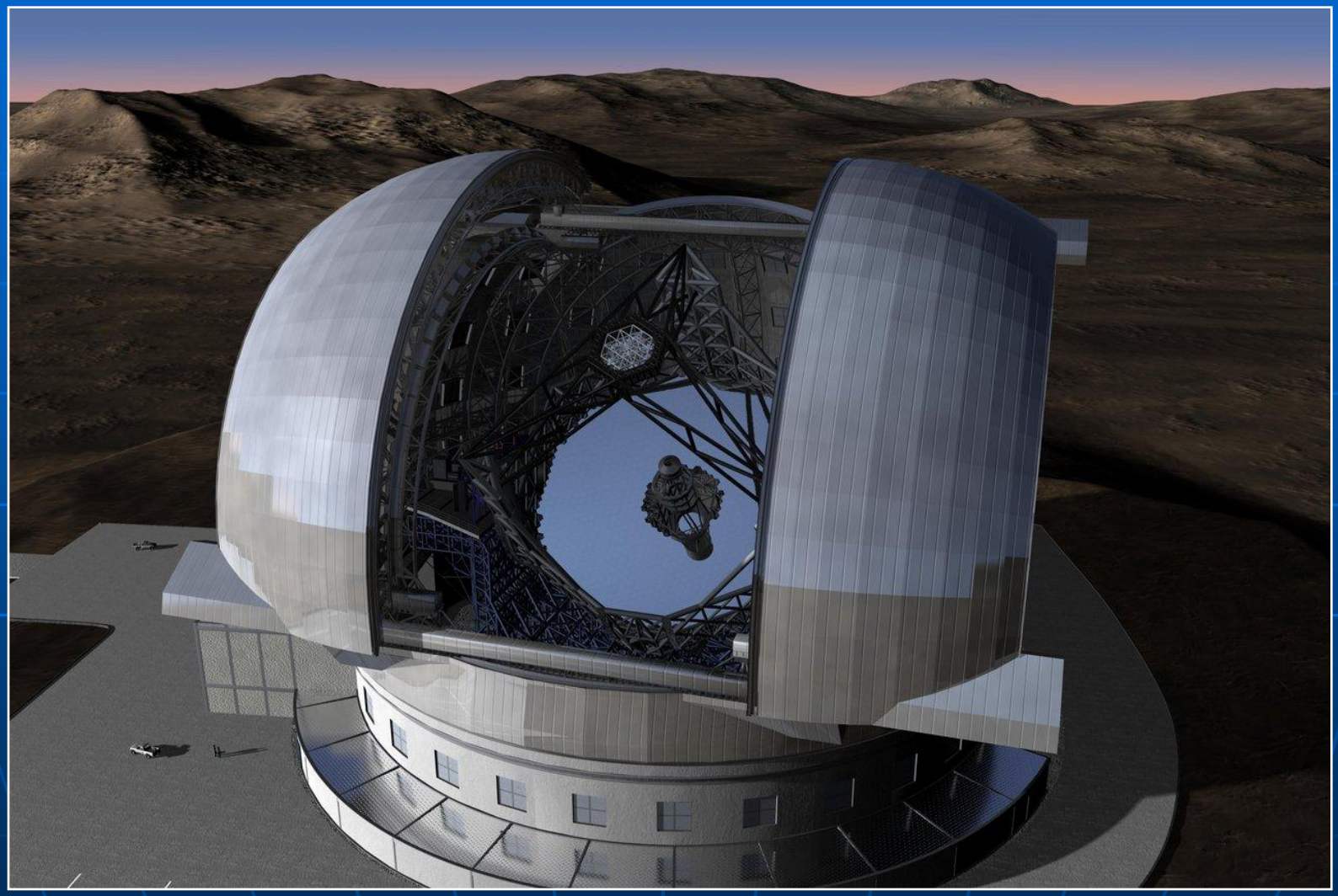
New telescopes for magnetic field observations

