

04 October 2021

# The SKA Observatory

[from an Italian perspective]

Isabella Prandoni



THE THIRD NATIONAL WORKSHOP ON THE -SKA- PROJECT

ONLINE 4-8 OCTOBER 2021

THE ITALIAN ROUTE TO THE SKAO REVOLUTION

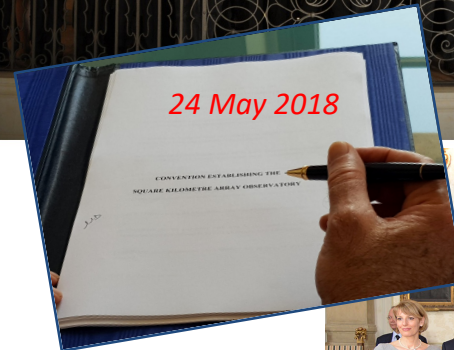
IN PARTNERSHIP WITH SKAO

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The banner features a background image of the SKA radio telescope array under construction against a blue sky with clouds. On the left, there is a close-up of a radio telescope dish. On the right, the INAF logo is visible, consisting of a blue circle and a diamond shape.

# SKAO - Milestones

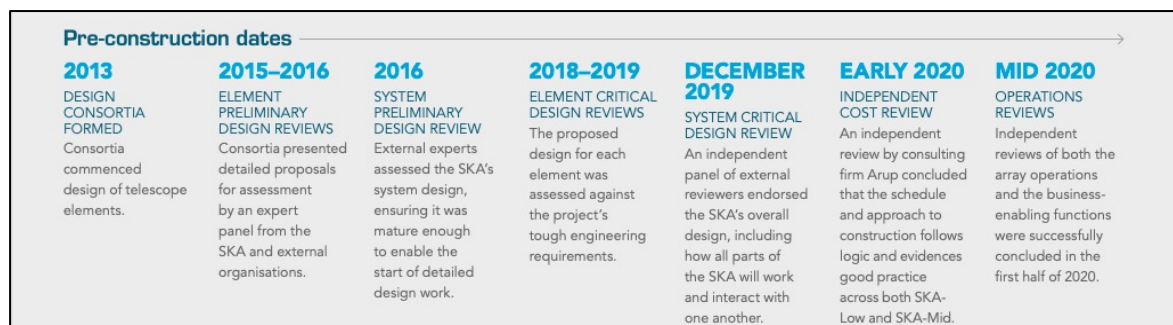
- **December 2011:** Establishment of SKA Organization (Italy founding member)
- **October 2015:** Negotiations start for establishment of an IGO (under Italy coordination)
- **24 May 2018:** Italy first country initialling the IGO convention
- **12 March 2019:** IGO signing ceremony – Rome
- **2019 - MAECI funds the SKA**
- **5 February 2020:** Italy second country ratifying the IGO convention
- **15 January 2021:** SKA Observatory enters into force (Italy among 6 founding members)
- **4 February 2021:** First SKAO Council meeting / SKAO Opening



# Italian Contribution: Technology

## Goal: Maximal return in terms of technology know-how and industrial contracts

- SKA Design Consortia (2013-2018) and Bridging phase (2019-2020)



## Italian Leaderships:

- **LFAA:** antenna & receiver chain design → **Tier 1/2 Contractor** [PI J. Monari]
- **OMC:** GUIs, TANGO framework services & LMC systems, SKA Pulsar Search Engine & CSP pulsar processing prototypes → **Tier 2 Contractor** [PI M. Dolci]
- **LMC@MeerKAT+** (based on LMC-Dish leadership) [PI C. Trigilio]
- **AIP:** PAF technology (integrated receivers and digital beam forming) [PI A. Navarrini]

### SKA design consortia

#### COMPONENTS

- Assembly, Integration and Verification
- Central Signal Processor
- Dish
- Infrastructure South Africa

**Will hear more later!**

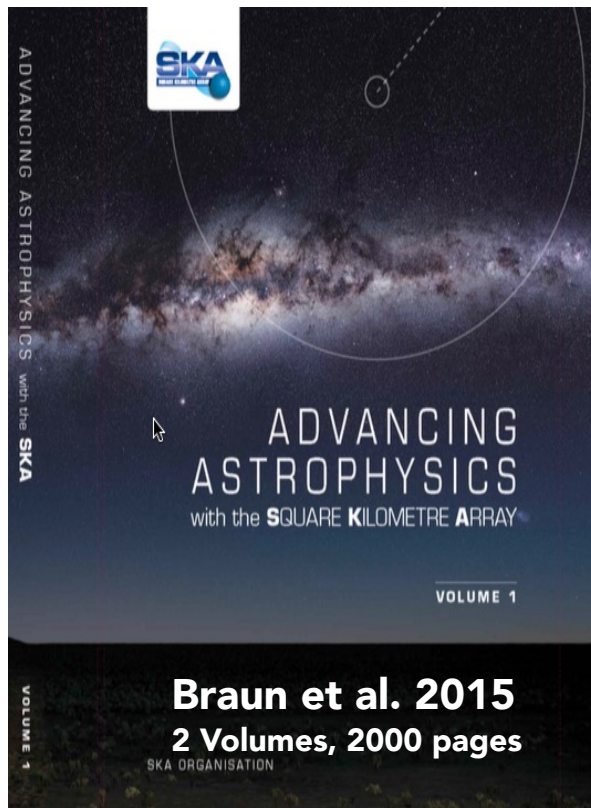
SKA-LOW Prototype station  
Antenna design SKALA 4.1AL



