SKA-France & Developments in Africa

Dr. Chiara Ferrari
(SKA-France Director, Chair of European SKA Forum, OCA)

SKA at a glance

- A global collaboration to design, build and operate the next generation radio astronomy observatory
- A new Inter-Governmental Organisation for astronomy and fundamental physics with 50+ year lifetime
- It will consist of:
  - An array of ~200 dishes in ZA
  - An array of ~131000 antennas in AU
  - A global HQ in UK
  - Two data computing centres in ZA & AU + A world-wide network of SKA regional centres (SRC)
- SKA is now:
  - Q4/2020: IGO exists
  - Q2/2021: construction activity begins

Courtesy: SKAO, H2020 AENEAS

SKA at a glance

- A global collaboration to design, build and operate the next generation radio astronomy observatory
- A new Inter-Governmental Organisation for astronomy and fundamental physics with 50+ year lifetime
- It will consist of:
  - An array of ~200 dishes in ZA
  - An array of ~131000 antennas in AU
  - A global HQ in UK
  - Two data computing centres in ZA & AU + A world-wide network of SKA regional centres (SRC)
- SKA is now:
  - Q4/2020: IGO exists
  - Q2/2021: construction activity begins

Courtesy: SKAO, H2020 AENEAS

SKA at a glance

- A global collaboration to design, build and operate the next generation radio astronomy observatory
- A new Inter-Governmental Organisation for astronomy and fundamental physics with 50+ year lifetime
- It will consist of:
  - An array of ~200 dishes in ZA
  - An array of ~131000 antennas in AU
  - A global HQ in UK
  - Two data computing centres in ZA & AU + A world-wide network of SKA regional centres (SRC)
- SKA is now:
  - Q4/2020: IGO exists
  - Q2/2021: construction activity begins

Courtesy: SKAO, H2020 AENEAS

SKA at a glance

- A global collaboration to design, build and operate the next generation radio astronomy observatory
- A new Inter-Governmental Organisation for astronomy and fundamental physics with 50+ year lifetime
- It will consist of:
  - An array of ~200 dishes in ZA
  - An array of ~131000 antennas in AU
  - A global HQ in UK
  - Two data computing centres in ZA & AU + A world-wide network of SKA regional centres (SRC)
- SKA is now:
  - February 3-4, 2021: First SKA Observatory Council
  - Q2/2021: construction activity begins

"This is the culmination of many years of work by hundreds of people, whose talents and dedication are the driving force behind the SKA. That collective effort, guided with skill and efficiency by the safe hands of the SKA Office, has brought us to this point."

Dr Catherine Cesarsky
Chair of the SKA Board of Directors

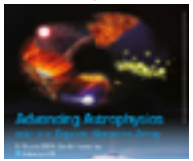
Courtesy: SKAO, H2020 AENEAS

Development of the SKA project

2012

2013

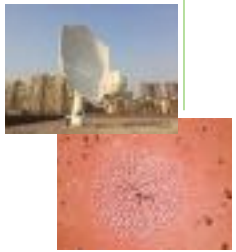
2014



2015

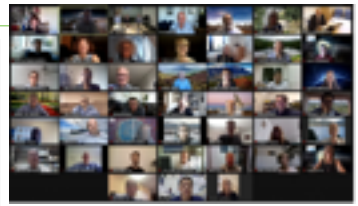
2016

2018



2019

2020



2021

2029

SKA Phase 1 (SKA1)

SKA1-LOW (AUS)
130,000 log periodic antennas

SKA1-MID (SA)
197 dishes (15m)

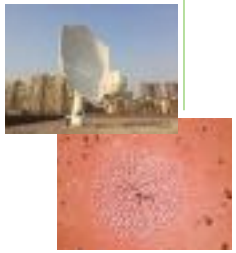
50 MHz — 350 MHz — 15 GHz →

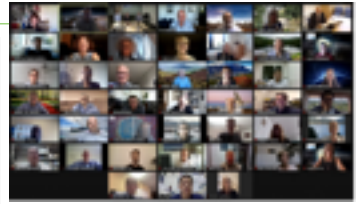
	SKA-Low	SKA-Mid
Start of construction (T0)	1st July 2021	1st July 2021
Earliest start of major contracts (C0)	August 2021	August 2021
Array Assembly 0.5 finish (AA0.5) SKA-Low = 6-station array SKA-Mid = 4 stations	February 2024	March 2024
Array Assembly 1 finish (AA1) SKA-Low = 18-station array SKA-Mid = 8 stations	February 2025	February 2025
Array Assembly 2 finish (AA2) SKA-Low = 64 stations SKA-Mid = 64 stations, baselines mostly <20km	February 2026	December 2025
Array Assembly 3 finish (AA3) SKA-Low = 256-station array, including long baselines SKA-Mid = 128-station array, including long baselines	January 2027	September 2026
Array Assembly 4 finish (AA4) SKA-Low = full Low array SKA-Mid = full Mid array, including MeerKAT dishes	November 2027	June 2027
Operational Readiness Review (ORR)	January 2028	December 2027
End of construction	July 2029	July 2029

