

IAA-CSIC activities to develop a SKA Regional Centre Prototype

*Susana Sánchez Expósito, Lourdes Verdes-Montenegro, Julián Garrido, Javier Moldón,
Sebastián Luna, Laura Darriba - (IAA-CSIC)*

SKA is a project to build a radio-interferometer capable of making revolutionary contributions to Astrophysics, Astrobiology, and Fundamental Physics and considered the Big Data machine of the 21st century. **The high data-rate and complexity of SKA will necessarily transform how scientists access, analyse and share data from observations.**

A network of SKA Regional Centres (**SRCs**) will be established to provide access for an international community to SKA data as well as the analysis tools and the processing power necessary to fully exploit their science potential. **The SRCs will hence play a key role in supporting the community for a successful scientific exploitation of SKA.**

IAA-CSIC is developing a prototype SRC (with support of its Severo Ochoa program), making a special effort to address the challenge of **extracting scientific knowledge from SKA data in a reproducible way, according to the FAIR principles.**

The Square Kilometre Array

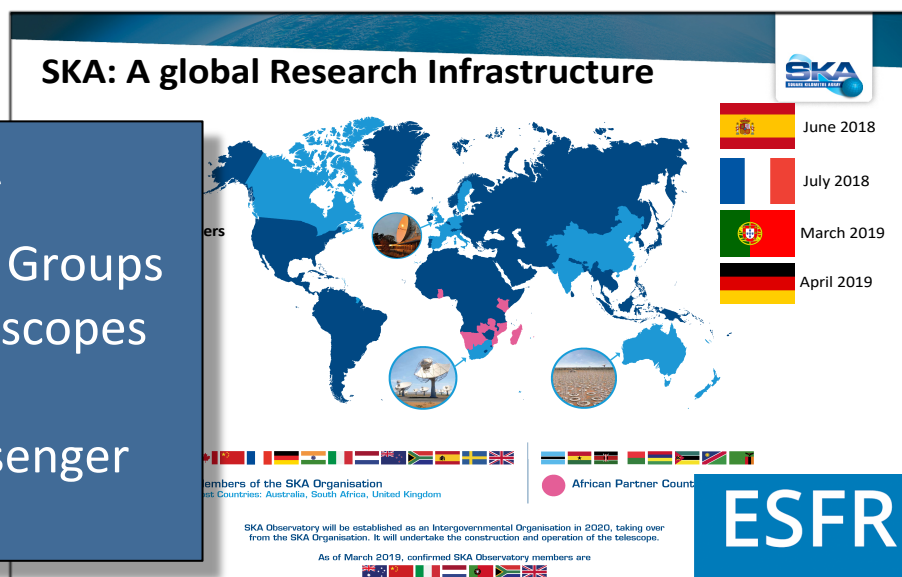
Open key questions in Astrophysics, Astrobiology and Fundamental Physics

- Formation of the 1st galaxies in a dark Universe dominated by atomic gas
- Evolution of the atomic gas and star formation till the current epoch
- Strong Field Tests of Gravity Using Pulsars and Black Holes
- Acceleration in the expansion of the Universe not understood yet
- Habitable extrasolar planets (proto-planetary disks, biomarkers)



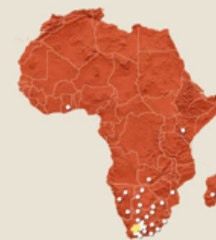
Scientific preparatory work for SKA

- Participation in Science Working Groups
- Use of pathfinder/precursor telescopes
- Preparation for commissioning
- Exploitation of multiλ/multimessenger synergies



Credits of map picture: SKA Organisation

SKA 1-mid = South Africa



350-14GHz.

Baselines 150 km

133+64 dishes

SKA 1-low = Australia



50-350 MHz.