# Italian Contribution: Science

## Goal: maximal scientific return in the exploitation of SKA

- Italian SKA White Book (2014): >80 IT co-authors
- SKA Science Book 2015 - 135 chapters: **56 with IT co-authors** (41%) - **20 with IT first authors** (15%)

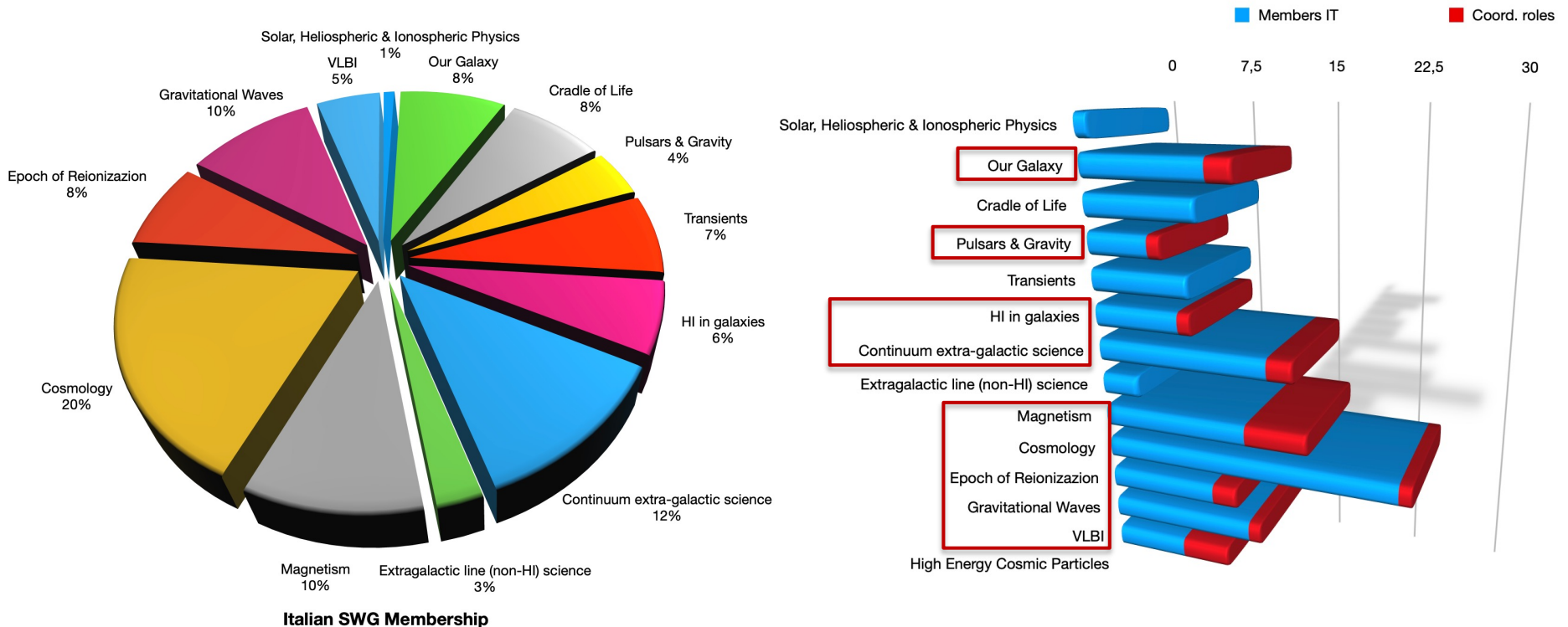