Development of the SKA project

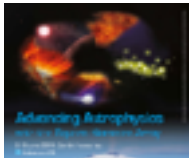
2012 — 2016 — 2019 — 2020 — 2021

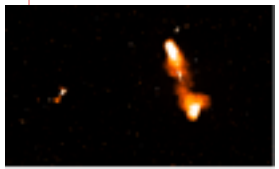
2013 — 2018 — 2019 — 2020 — 2021 — 2029

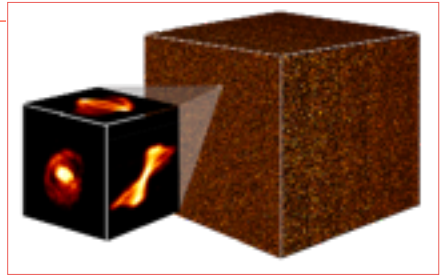




2014 — 2015 — 2018 — 2019 — 2020



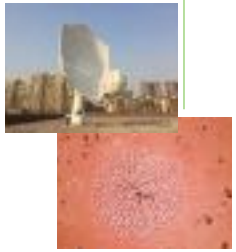




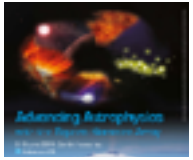
Development of the SKA project

2012 — 2016 — 2019 — 2020 — 2021

2013 — 2018 — 2019 — 2020 — 2021 — 2029



2014 — 2015 — 2020 — 2024 — 2025 — 2026 — 2028



Science Commissioning

Data Challenges

Early Science | Shared Risk | PI Proposals

KSP Workshops | KSP Proposals

