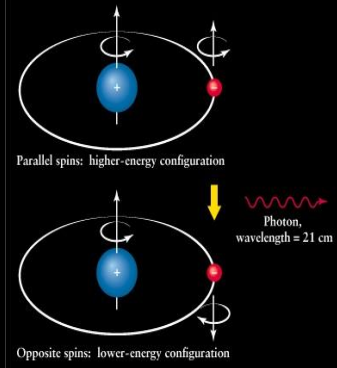
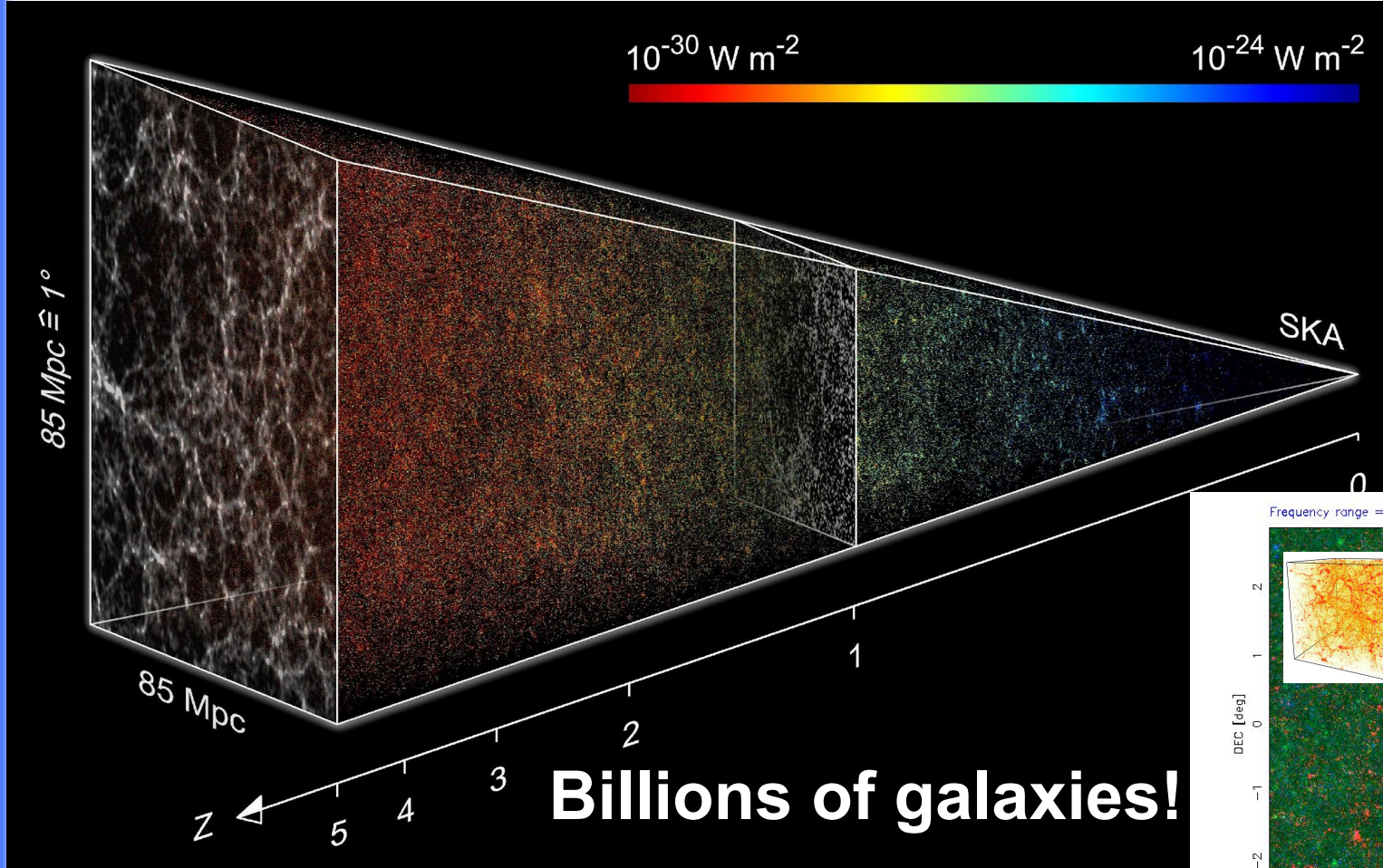


M 51 VLA+Eff 6cm
(Fletcher & Beck)