# Italian Contribution: Science

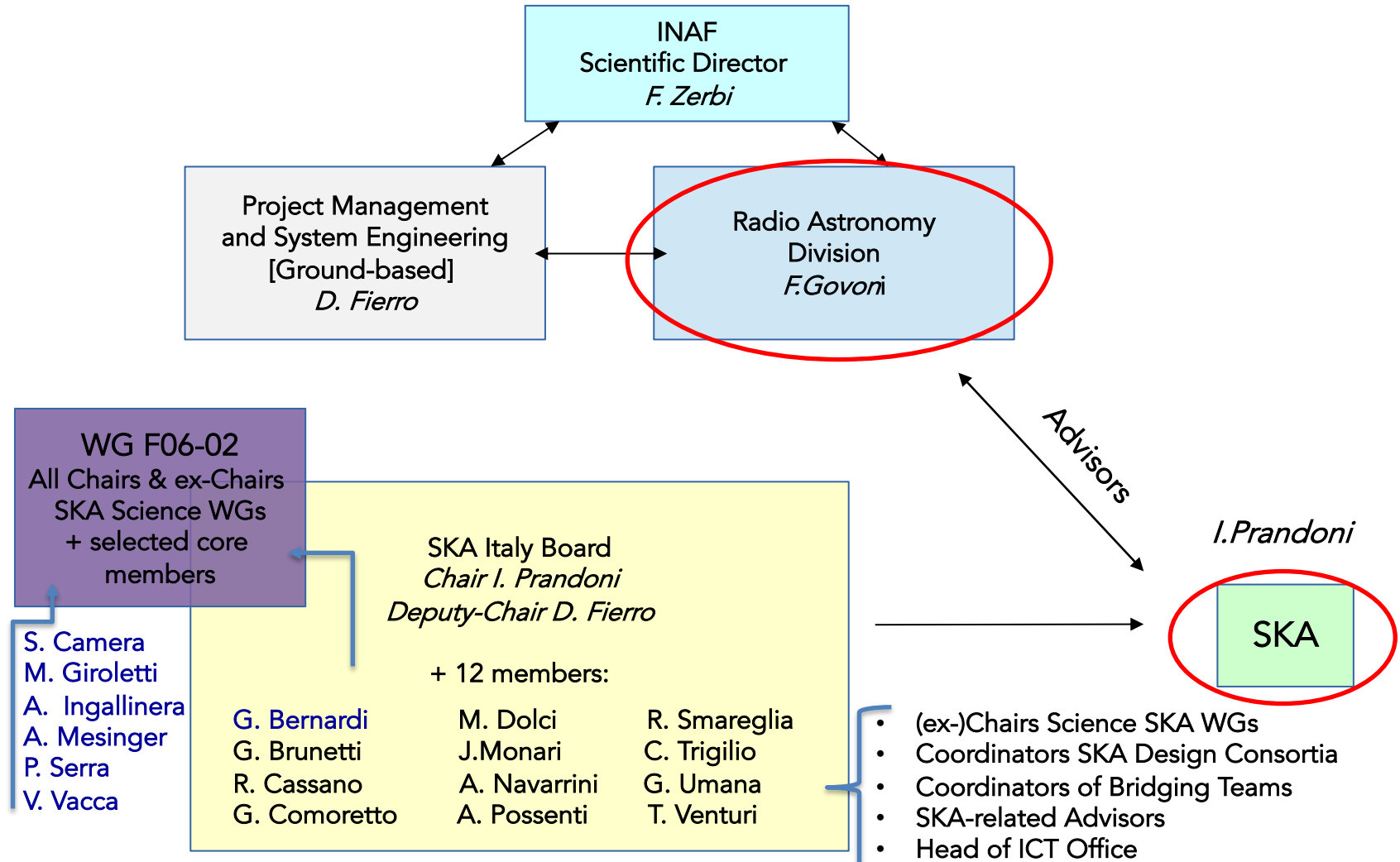
## Goal: maximal scientific return in the exploitation of SKA

- 14 SKA Science Working Groups: **93 IT Members** (9%) in 13 SWG - **6 Chairs** - **19 IT with Coordination Roles in 9 SWG** – 15 INAF structures + 14 IT Universities (overall 7 FTE/yr 2021-2023)