Major Science Meetings

A Golden Age for Radio Astronomy

Some of the SKA Pathfinders

NenuFAR
France
10-85 MHz

LOFAR
Europe
30-80 MHz + 110-240 MHz

CHIME
Canada
400-800 MHz

APERTIF
The Netherlands
1 – 1.750 GHz

JVLA
US
1- 50 GHz

SKA Precursors

MWA
Australia
80 - 300 MHz

ASKAP
Australia
700 - 1800 MHz

HERA
South Africa
50 - 250 MHz

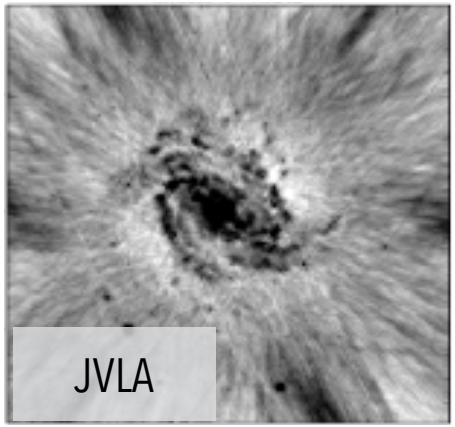
MeerKAT
South Africa
0.580 – 14 GHz

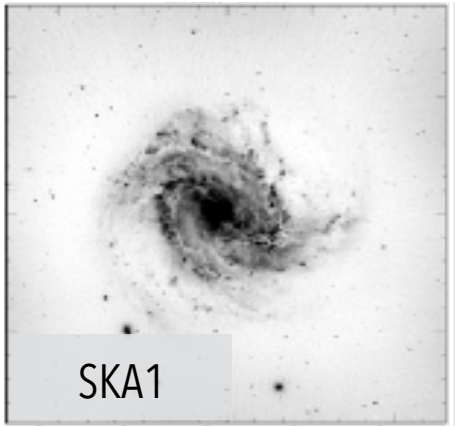
SKA

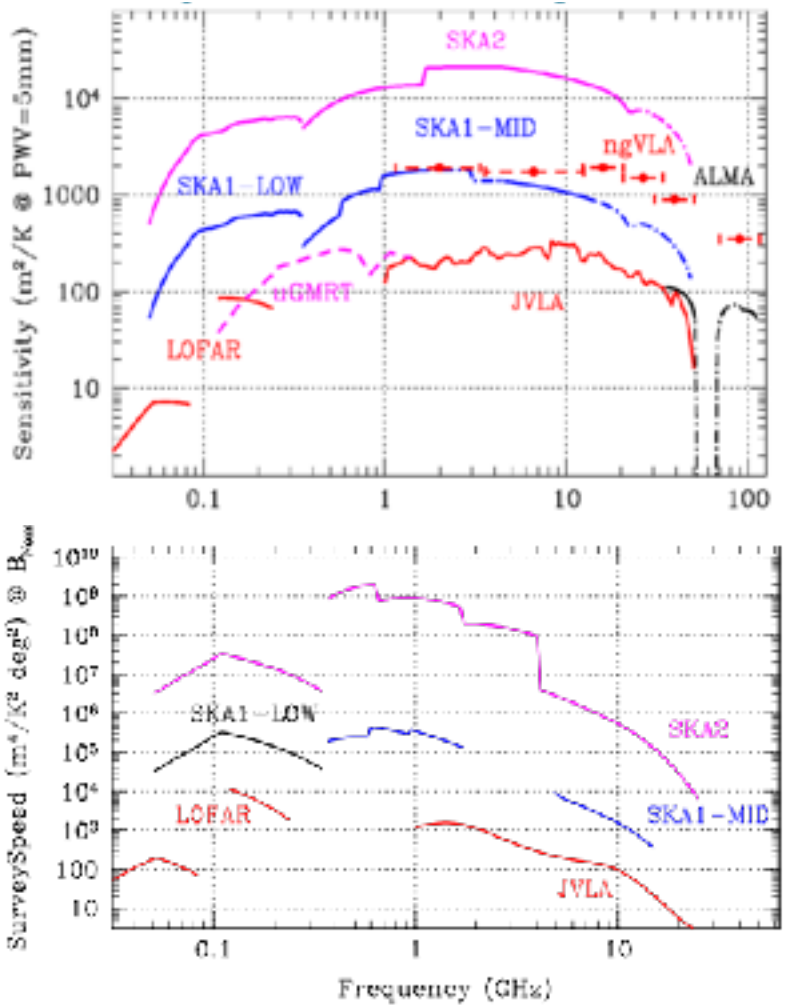
SKA1-LOW
Australia
50 MHz - 350 MHz

SKA1-MID
South Africa
350 MHz – 15.4 GHz

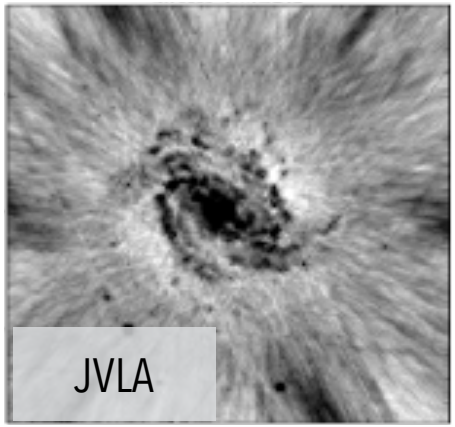
Why building the SKA?