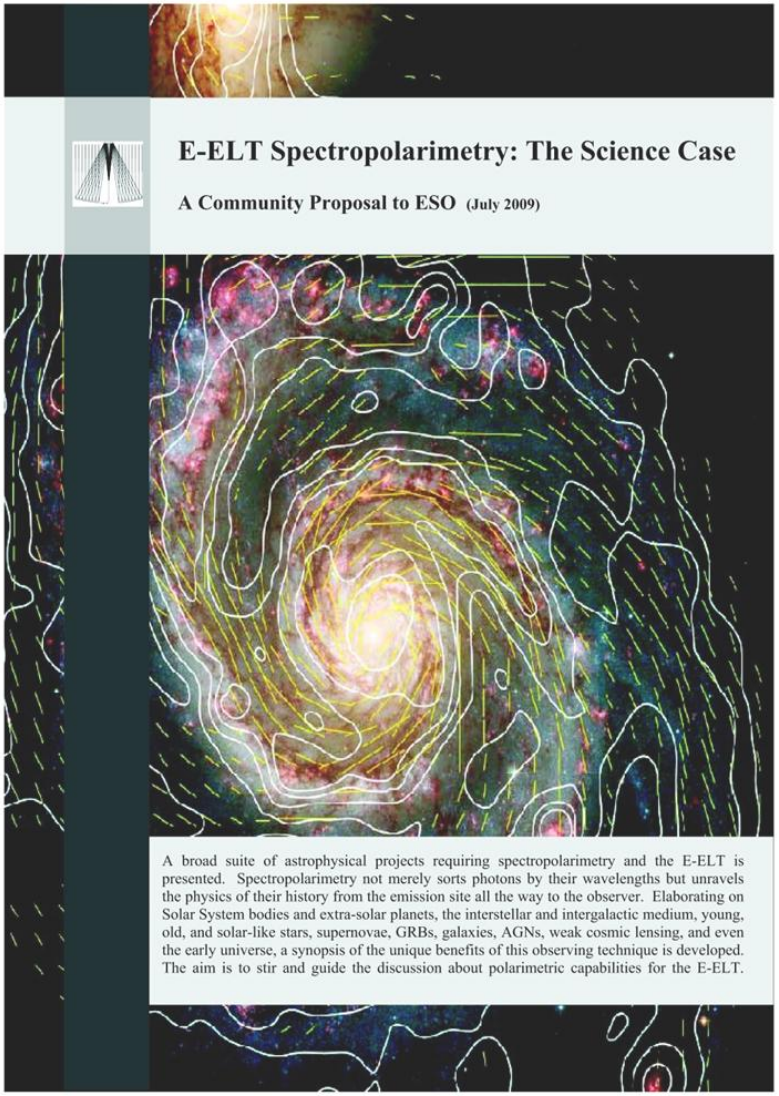
Rainer Beck

E-ELT



Construction: 2012-2016
Site chosen: Cerro Armazones

E-ELT



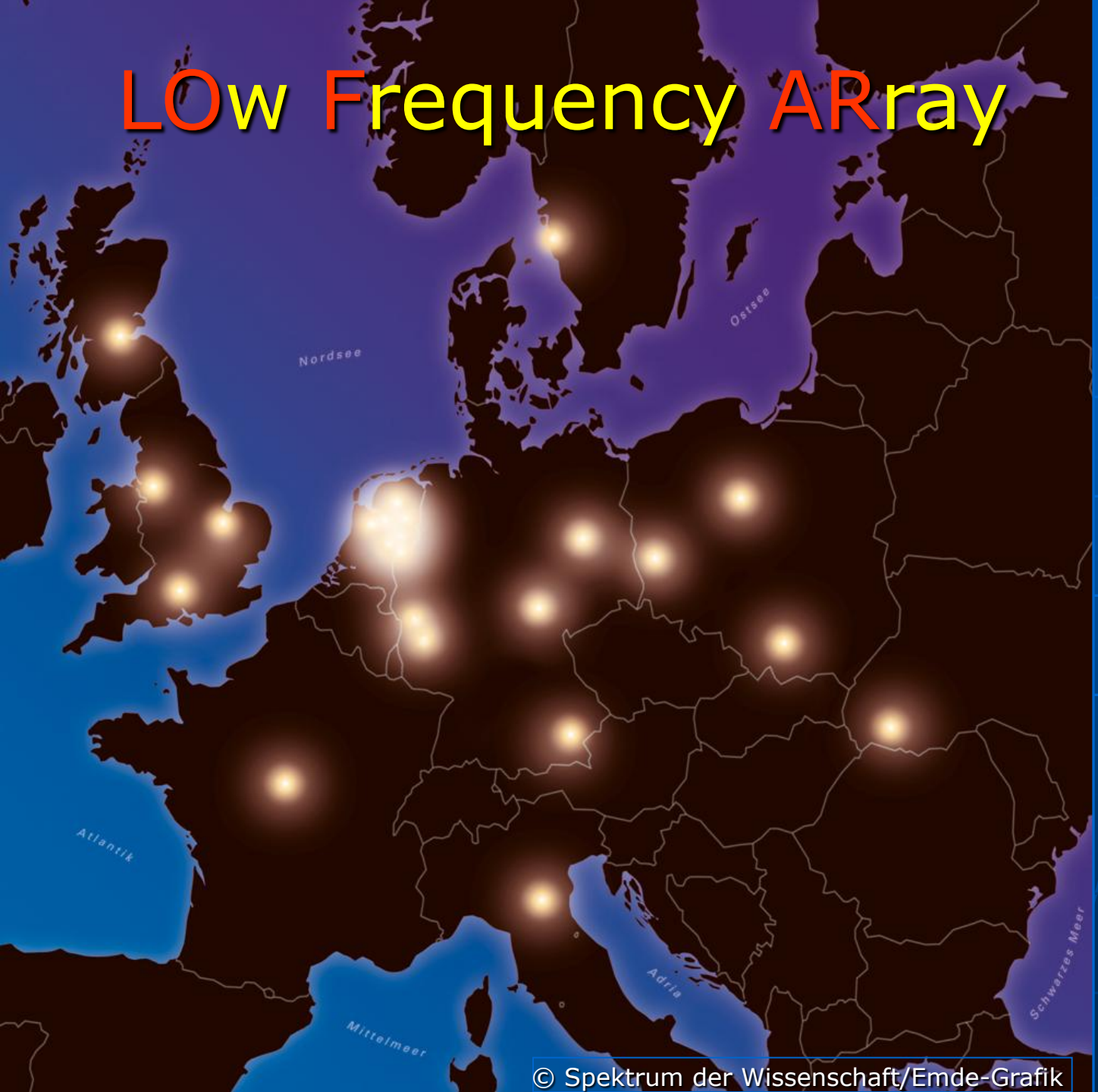
Spectro-polarimetry:

- opens a new window
- should be done from ground
- needs a large collecting area
- does not need photometric nights

(from science case, July 2009)

Ideal for the E-ELT, but not secured yet

LOw Frequency ARray



© Spektrum der Wissenschaft/Emde-Grafik

LOFAR

10-80 MHz
110-240 MHz

LOFAR Key Science Project

Cosmic Magnetism in the Nearby Universe

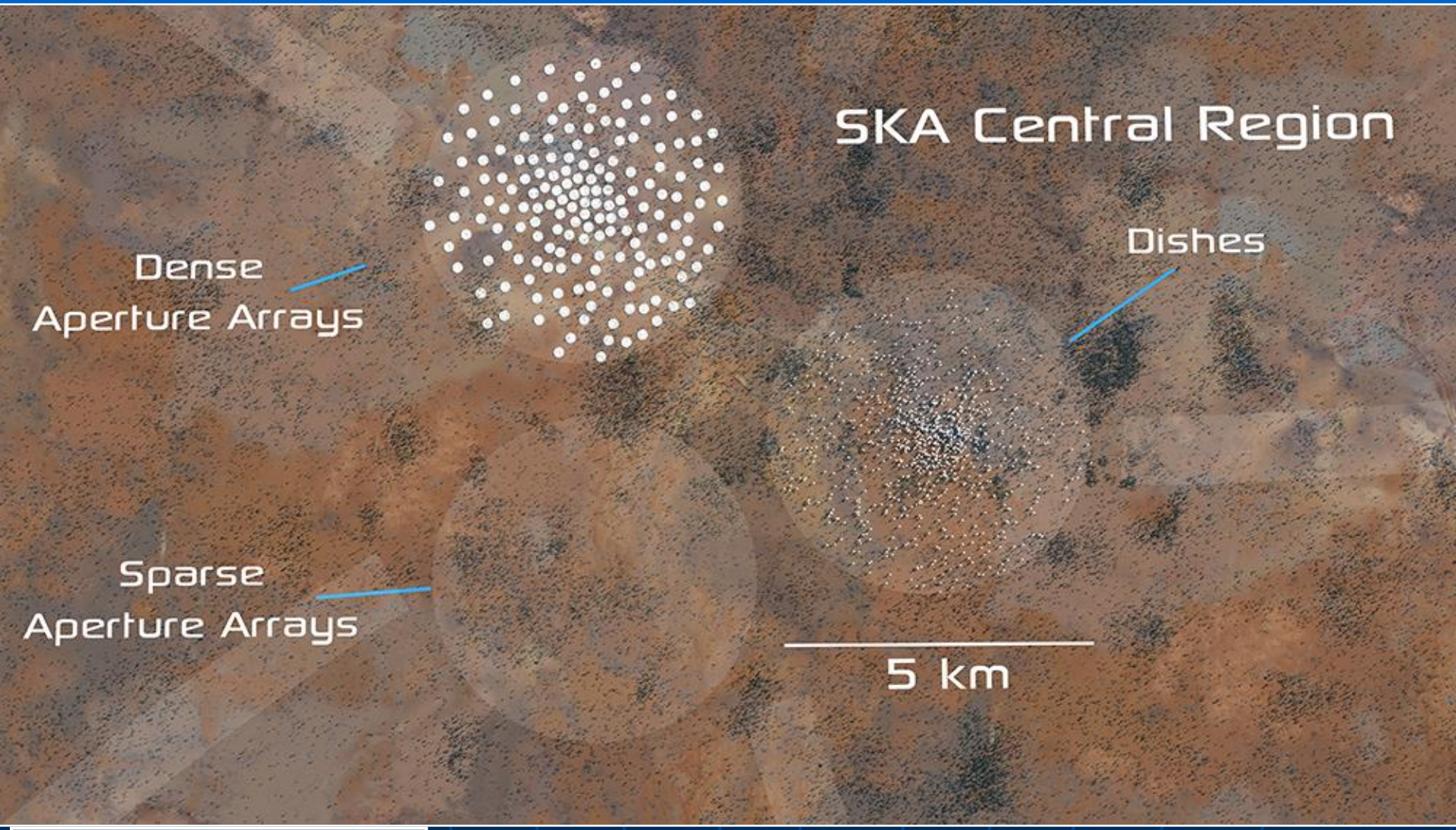
http://www.mpifr-bonn.mpg.de/staff/rbeck/mksp.html