**Rich and diverse ongoing scientific activities (see scientific sessions)**

# SKA-Italy: Organization of UTG-II





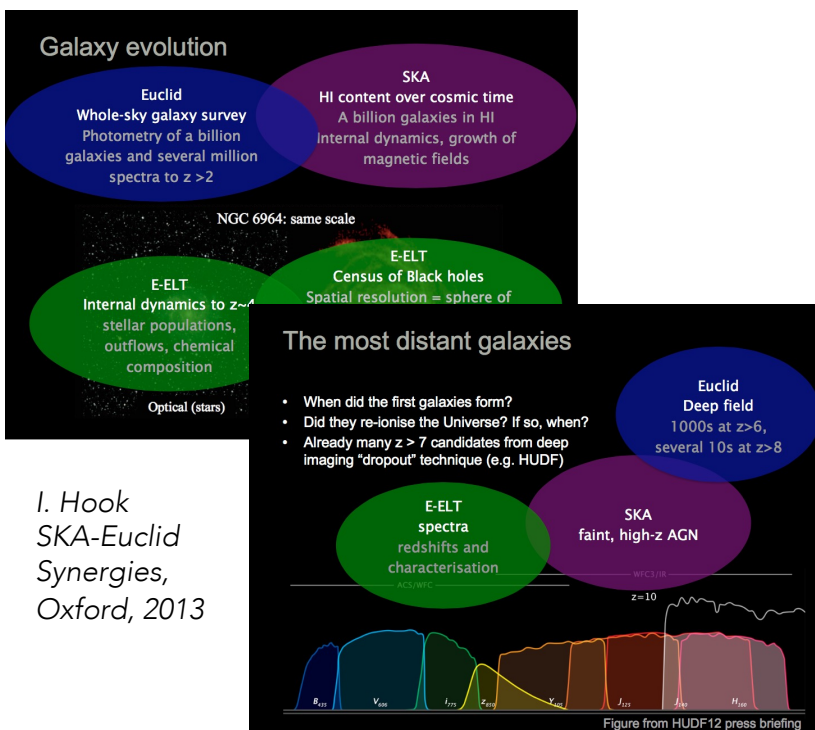




# SKA-Italy Roadmap: Synergies

## Goal: maximal scientific return in the exploitation of SKA

- Exploit synergies with other facilities: Italy strongly involved in next generation multi-wavelength facilities

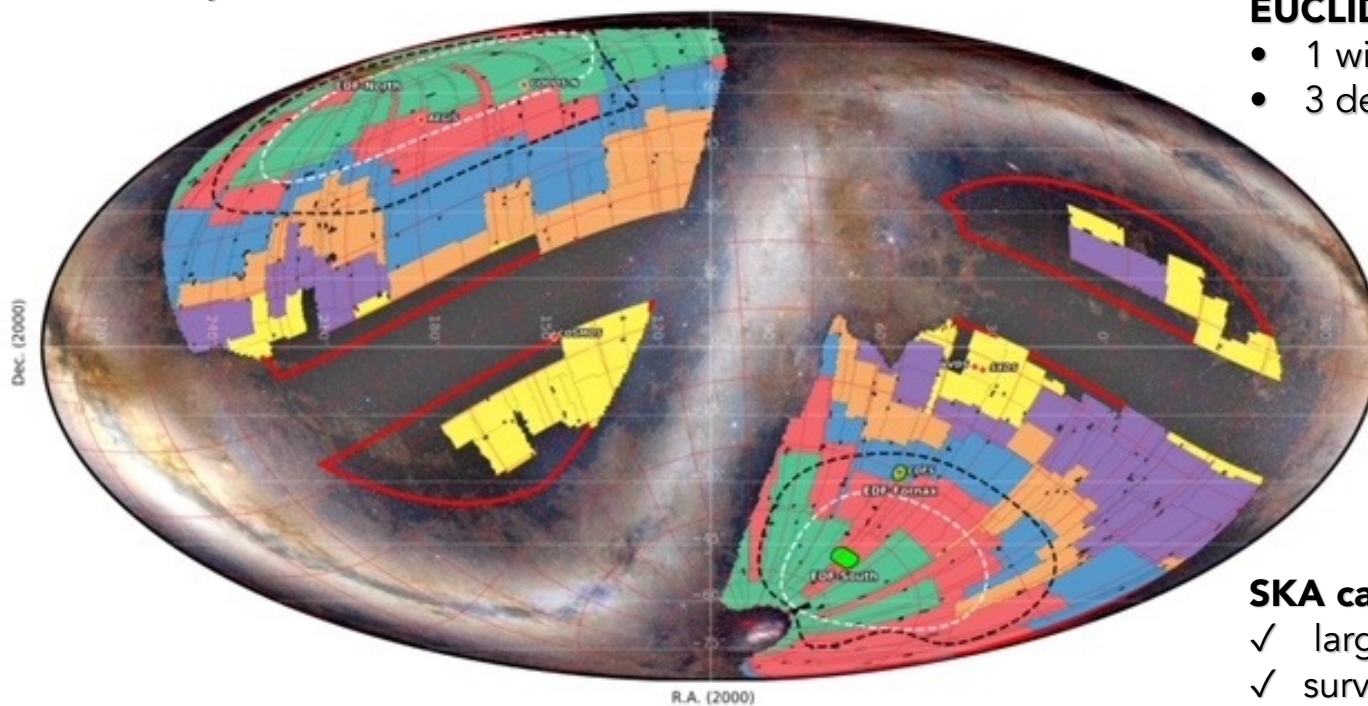


I. Hook  
 SKA-Euclid  
 Synergies,  
 Oxford, 2013

SKA Science	Telescopes							
	ALMA	JWST	ELT	LSST	Euclid	Athena	CTA	LIGO/VIRGO
Sun & Solar System								
Our Galaxy								
Cradle of Life								
Pulsars & Gravity								
Transients & Multi-Messenger								
Galaxy formation and Evolution								
Cosmic Magnetism								
Cosmology								
Epoch of Reionization								
High Energy Cosmic Particles								

# Euclid & SKA working together

Courtesy R. Scaramella



## EUCLID will cover:

- 1 wide survey ~ 15,000 sq degs
- 3 deep fields ~ 50 sq degs

## SKA can see EUCLID:

- ✓ large fraction of the wide
- ✓ survey 2 deep fields ~ 30 sq degs

RSD 2021a ECTile realization of a Euclid Wide Survey within the 17 Kdeg.<sup>2</sup> Rol : 14,853 deg.<sup>2</sup> over 6 years in 364 patches