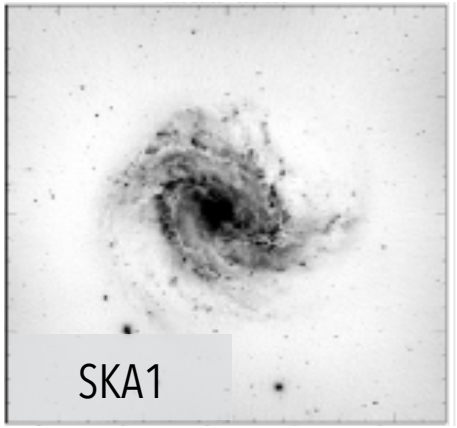




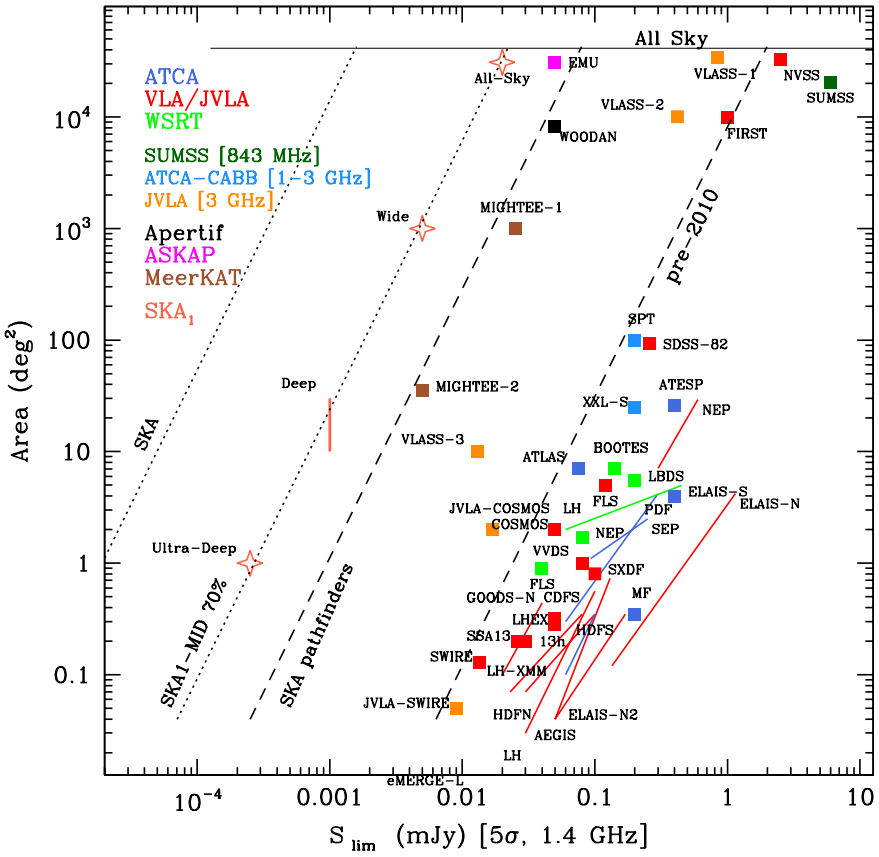


Why building the SKA?





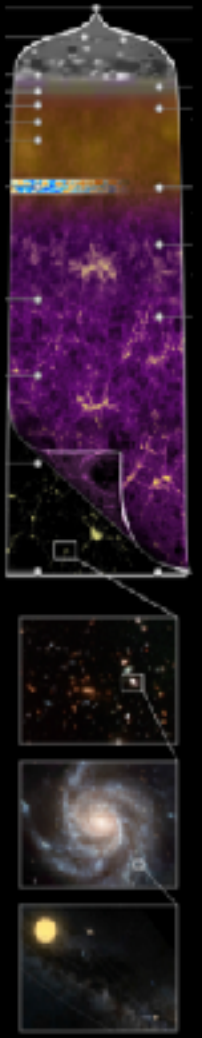
Prandoni & Seymour 2015



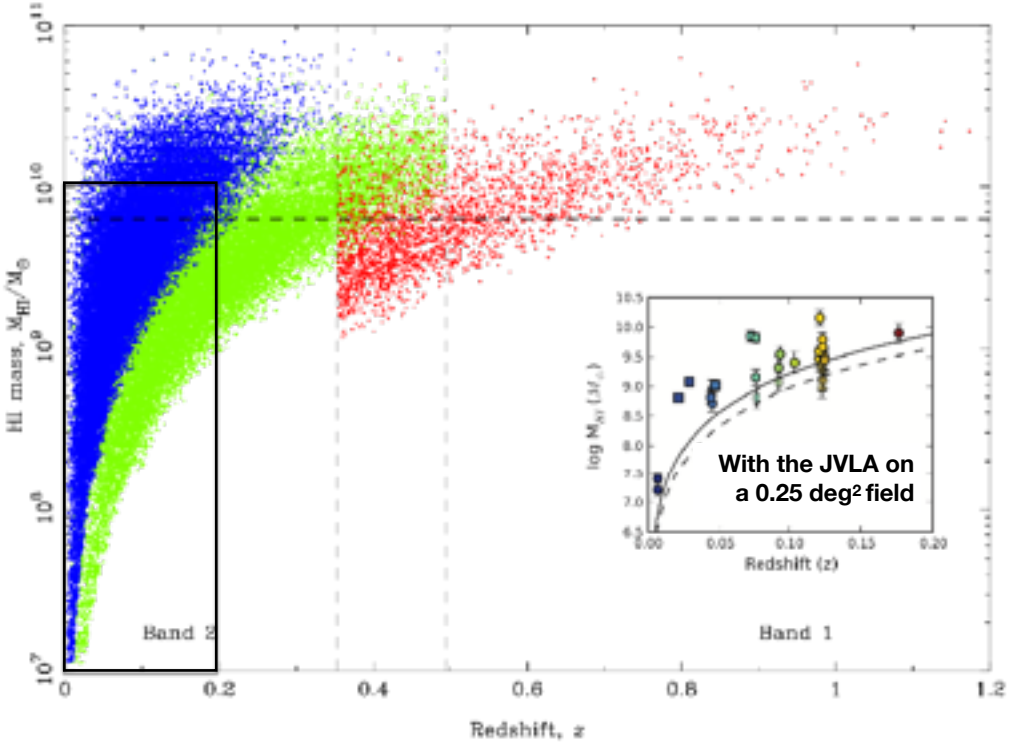
Exploring the cosmos with the SKA

Braun et al. 2015

- Cosmic dawn & Epoch of Reionisation
- Cosmology
- Galaxy evolution
- Cosmic magnetism
- Fundamental physics
- Transient sky
- Cradle of life
- Solar, Heliospheric and Ionospheric Physics