Baselines 65 km

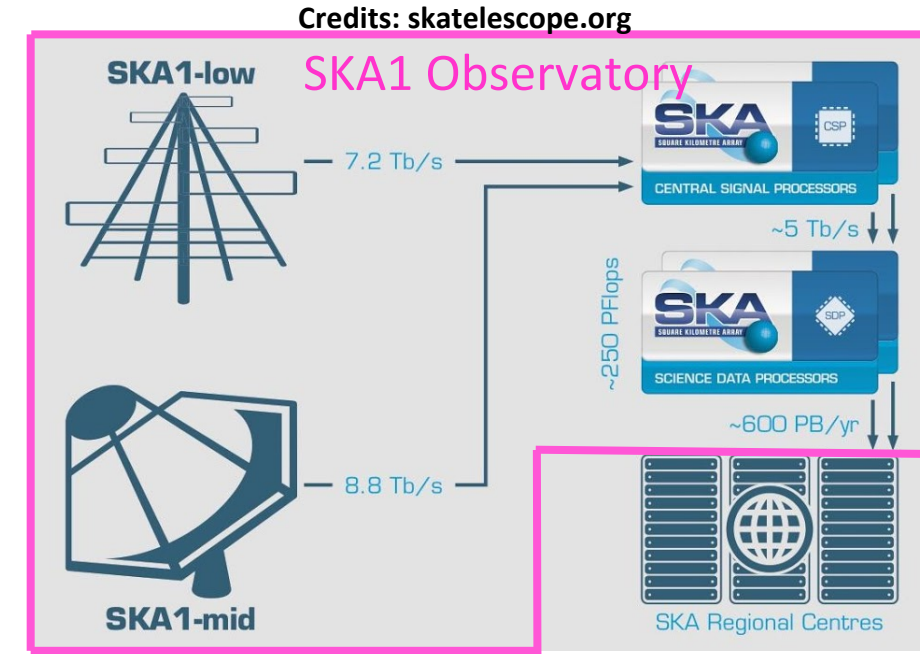
131.000 dipoles

- Construction approval: end 2020
- Phased assembly till ~2028

The SKA Regional Centres (SRCs)

The SKA Observatory will deliver **600 PetaBytes/year** of pre-processed data to the SRCs, where they will be taken to the final state required for science analysis. The SRCs are expected to provide ¹:

- Access to **SKA data** / storage capacity for **archiving**
- A place for **software tools for analysis**, modelling, visualisation/**computational capacity**
- All this through a **platform** that
 - is transparent and a **location agnostic interface** for users
 - enables **collaborative science**
- **User support**, training the new generation of radioastronomers



The SKA Regional Centre Steering Committee (SRCSC) (2019-)



- L. Verdes-Montenegro designated by the Ministry as Spanish representative
- Formation of the 1st global network of Prototype SRCs

[1] SKAO TO SRC TECHNICAL INTERFACE DESCRIPTION. Dolensky et al. SKA-TEL-SKO-0001072

IAA-CSIC aim: FAIR and Open Science at the SRCs

Following the
Scientific Method!



INSTITUTO DE
ASTROFÍSICA DE
ANDALUCÍA



EXCELENCIA
SEVERO
OCHOA

Open Science represents an approach to research that is collaborative, transparent and accessible.

Open Science definition, European Commission, 2017, doi: 10.2777/75255

This approach is encouraging the development of new solutions to enhance knowledge sharing and collaboration and we can use them to address key aspects for the SKA community:

- Scientific Reproducibility (as for any scientific community) since the SRCs will constitute the core of SKA Science.
- Building an effective collaborative platform for a world-wide distributed community
- Handling (curating, sharing) extremely massive data
- Training astronomers
- Supporting multi-wavelength/messenger science

FAIR Principles (www.go-fair.org)

Findable: Data/codes have sufficient metadata and unique, persistent identifiers in a searchable database.

Accessible: Data/codes is stored in trusted/standard repository. Metadata and data can be understood by machines/people.

Interoperable: Metadata use a standard language, external connections to other data/resources are qualified.

Reusable: Data/codes have sufficient provenance information and clear licenses.

The IAA-CSIC SRC Prototype

Science Analysis Platform

- Development driven by requirements being gathered in F2F meetings with IAA members from both radio and non radio community
- Current hardware: a Cloud platform with 200 CPUs, 2.5 TB Memory, ~ 700 TB storage

User Support

- Advice on radiointerferometry data processing, SKA science, reproducible science, ...
- Started a training program: Open Science droplets (<https://droplets-spsrc.readthedocs.io/>)

Community Engagement

- Special effort on ensuring that the offered services match the actual needs of the community
- Encouraging synergies: e.g. 3 Parallel sessions organised in the RIA Workshop *Spain in SKA!* (June 2019)

Collaborations

- In partnership with national HPC facilities, building on top of and expanding previous collaborations, and international initiatives
- Members of the Open e-Science Spanish Network, coordinators of Red-SKA Network

TEAM: Coordinator – L. Verdes-M.; **Technical responsible** – S. Sánchez; **Open Science expert** – J. Garrido; **Radio-astronomer for user support** – J. Moldón ; **Sysadmin** – Sebastián Luna; **Data scientist** – Laura Darriba

Impact and prospects for the future

IMPACT

- SRCs are crucial to
 - achieve a maximal scientific return from the SKA,
 - allow our communities developing scientific and technical skills,
 - provide a collaborative framework that will enable the handling of massive data as well as scientific collaborations
- Successful proposals for telescope time will have to come with the necessary SRC resources
- SKA will be a game changer in the way we do science and SRCs will support astronomers to take this leap

PROSPECT FOR THE FUTURE of the Spanish (proto)SRC

- Be integrated in the First Global Prototype SRC Network
- Set-up of 1 of the 6 Working Groups of the SKA Regional Centre Steering Committee: “Archive/VO/FAIR” (chaired by L. Verdes-Montenegro)
- Partnership with national and international centres
- Expand to become a service for the whole Spanish SKA community (full SRC)