Euclid Wide Survey Region of Interest (Rol) : 17 Kdeg.<sup>2</sup> compliant with a 15 Kdeg.<sup>2</sup> survey

Best 2600 deg.<sup>2</sup> (black) and 1300 deg.<sup>2</sup> (white) SNR areas per galactic cap

Euclid Deep Fields (EDF, from north to south): 10+10+23 deg.<sup>2</sup>

Euclid Wide Survey chronology (2.5Kdeg.<sup>2</sup>/yr)



Background image: Euclid Consortium / Planck Collaboration / A. Mellinger



- Coordinated observations / sharing of data
- Sharing of simulation / data analysis tools
- Scientific benefits form combined analysis (e.g cosmology)

# SKAO - Next Milestones

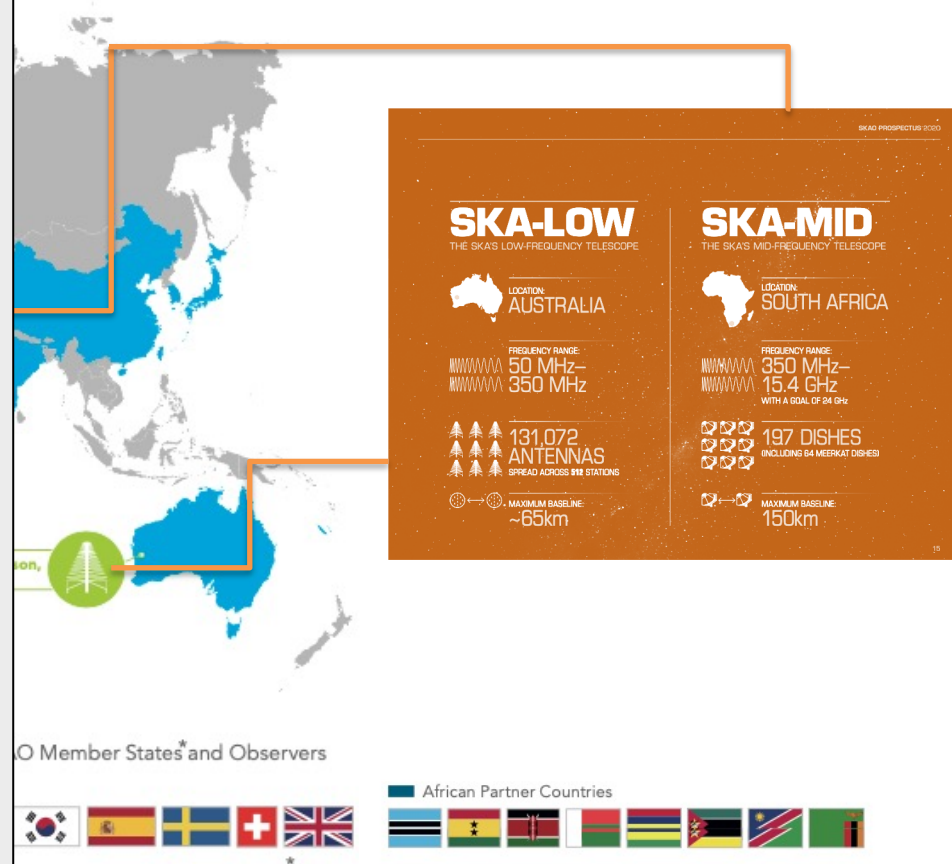
## Key project milestones

	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-dish array	FEBRUARY 2024	MARCH 2024
Array Assembly 1 finish (AA1) SKA-Low = 18-station array SKA-Mid = 8-dish array	FEBRUARY 2025	FEBRUARY 2025
Array Assembly 2 finish (AA2) SKA-Low = 64-station array SKA-Mid = 64-dish array, baselines mostly <20km	FEBRUARY 2026	DECEMBER 2025
Array Assembly 3 finish (AA3) SKA-Low = 256-station array, including long baselines SKA-Mid = 133-dish 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
Operations Readiness Review (ORR)	JANUARY 2028	DECEMBER 2027
End of construction	JULY 2029	JULY 2029