Galaxy evolution



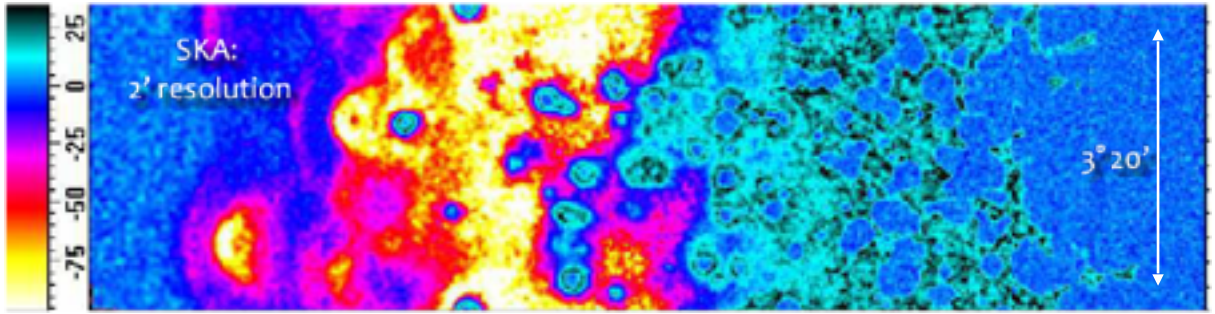
With SKA1

400 deg²
20 deg²
1 deg²

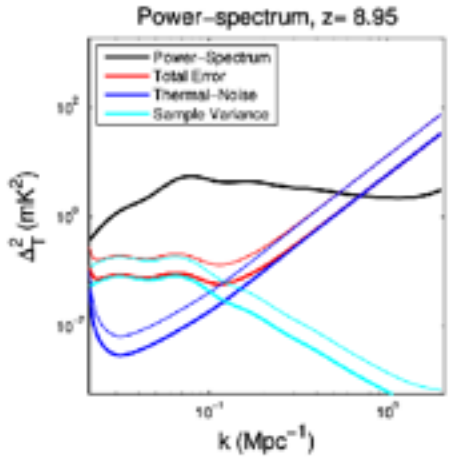
Survey	Ω deg²	Frequency[1] MHz	Resolution[2]	N	< z > (z_{max})	N_{HI} 10^{20} cm^{-2}
Galaxy/MS (absorption)	400	1418-1422	5″	4,000		
Extragalactic	1000	350-1050	2″	5,000	1(3)	
(absorption)	1000	200-350[3]	10″	?	4(6)	
Galaxy/MS	600	1418-1422	10″-1′			2
Medium wide	400	950-1420	10″	34,000	0.1 (0.3)	2
Medium deep	20	950-1420	5″	25,000	0.2 (0.5)	0.6
Deep	1	600-1050	2″	2,600	0.5 (1)	0.4
Targeted	..	1400-1420	7″-1′	50	0.002 (0.01)	0.5