New membes welcome!

ALMA

Antennas: 54x 12-m plus 12x 7-m
Recveivers: 84-720 GHz (0.4-3.6mm), mostly with pol
Construction: 2010-2015

SKA



SKA Project Office
+ Swinburne Astr. Prod.

Sparse Aperture Array (70-300 MHz)

SKA Project Office
+ Swinburne Astr. Prod.

Dense Aperture Array (500-1000 MHz)

SKA Project Office
+ Swinburne Astr. Prod.

Dishes (800 MHz – 10 GHz)

SKA Project Office
+ Swinburne Astr. Prod.

Dishes (800 MHz – 10 GHz)

SKA Project Office
+ Swinburne Astr. Prod.

SKA Timeline

- Start of Phase 1 construction: 2016
- Start of observations: 2018
- Start of Phase 2 construction: 2020
- Start of Phase 3 design studies: 2023
- Phase 1: Only two science drivers (EoR/redshifted HI and pulsars)
- *Magnetism remains Key Science for Phase 2 and "demonstration science" for Phase 1*

Summary (updated regularly):

http://www.scholarpedia.org/article/Square_kilometre_array

ASKAP
(Australian SKA Pathfinder)

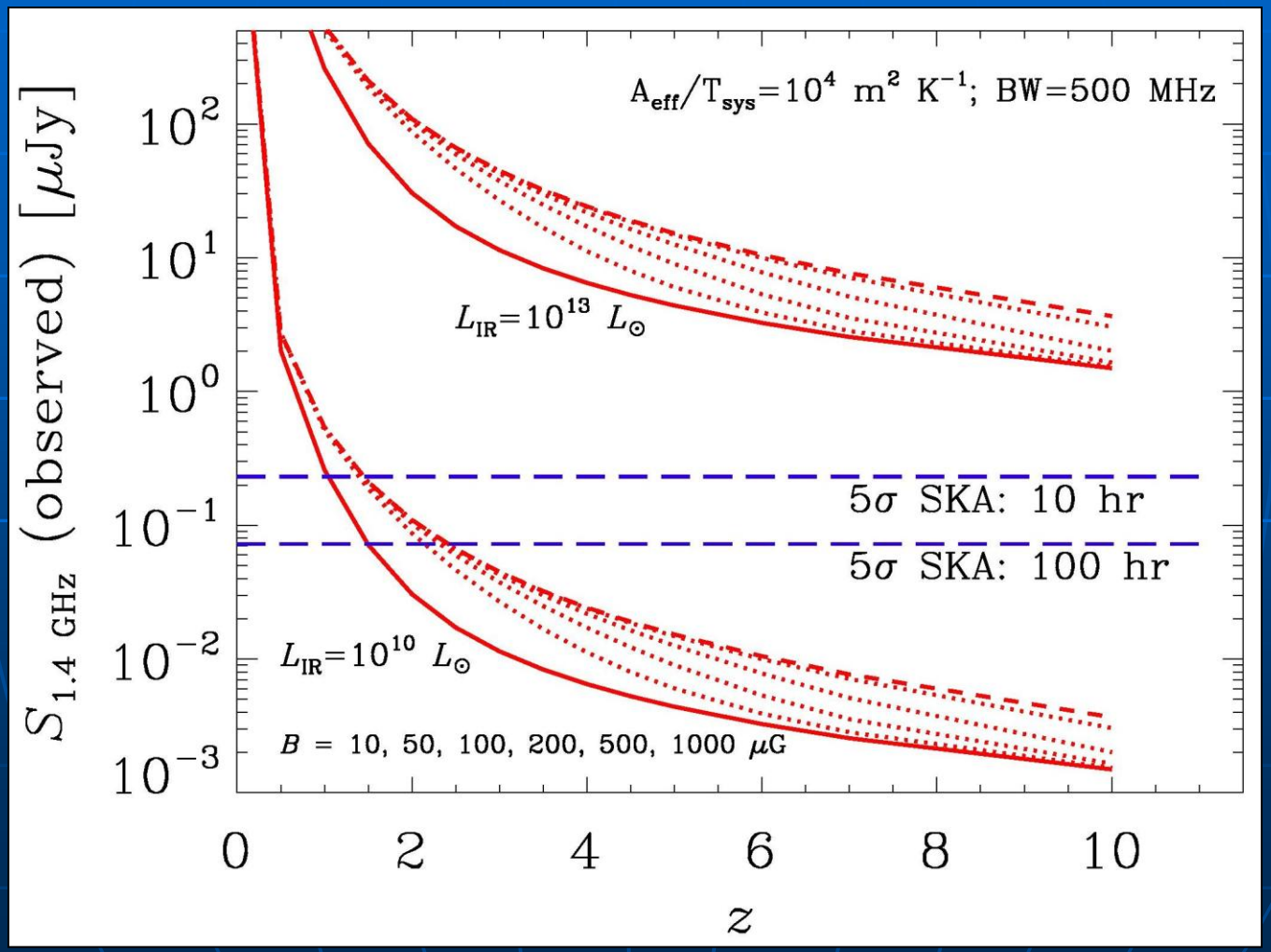
- 36 antennas of 12m diameter
- Max. baseline 6km
- Frequency range 0.7 - 1.8 GHz
- Funded

POSSUM: *POlarization Survey of the Universe´s Magnetism*

- All-sky RM survey 1.2-1.5 GHz
- Accepted
- Start: ~2013
- Preparing working groups active
- Further members welcome

SKA: Observation of distant galaxies

Murphy 2009



Magnetic fields at high z

- Radio synchrotron emission should break down at large z due to IC loss
- IR/radio ratio should increase

Murphy 2009

- This is *not* observed:

Magnetic fields are strong in distant galaxies

$B > B_{CMB} = 3.25\ \mu G\ (1+z)^2$

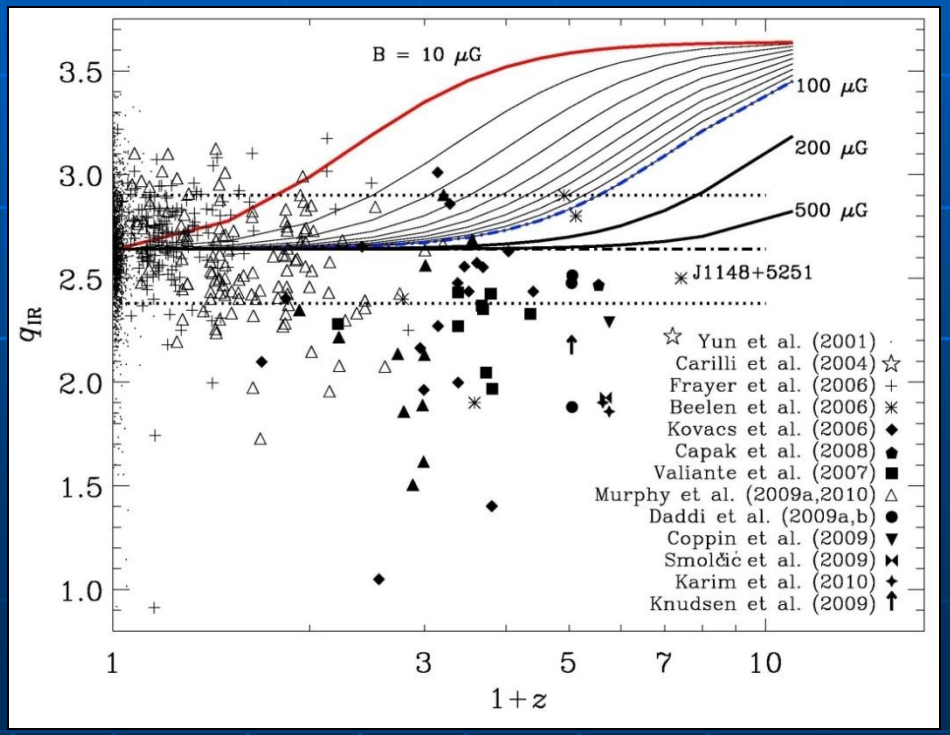
- Fixed observation frequency:

$E_{CR} \sim B^{-0.5}\ (1+z)^{-0.5}$

$B \sim (1+z)^2$:

$E_{CR} \sim (1+z)^{-1.5}$

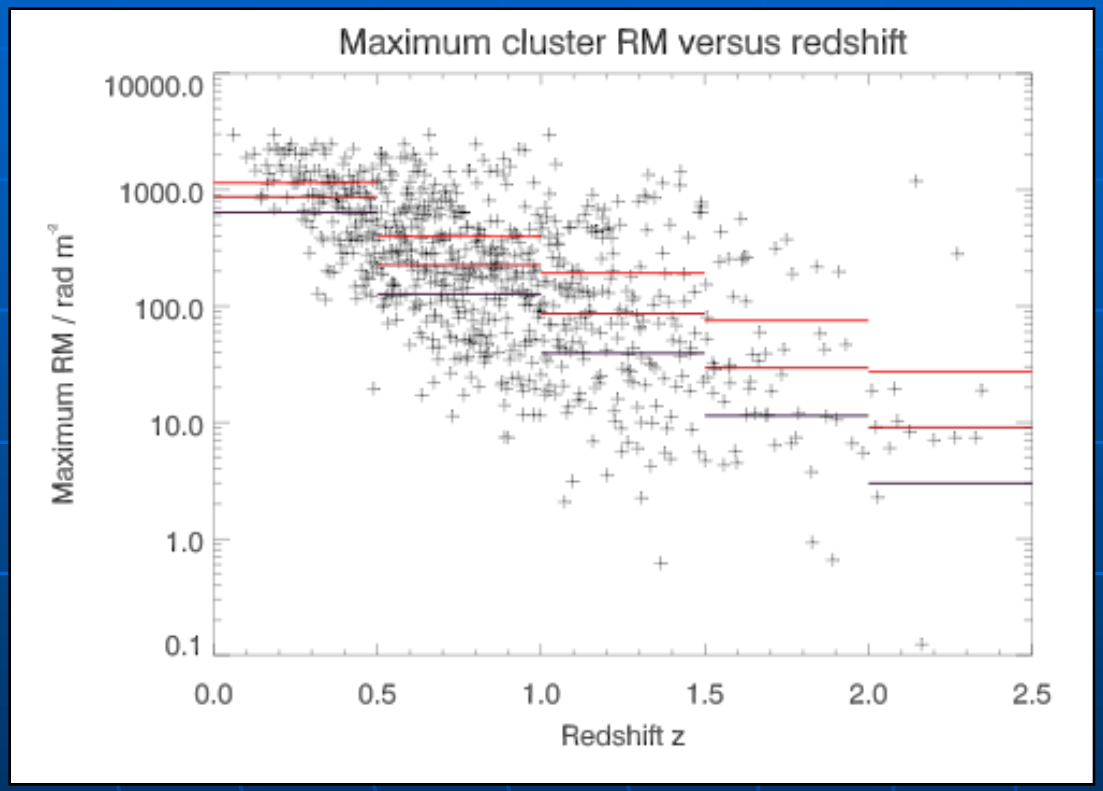
Bremsstrahlung and ionization losses dominate at large z



IR/radio luminosity

Cosmic evolution of cluster magnetic fields

Krause et al. 2009



- Chance to hit cluster center decreases with redshift
- Constrain magnetic field evolution:
  if $B \sim (1+z)^n$,
  $\Delta n < 0.4$ accuracy
  (for 100h SKA AA)

With the SKA we can check the history of magnetic fields in clusters