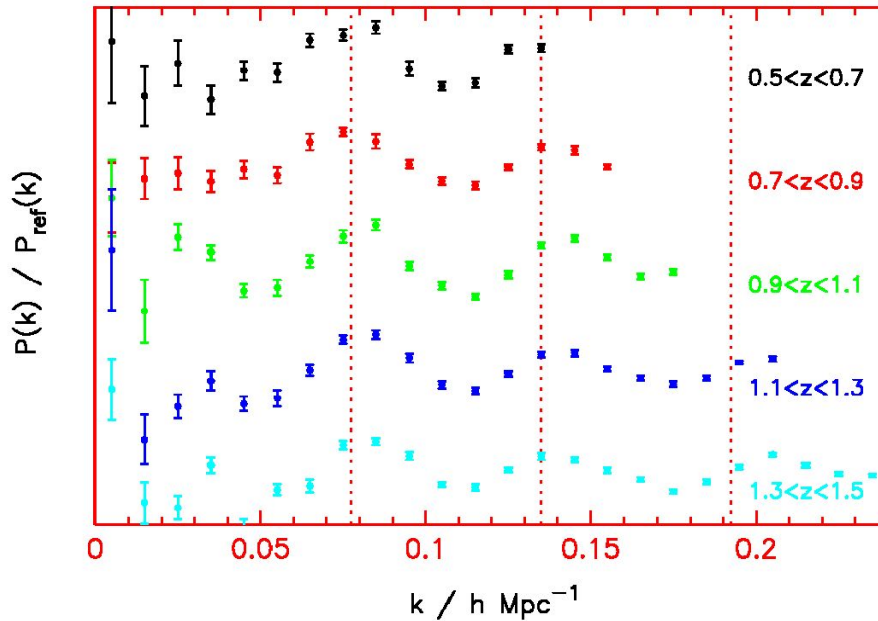
Large Scale Structure



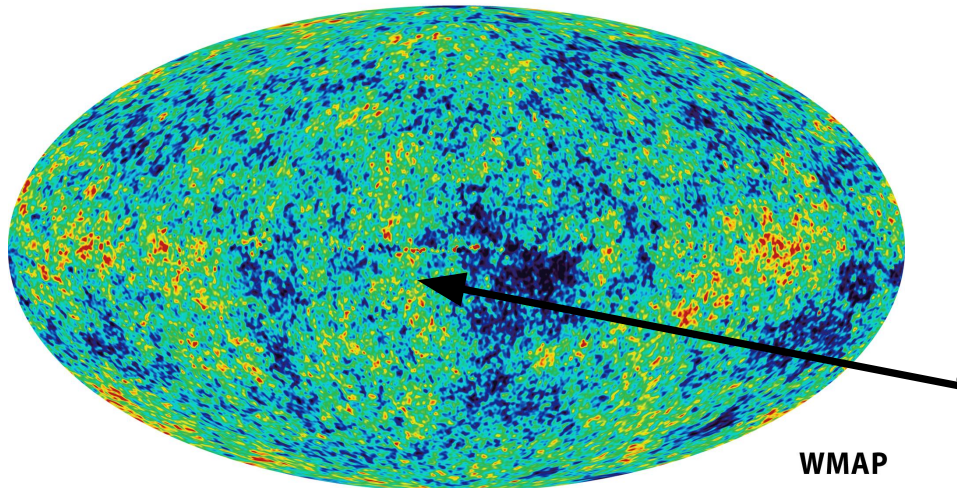
Billions of galaxies!



Baryonic Acoustic Oscillations



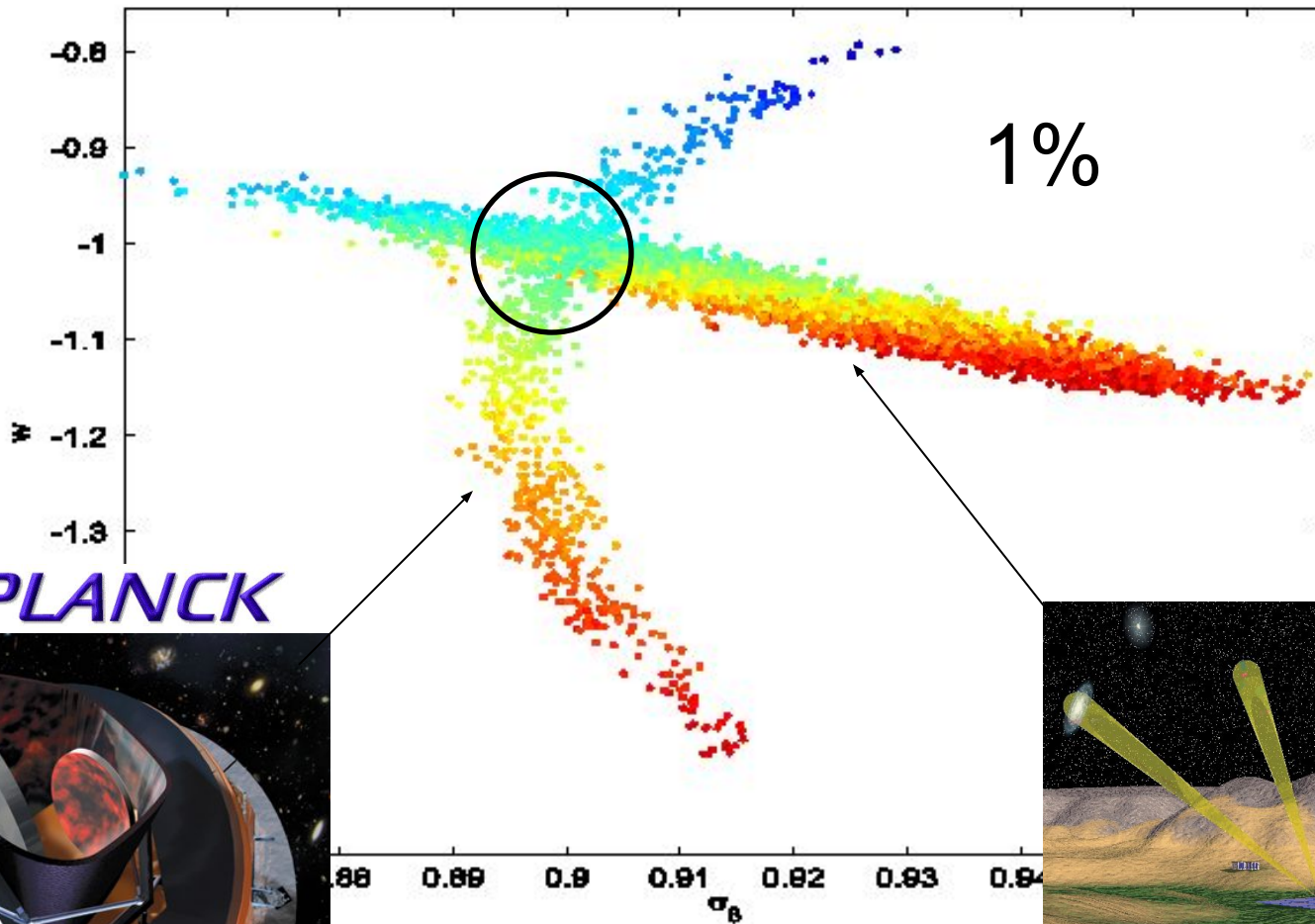
- Improve signal confidence by measuring wiggles in separate redshift bins
- A catalog of a billion galaxies
- Position and redshift measured simultaneously



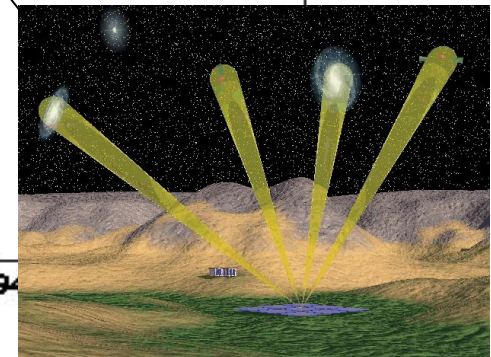
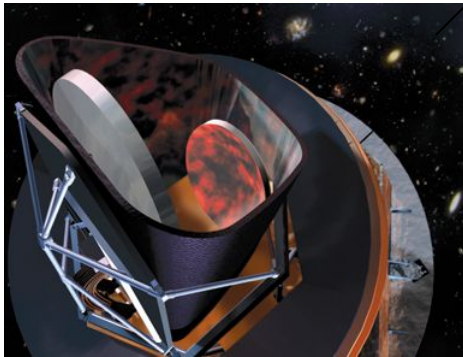
There are fluctuations at all scales but there is a preferred scale of around 1 deg.