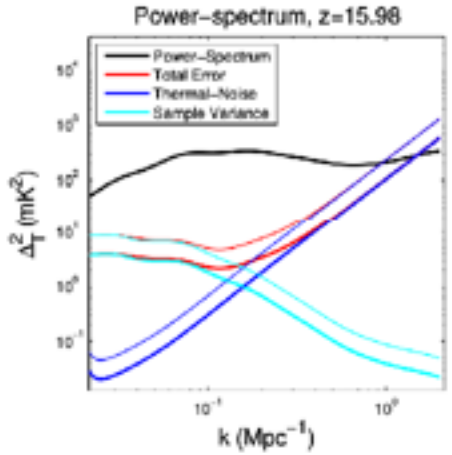
Staveley-Smith & Oosterloo 2015

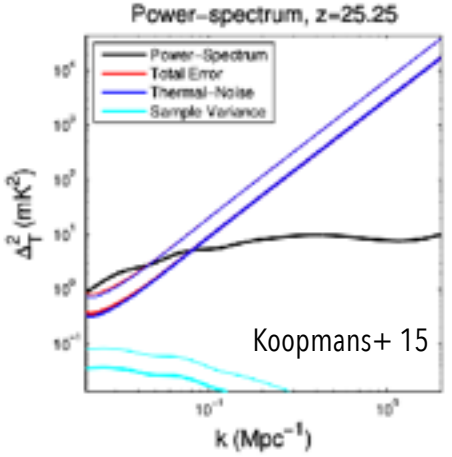
Epoch of Reionisation and Cosmic Dawn



Courtesy: B. Semelin

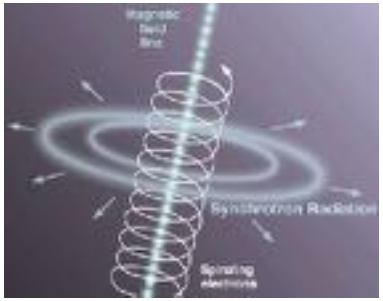


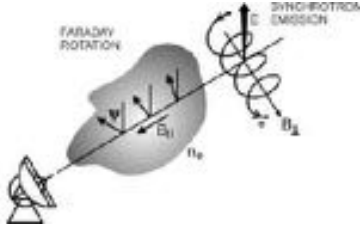




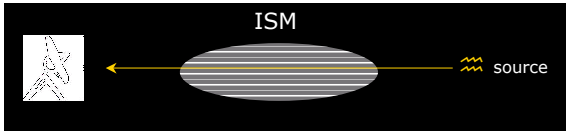
Cosmic magnetism

Total intensity and polarisation of synchrotron radiation

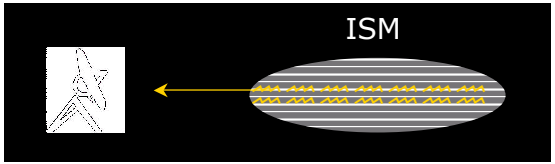




Faraday Rotation



Faraday Tomography



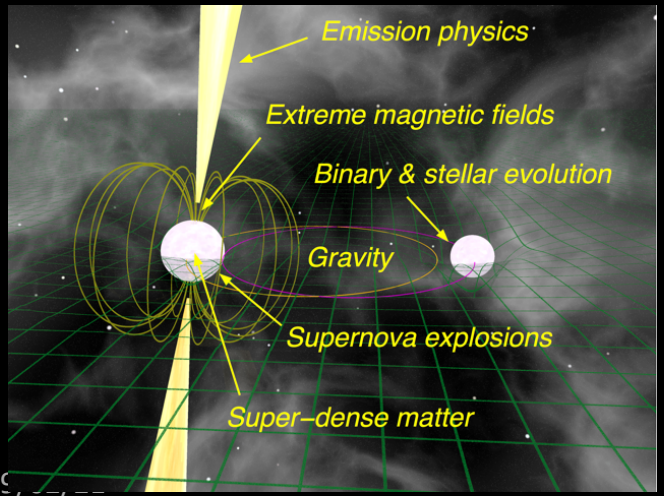
Credit: *Marijke Haverkorn*

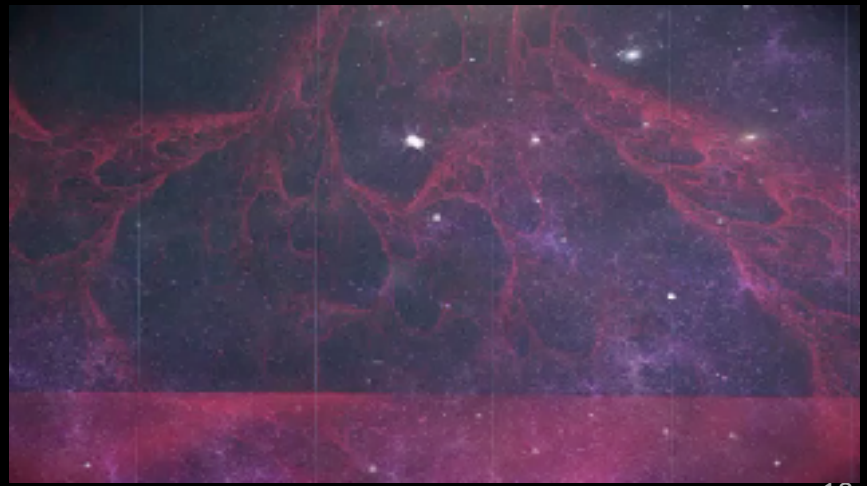
Pulsars

- Strongly self-gravitating compact bodies
- Very stable clocks

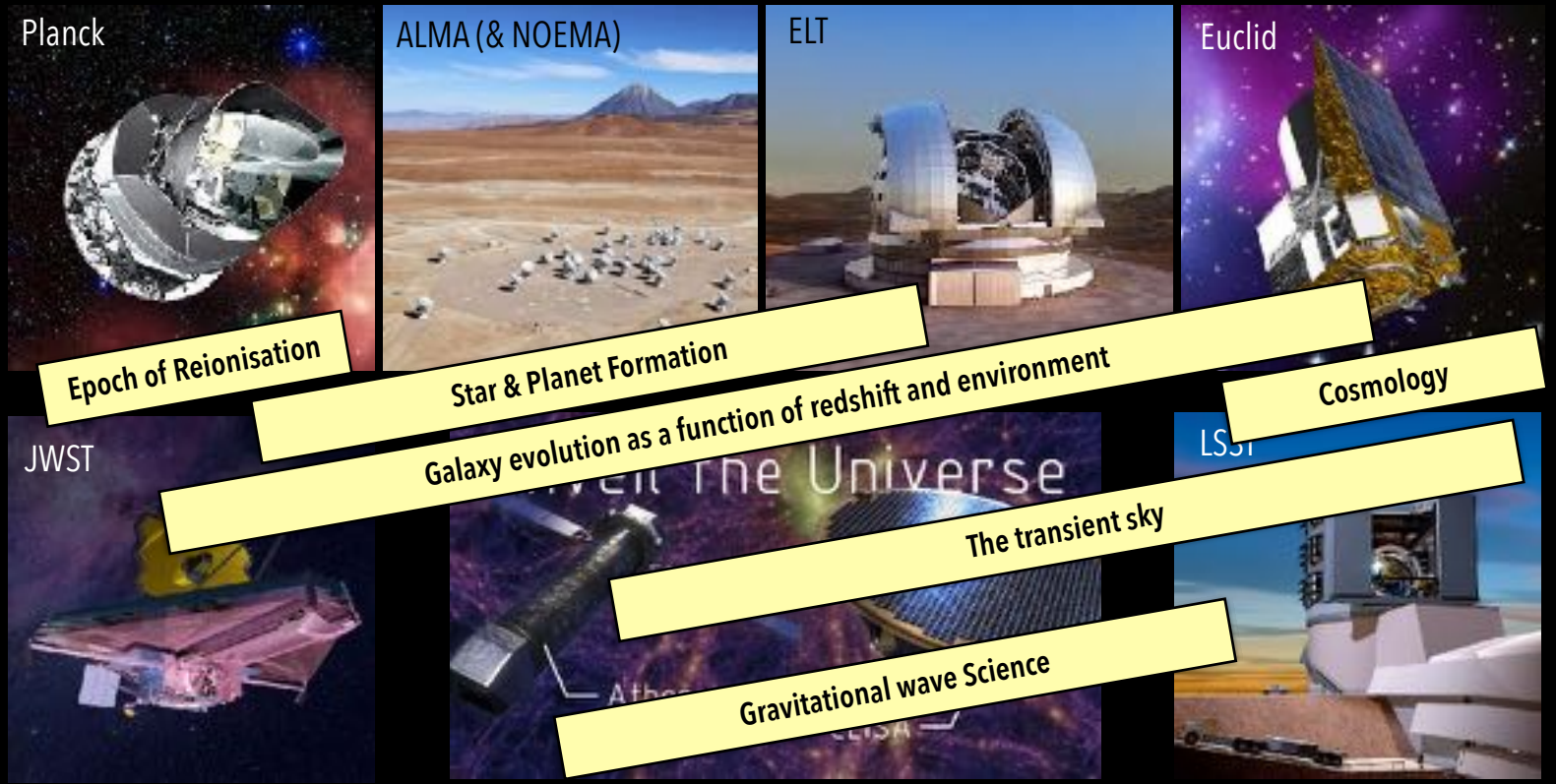
Test of gravitation theories

Astrophysics





Synergies


Planck
ALMA (& NOEMA)
ELT
Euclid
JWST
Epoch of Reionisation
Star & Planet Formation
Galaxy evolution as a function of redshift and environment
Cosmology
The transient sky
Gravitational wave Science

The French SKA White Book


French SKA White Book

The French community towards the Square Kilometre Array

Editor in Chief:
C. Ferrari

Editors:
G. Lagache, J.-M. Martin, B. Semelin — Cosmology and Extra-galactic astronomy
M. Alves, K. Ferrière, M.-A. Miville-Deschenes, L. Montier — Galactic Astronomy
E. Josselin, N. Vilmer, P. Zarka — Planets, Sun, Stars and Civilizations
S. Corbel, S. Vergani — Transient Universe
S. Lambert, G. Theureau — Fundamental Physics
S. Bosse, A. Ferrari, S. Gauffre — Technological Developments
G. Marquette — Industrial Perspectives and Solutions

arXiv:1712.06950

178 co-authors from

- 40 research institutes
- 6 private companies

The richest synergy chapter ever published about SKA vs. other projects, including:

- instruments covering the whole electromagnetic spectrum
- gravitational wave detectors