SV Call

KSP Call

PI Call



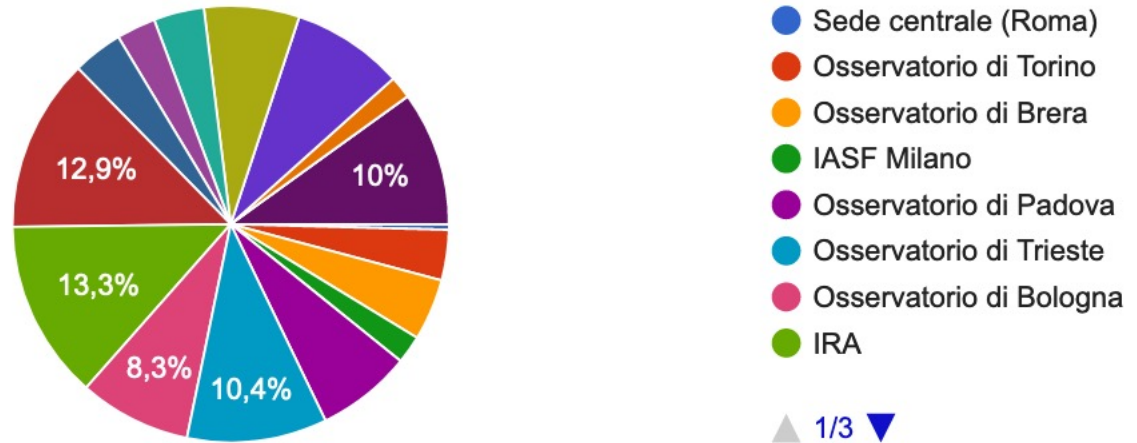
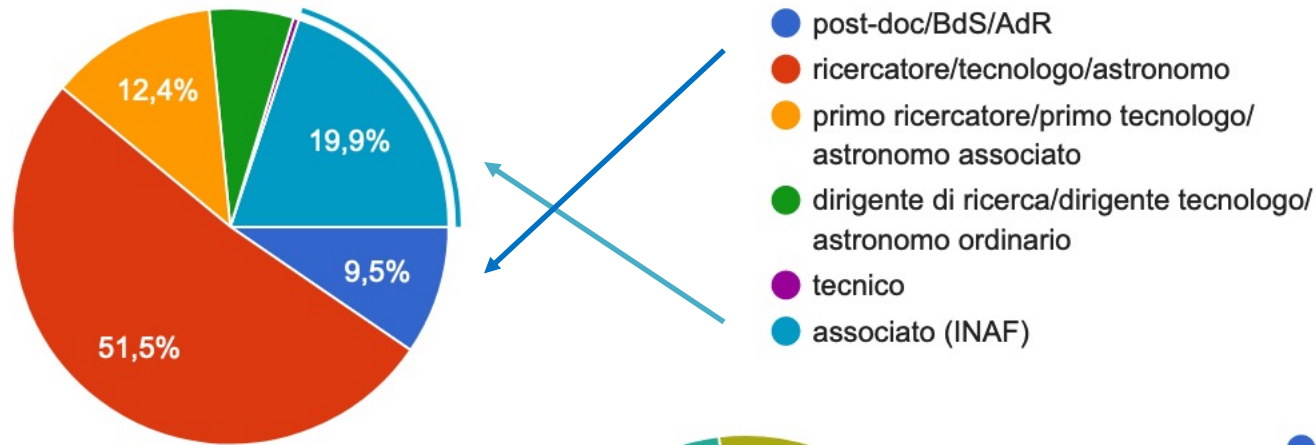
- Until now support mostly focused on design / prototyping activities in view of construction
- next 5-10 years are critical to prepare for SKAO science exploitation





# Questionnaire

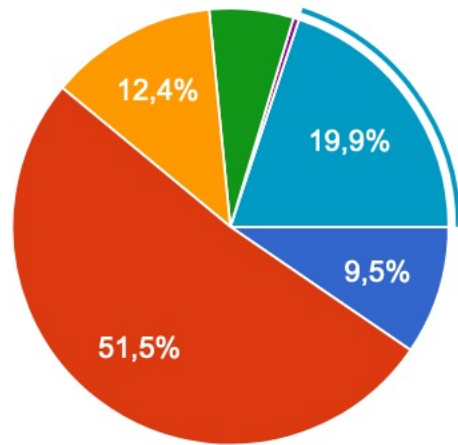
**June 2021: 241 Answers** (43% of researchers in RSNs)





# Questionnaire

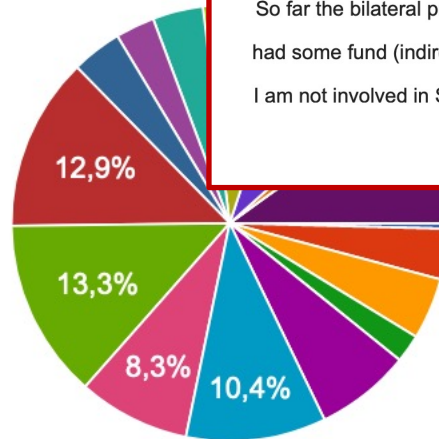
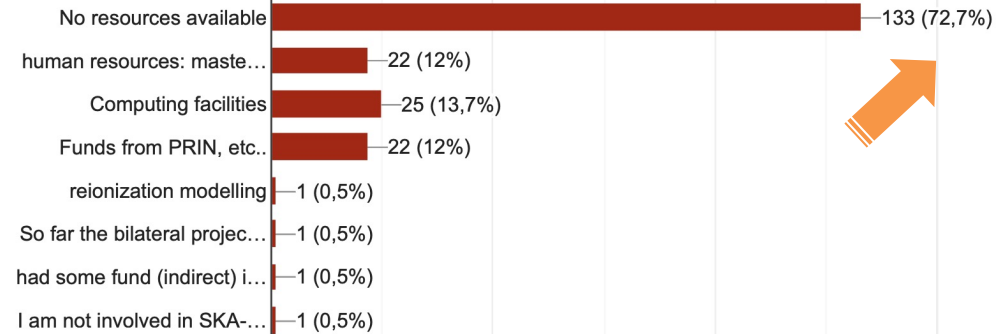
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● post-doc/BdS/AdR

Do you have dedicated resources for your SKA-related activity?