Complementarity with Planck



PLANCK

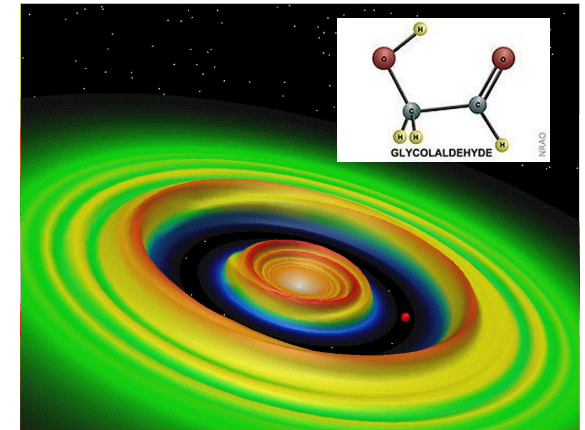




Cradle of Life



- Protoplanetary disks resolved to Earth-like orbits
- Organic molecules
- Extrasolar planets
- Extra terrestrial intelligence







Transients



- Pulsar is a special case of transient phenomena (periodic)
- Giant pulses
- Supernova
- Bursters
- ETI

requires:

- fast time constant
- memory buffer for post analysis
- wide instantaneous, fully-sampled FoV



The Unknown



- New discoveries always result from observations in new parameter space
 - sensitivity
 - spatial resolution
 - spectral resolution
 - polarisation
 - time domain
 - observing speed (multibeaming)
- *eg.* CMB, pulsars, extra solar planets,...

SKA
improves
all of
these

SKA is designed for the Key Projects but with an overriding design philosophy of flexibility to maximise the likelihood of new discoveries



Worldwide SKA efforts

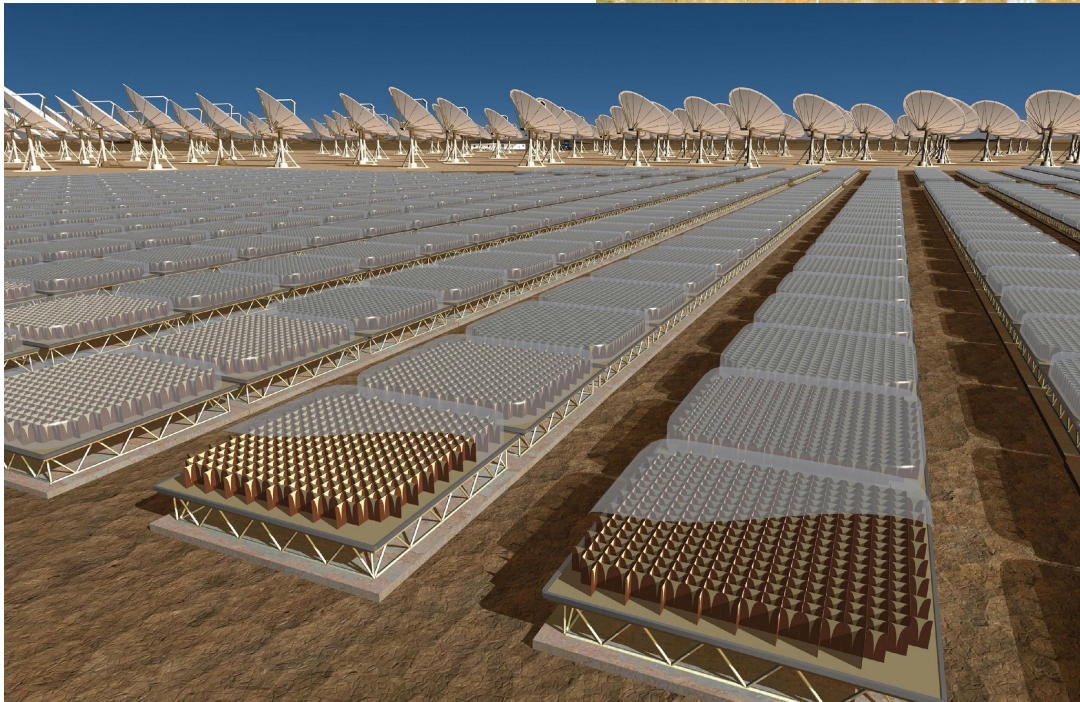
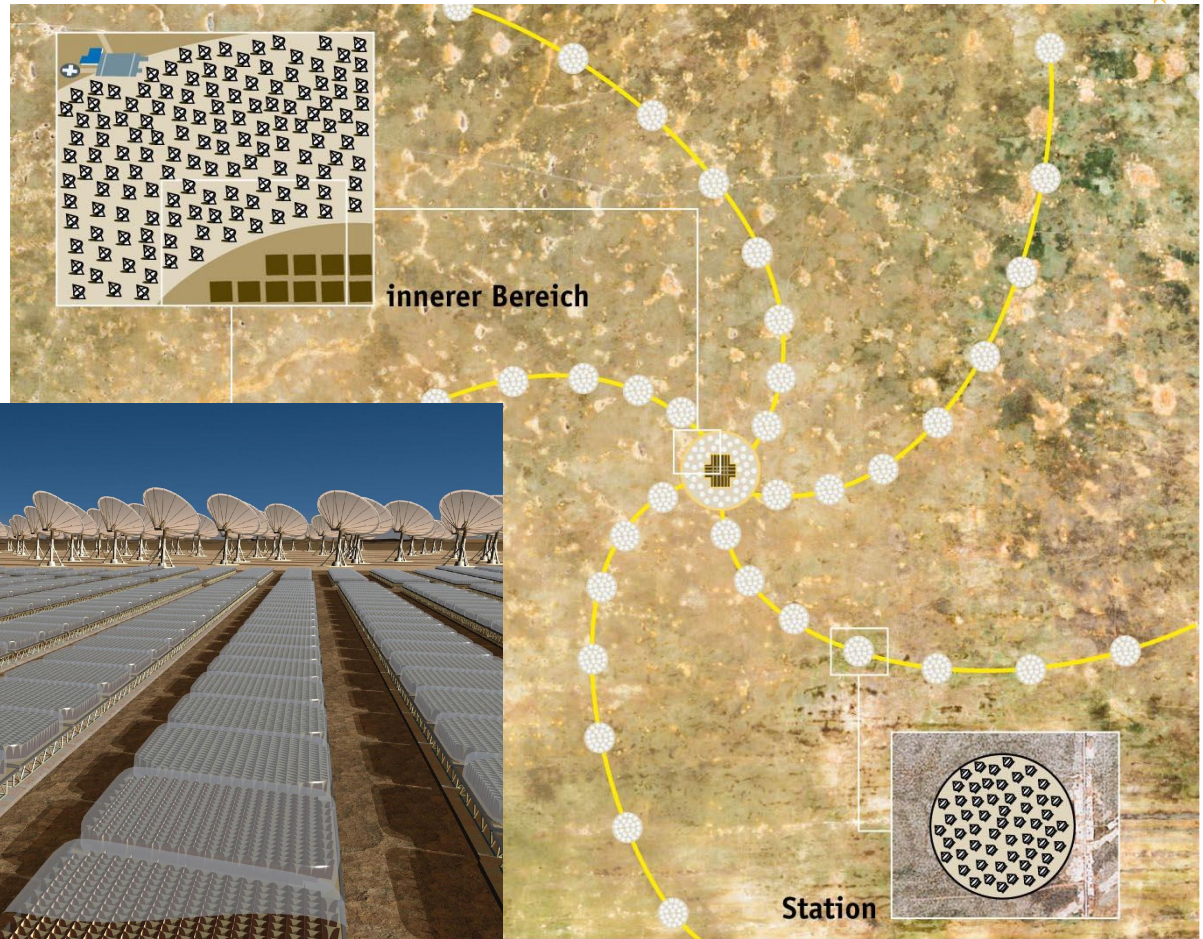