SKA-France milestones

October 16, 2017

First SKA-France Day

July 1st, 2016

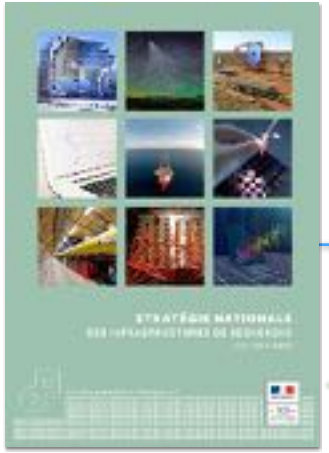
SKA-France Coordination

SKA-France milestones

February 1st, 2018

Kick-off meeting of Maison SKA-France

SKA-France milestones



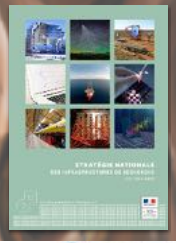
Mai 17, 2018

MESRI publishes the French Large Research Infrastructure Roadmap

SKA-France milestones

July 12, 2018

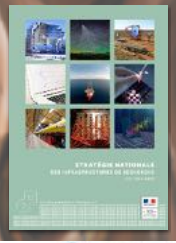
CNRS approved as new member of SKAO by the SKA Board of Directors



SKA-France milestones

November 15, 2019

Two new academic partners of Maison SKA-France



The French Ministry of Higher Education, Research and Innovation has announced that France is now engaged in the process of applying for membership in SKA Observatory

MINISTÈRE
DE L'ENSEIGNEMENT
SUPÉRIEUR,
DE LA RECHERCHE
ET DE L'INNOVATION

MINISTÈRE | STRATÉGIE | ENSEIGNEMENT SUPÉRIEUR | RECHERCHE | INNOVATION | EUROPE ET INTERNATIONAL | RESSOURCES HUMAINES

Accueil > Recherche > Domaines de la recherche > Environnement planète, univers

ENVIRONNEMENT, PLANÈTE, UNIVERS

La France exprime le souhait de devenir membre de SKA Observatory (SKAO)

infrastructure de recherche

A l'occasion de la première réunion du Conseil de SKA Observatory (SKAO) qui s'est déroulée les 3 et 4 février 2021, la France a exprimé le souhait de devenir membre de cette organisation intergouvernementale qui assurera la construction puis l'exploitation de ce qui sera le plus grand instrument de radioastronomie jamais réalisé.

ACTUALITÉ

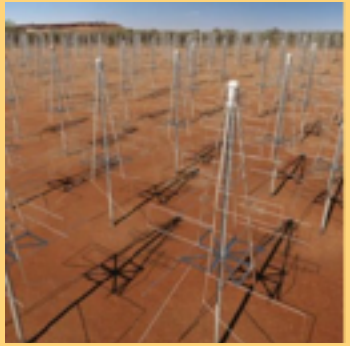
› Infrastructures de recherche : tous les événements

CONTACT PRESSE

Ministère de l'Enseignement supérieur, de la Recherche et de l'Innovation
06 65 65 84 34

Technology

SKA1-MID



SKA1-LOW

8.8 Tb/s

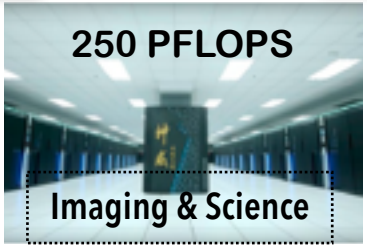
~2 Pb/s

7.2 Tb/s

Pulsar search & Correlation

KALRAY

2 x 5 Tb/s



350 PB/telescope/yr
(could be a lot, lot, lot more)

SKA contribution to a knowledge society

- SKA offers challenge and opportunities in terms of energy needs:
  - Reduction of the environmental impact associated with energy consumption of computing centre
  - Broader driver for the collaboration between Africa and Europe in the development of carbon-free energy system
- One of the "big science" Big Data projects driving the development of:
  - Open Science practices with much wider impact
  - Artificial Intelligence / Machine Learning-optimized exascale platforms
  - Networking and communication
- A lively collaboration between academia, society, research infrastructures and industry:
  - Acquired expertise in critical elements of the innovation sector (electricity supply, connectivity, IT, …)
  - Adaptability and capacity to produce novel solutions in emerging challenges

SKA contribution to a knowledge society

Open Science

ESCAPE

EUROPEAN OPEN SCIENCE CLOUD

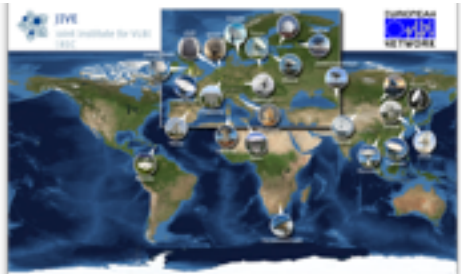
Findable Accessible Interoperable Reusable

Human capital development

DARA

DARA BIG DATA

DOPPLER




SKA-LOW


SKA-MID


Initial signatories of the SKA Observatory Convention


Human Capital Programmes