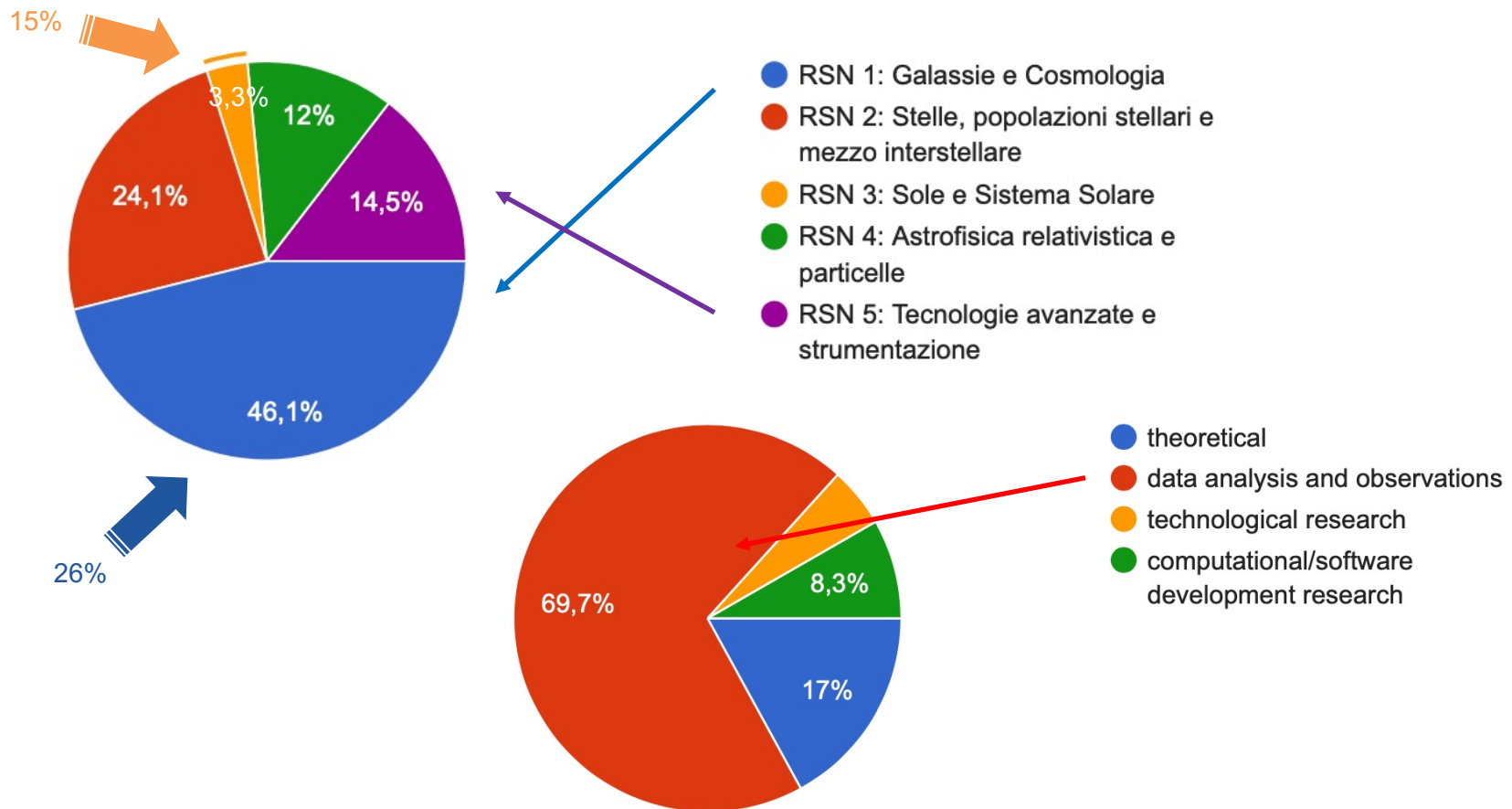
183 risposte



- Osservatorio di Padova
- Osservatorio di Trieste
- Osservatorio di Bologna
- IRA
- ▲ 1/3 ▼

# Questionnaire

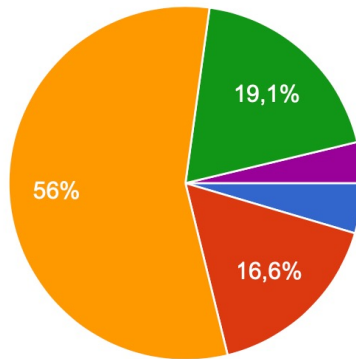
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# Questionnaire

Do you believe your research can benefit from observations with the SKA observatory?