- Europe
 - LOFAR
 - Square Kilometre Array Design Studies
 - 4 year study, 38MEuro (11MEuro from EU Framework Programme 6)
 - EMBRACE demonstrator at Westerbork and Nançay
- Australia & Canada
 - AU\$56M announced in 2007 Australian budget
 - ASKAP demonstrator
- South Africa
 - Karoo Array Telescope and MeerKAT
 - Over US\$200M confirmed by SA gov't for construction, infrastructure, including high capacity network to Karoo region.
- USA
 - Allen Telescope Array
 - Technology Demonstrator Programme (proposed)

www.skads-eu.org

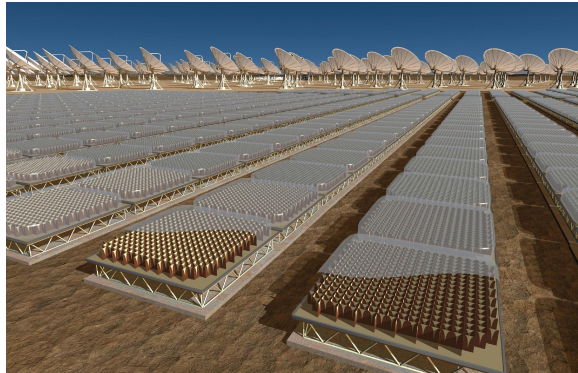


SKA Reference Design (1)

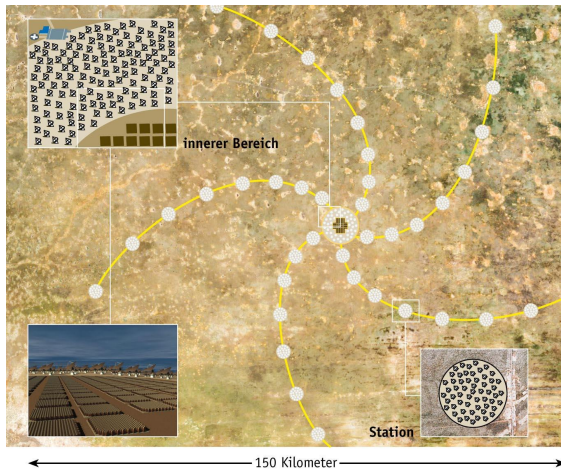




SKA Reference Design (2)

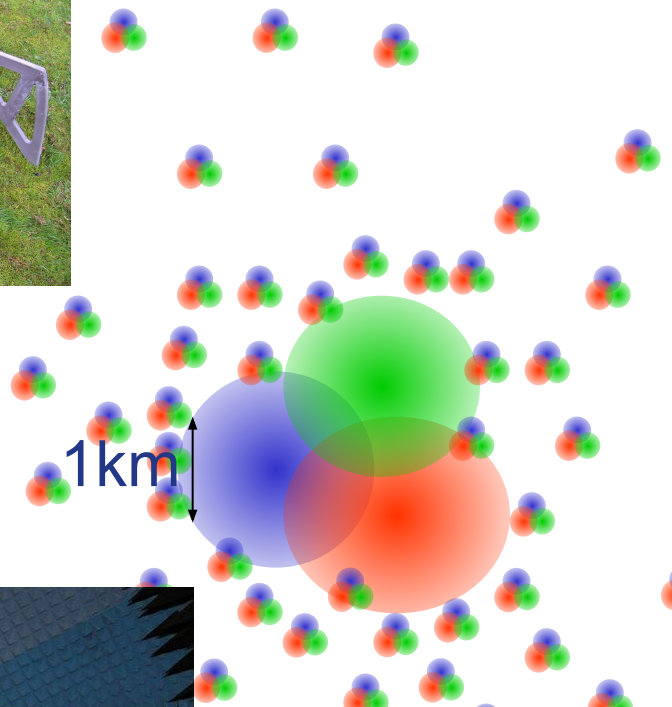


- Inner core (~1km) of densely packed phased-array tiles
- Surrounded by paraboloid dishes (~10m diameter)
- Dishes may have multibeam feeds (phased arrays or horn clusters)
- ~200 stations of ~100 dishes each out to a baseline of 3000km





Three Technologies



- ~1km inner cores
- sparse aperture arrays (eg. LOFAR)
- dense aperture arrays (eg. EMBRACE)
- parabolic dishes
- Outer core ~5km of stations
- Arms > 5km of stations
- maximum baseline of ~3000km

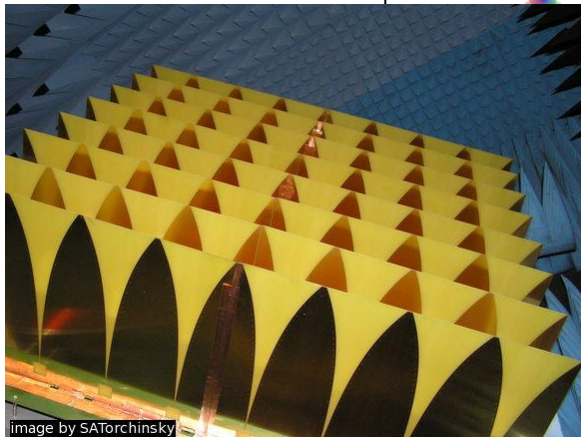


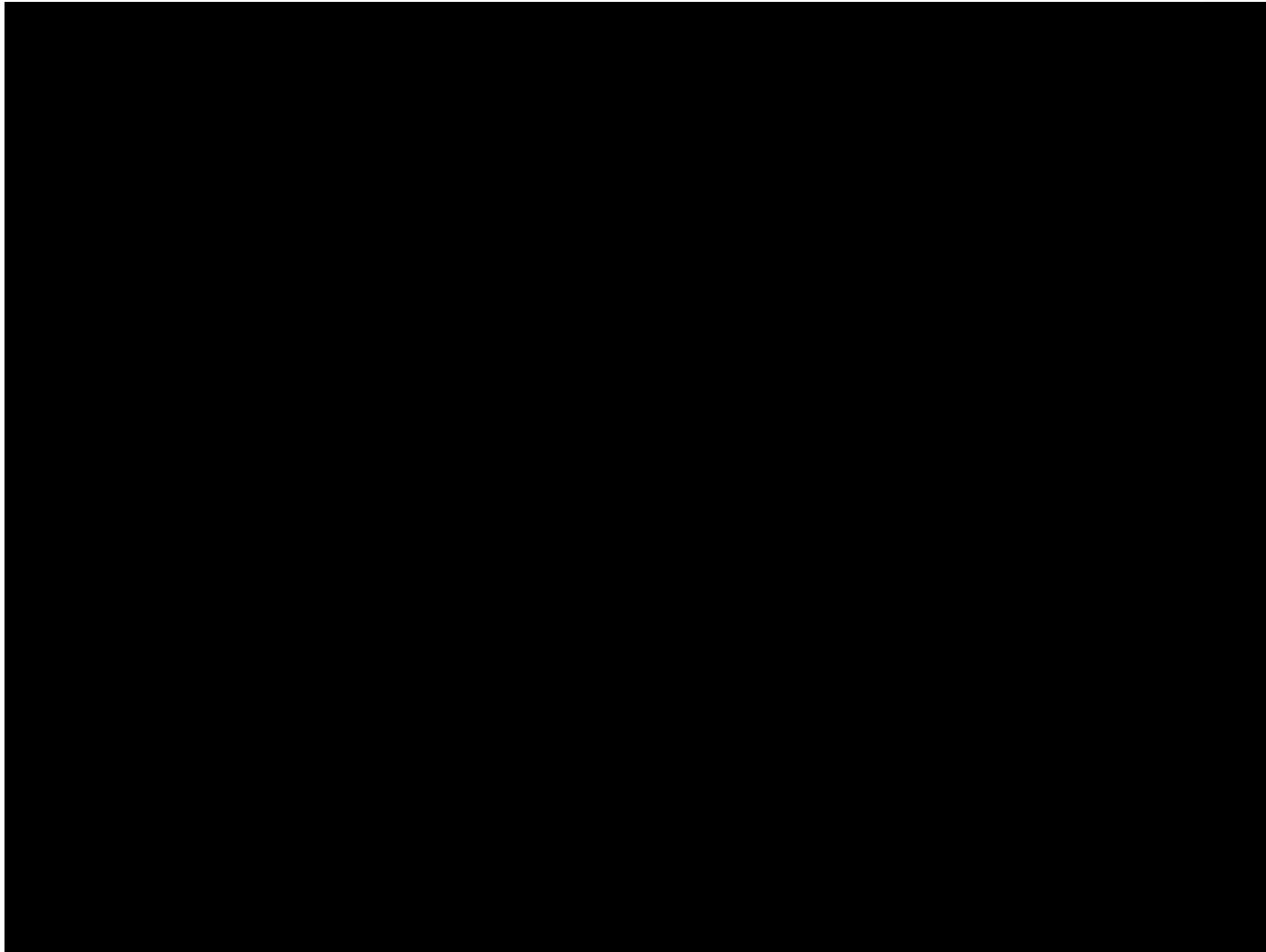
image by SATorchinsky



Allen Telescope Array Begins Scientific Observations



SKA Reference Design



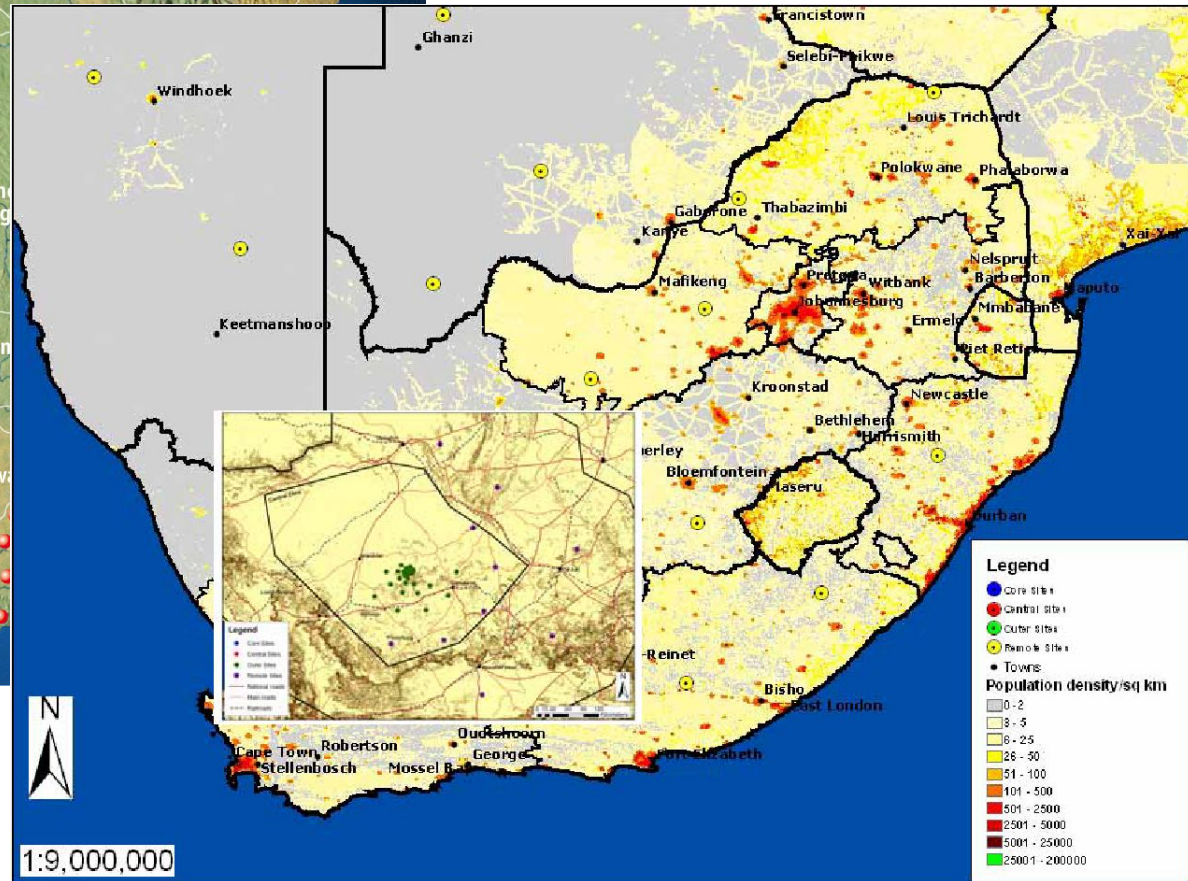
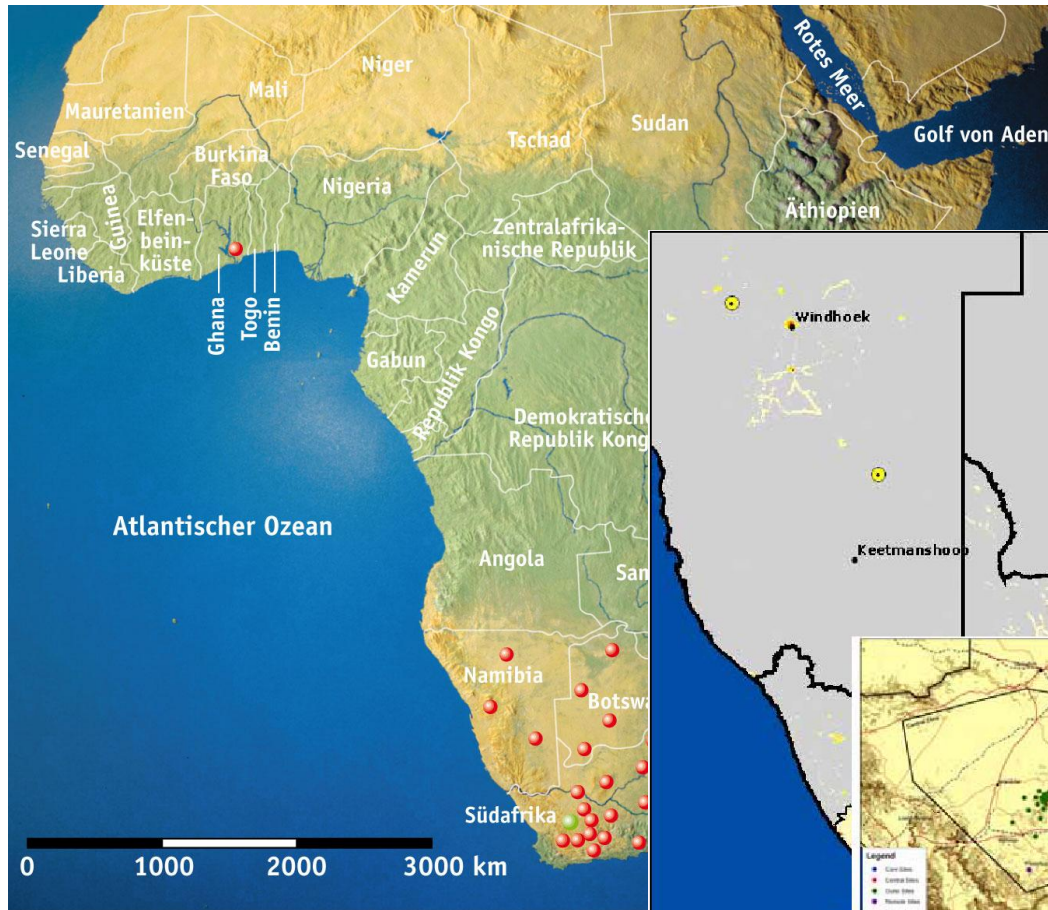