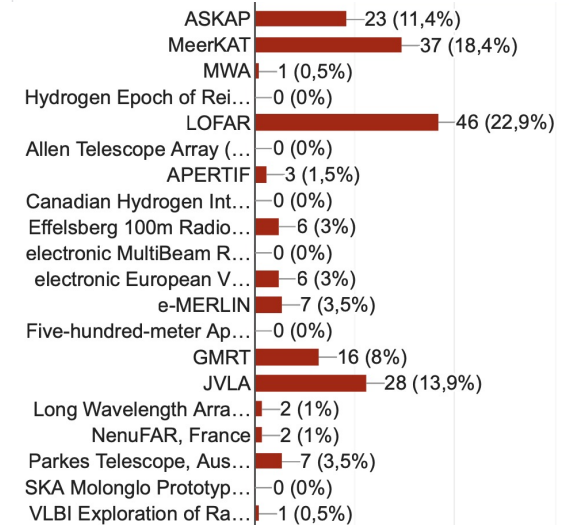
241 risposte



- Yes, SKA-LOW (i.e. the array operating at low radio frequencies)
- Yes, SKA-MID (i.e. the array operating at intermediate radio frequencies)
- Both SKA-LOW and SKA-MID
- Maybe
- No



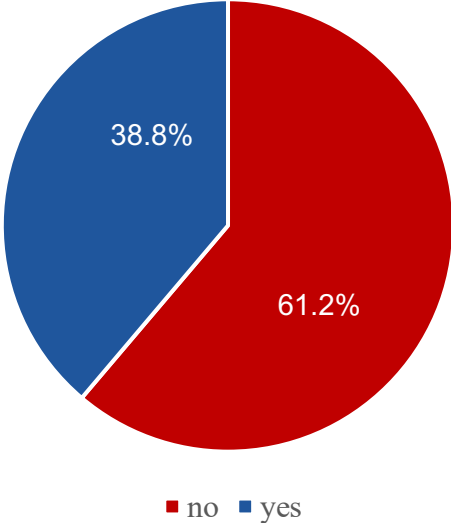
## Involvement in Pathfinders/Precursors



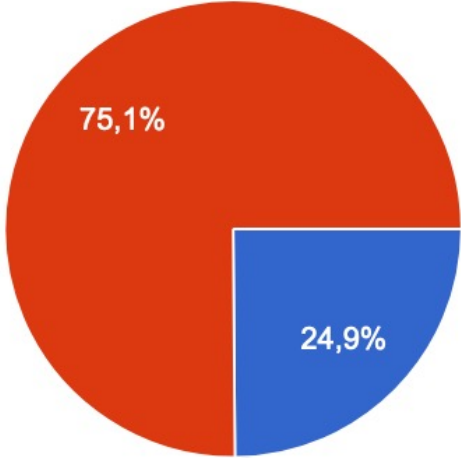
# Questionnaire

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**Pathfinders/Precursor Involvement**



**SKA SWG Involvement**



# Summary

## Strengths

- Recognized leaderships in SKA technology (SKA Tier 1 and Tier 2 contracts / MeerKAT+ / LOFAR 2.0)
- Recognized leadership in SKA science (SWG chairs/coordination roles)
- Official involvement in both SKA MID and SKA LOW precursors (strong interests in both SKA MID and SKA LOW)

## Opportunities

- Strong involvement in a number of other next-generation facilities (CTA/Euclid/Athena/LIGO/VIRGO, etc.)
- Strong expertise in data analysis/observations (radio interferometry) & computational research

## Weaknesses

- Need to increase involvement in pathfinder/precursor projects
- Need to increase involvement in SKA SWGs
- Need to build SKA generation (too few students/postdoc involved)

- Maintain and possibly increase scientific visibility of Italian community
- Support over the years national teams able to get leadership roles in SKA KSPs (scientific and data analysis expertise)

- Exploit synergies to widen involvement & expertise
- Build on data/computational expertise to develop Italian SKA Data Center

- Definition of SKA Key Science Projects (KSP)
- Development of SKA-related science leaderships & SKA-specific data analysis skills
- Formation of international KSP teams and leaderships

## Funding

- IGO IT share: 120 Meu (6% share)
  - SKA construction & running costs
- DM450 (SKA/CTA)
  - support SKA-related activities, incl. science

Support to science to 2030

- at least 10% of IT IGO share (1-1.5 Meu / year)

SKA in numbers

€1.282  
BILLION  
CONSTRUCTION  
COST (2020 €)

€0.704  
BILLION  
FIRST 10 YEARS  
OF OPERATIONS  
COST (2020 €)



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**Reminder:**  
**Plenary Discussion on Friday 8th October**

**Thanks!**

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