candidate site: South Africa

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- Karoo radio quiet zone

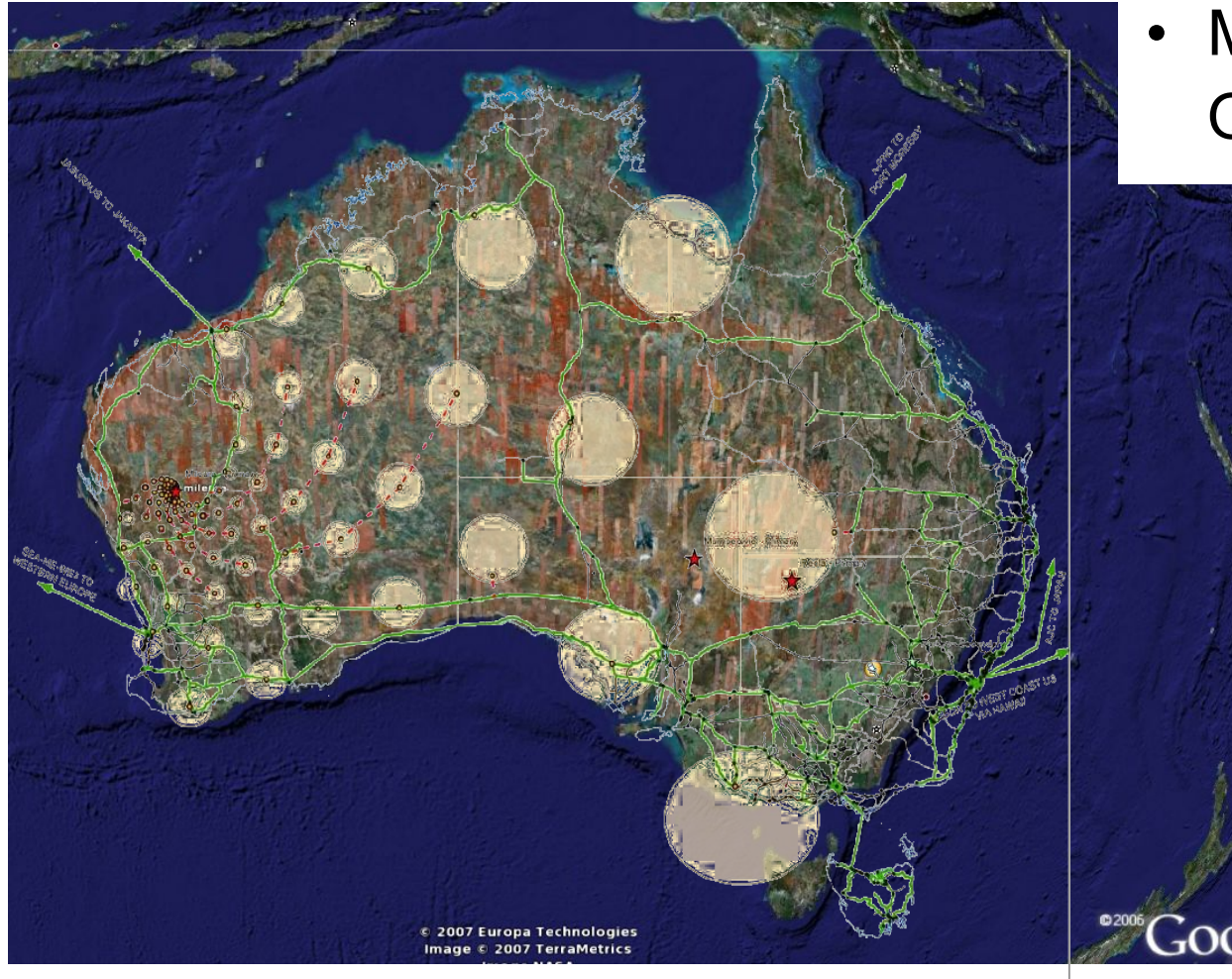




Candidate site: Australia



- Mileura Radio Quiet Zone





Detailed Design for SKA



- Square Kilometre Array Design Studies
 - 26 institutes in 13 countries
 - 38MEuro (including matching funds and EU funds)
 - Detailed design and costing, including signal transport, processing requirements, construction costs,...
 - www.skads.eu.org/p/memos.php

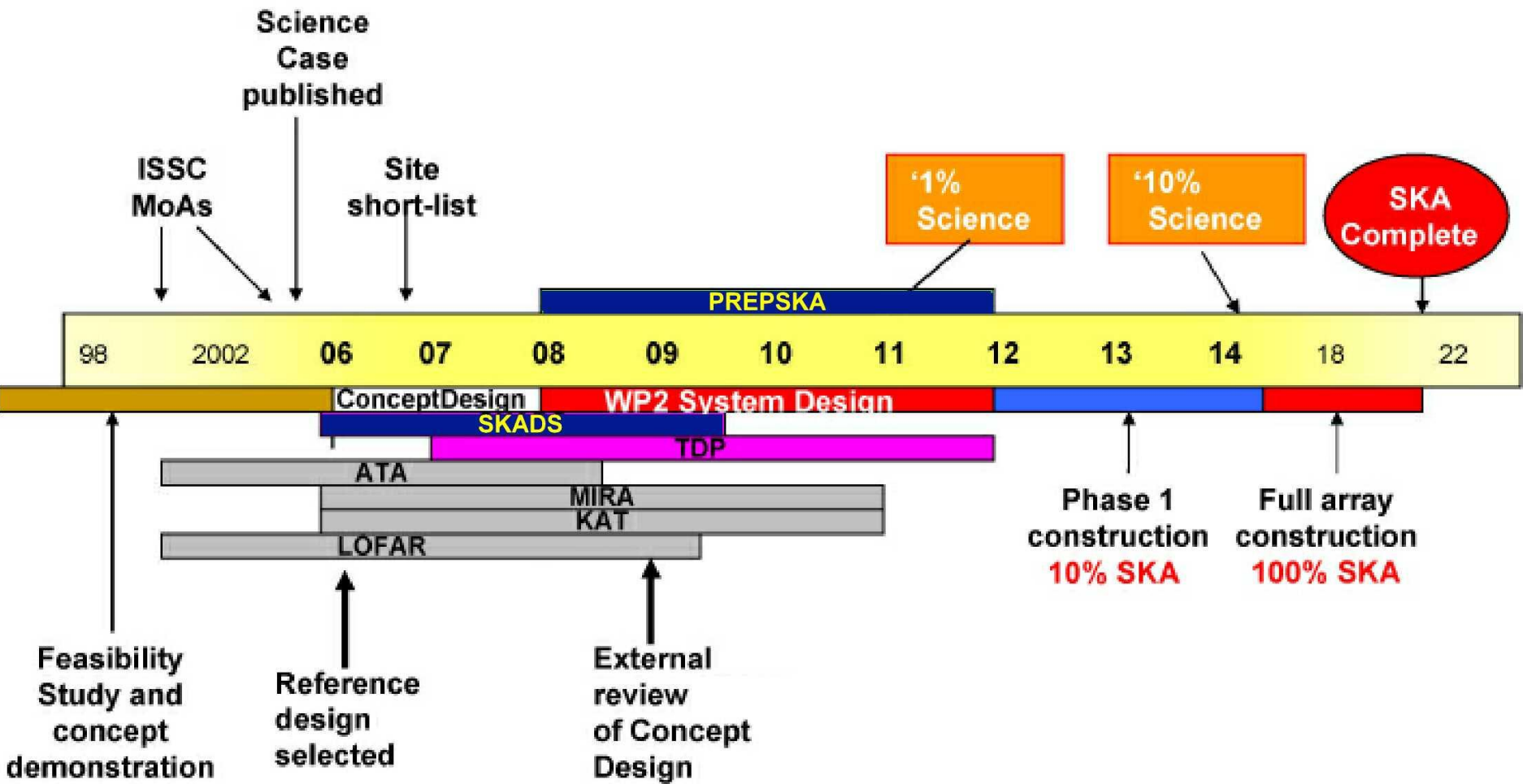
www.skads-eu.org



SKA Timeline

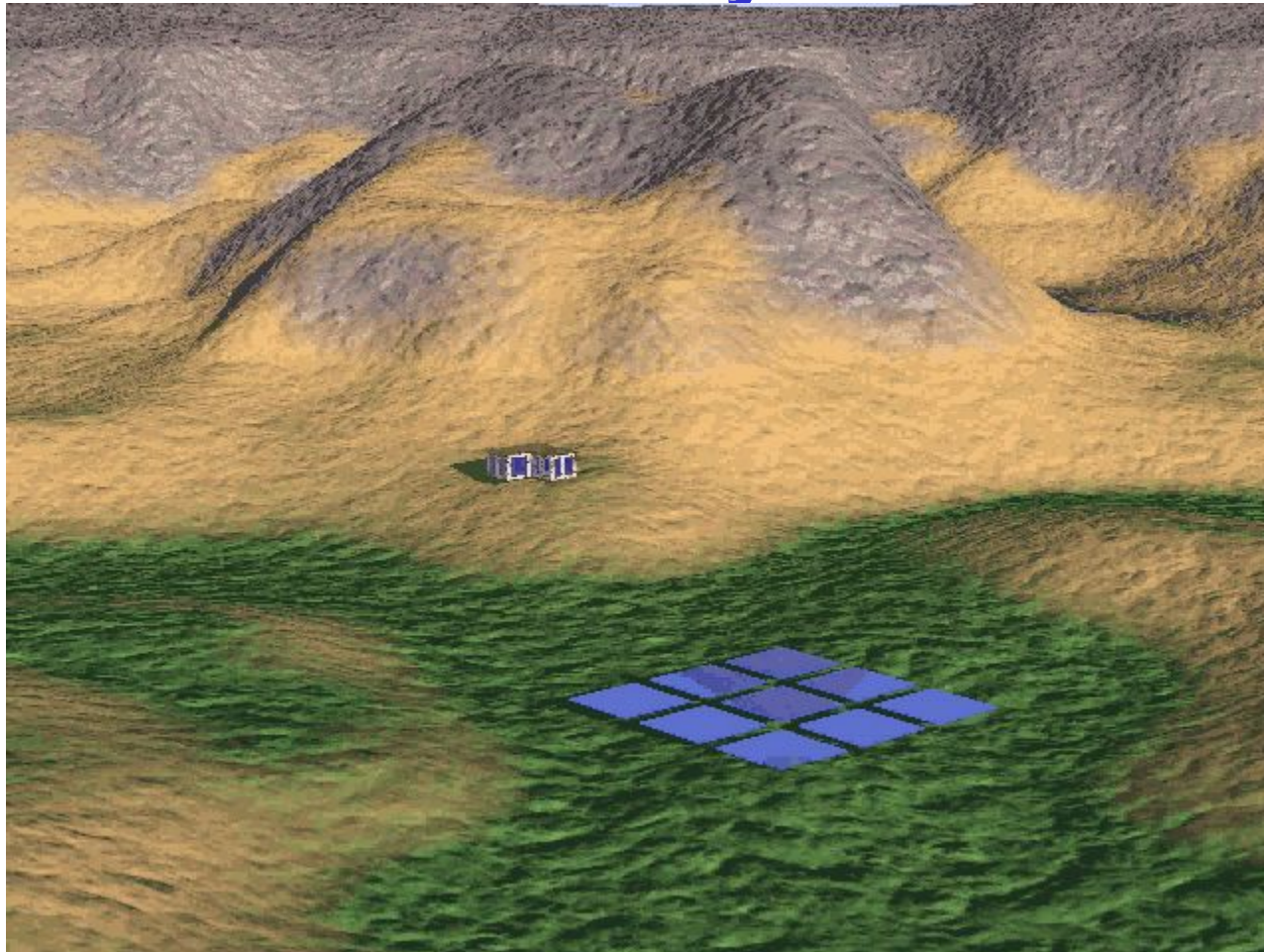


<http://www.skatelescope.org>





Multibeaming with an Aperture Plane Phased Array



www.skads-eu.org