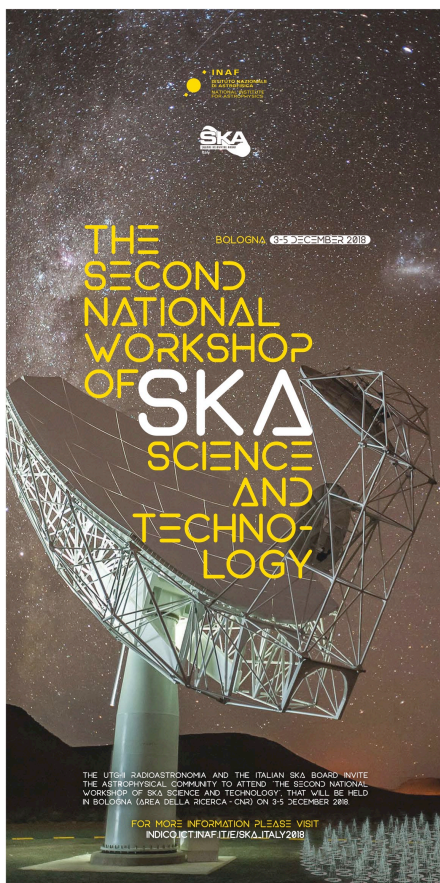


# The II National Workshop of SKA Science and Technology

## Summary & Immediate Actions

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(on behalf of the Italian SKA Coordination Board)



The *II National Workshop of SKA Science and Technology* (Bologna, 3-5 December 2018), was organized by the *Italian SKA Coordination Board*<sup>1</sup>, as part of the initiatives taken by INAF UTG-II. Its main scopes were:

- a) to inform the wider-community on the current status of the SKA project;
- b) to get an overall update of scientific and technological SKA-related activities in Italy, and
- c) to provide an opportunity for a general informal discussion of the SKA project from an Italian perspective.

The workshop was very successful with 178 registered participants<sup>2</sup>, and a very lively discussion session. It is worth to highlight that a good number of industrial partners<sup>3</sup> attended the conference (some with boots and posters), a clear sign of the strong industrial interest in the SKA project.

A comprehensive review was given of the ongoing SKA-related R&D activities in the framework of the *SKA Design Consortia*<sup>4</sup>. The (just starting) post-*Consortia* phase (called *Bridging*) was also presented, including the recent initiative towards the SKA-LOW, where INAF is playing a leading role.

The SKA poses unprecedented requirements in terms of super-computing and big data. A session was dedicated to present and discuss the Italian activities in the framework of the EU-funded AENEAS<sup>5</sup> and EUROEXA<sup>6</sup> projects, as well as the Italian involvement in the *SKA Data Challenge*<sup>7</sup> initiative. All important steps towards the establishment of *SKA Regional Data Centers*.

<sup>1</sup> This *Board*, first nominated on December 21<sup>st</sup>, 2017 by the Head of INAF-UTG-II, was further integrated on November 16<sup>th</sup>, 2018. Current members are I. Prandoni (chair), D. Fierro (deputy-chair), G. Bernardi, G. Brunetti, R. Cassano, G. Comoretto, M. Dolci, J. Monari, A. Navarrini, A. Possenti, R. Smareglia, C. Trigilio, G. Umama, T. Venturi.

<sup>2</sup> The list of participants is available at <https://indico.ict.inaf.it/event/685/registrations/participants>.

<sup>3</sup> CAEN SpA, Celte, Diamond SA, EES, EIE Group Srl, ELETTRA, Leonardo ETN SpA, OPTEL SNC Italy, Optoplast, Protec, Società Aerospaziale Mediterranea (SAM), Sanitas, Tecnotel.

<sup>4</sup> INAF is actively involved in five Consortia: *Telescope Manager* (TM), *Dish*, *Low Frequency Aperture Arrays* (LFAA), *Central Signal Processor* (CSP), *Phased Array Feeds* (PAF). The latter is part of the *SKA Advanced Instrumentation Programme*.

<sup>5</sup> <https://www.aeneas2020.eu/>

<sup>6</sup> <https://euroexa.eu/>

<sup>7</sup> For more information see <https://www.skatelescope.org/news/ska-launches-science-data-challenge/>



**Figure 1**

**Top)** The SCORPIO field, observed by ASKAP at 900 MHz as part of the ASKAP Early Science Programme (field size  $5.4^{\circ} \times 1.3^{\circ}$ , center  $343.8^{\circ}$ ,  $-0.2^{\circ}$ ). This region of the Galactic Plane was observed in the framework of the all-sky Evolutionary Map of the Universe (EMU) survey (PI: R. Norris, CSIRO, Australia). The data reduction has been conducted under the responsibility of the observatory of Catania.

**Left)** The radio galaxy Fornax A (located in the Fornax galaxy cluster) observed at 1.4 GHz as part of the MeerKAT commissioning programme. These observations have been taken in preparation to the MeerKAT Fornax Survey (PI P. Serra, INAF, Italy). The data have been reduced using the MeerKAT pipeline installed at the Observatory of Cagliari.

**Right)** The galaxy cluster Abell 2255 observed at 150 MHz as part of the LOFAR Survey Key-Project (PI H. Röttgering, Leiden Obs., NL). The data have been reduced using the LOFAR pipeline installed at the Radioastronomy Institute (Bologna).

Many interesting scientific projects were presented, that fully exploit the unprecedented quality of the data delivered by SKA precursors and pathfinders (for a demonstration see Figure 1). A special session of the workshop was dedicated to investigate synergies between SKA and facilities working at other wavebands, as the exploitation of synergies will be an important part of SKA Science Key-Project definition. Special focus was given to those facilities that are of major interest for INAF. This

session was organized in collaboration with the Heads of INAF-UTG-I and UTG-III.

For more details we refer to the *Workshop* website<sup>8</sup>, where all contributions will be made available, as well as the minutes of the discussion.

The inputs gathered at the workshop will be considered by the Italian SKA Coordination Board in the preparation of a *Roadmap* document for INAF, currently under development. There are, however, a few issues emerged at the workshop, that, in our opinion, require timely actions. We would like to bring them to the attention of INAF with this document. We are keen to provide further details, upon request.

1. Italian contribution to SKA-LOW bridging

The main reason behind the recently started SKA-LOW bridging activities is the need to investigate the calibratability of the station reference design of log-periodic antennas. A mitigation solution would be the deployment of dipoles (Australian design) instead of log-periodic antennas (It/UK designs). While INAF should be ready to exploit *any* final architecture adopted, this would admittedly have a strong impact on the breadth of science that SKA-LOW can deliver, since dipoles can efficiently work only in the lower part of the frequency range allowed by log-periodic antennas. It is therefore strategic to have Italian experts in the calibration team, and enough man-power, to be able to fully evaluate the calibratability of log-periodic vs dipole antennas. Experts in these matters in Italy are a few, all keen to be involved, but need help for data acquisition and analysis. Man power dedicated to this activity should be hired in the next few months, since this work will start as soon as the deployment of the phase-1 stations will be completed (spring 2019). In order to attract experts from abroad, we think a TD position should be offered. Considering the need to closely interact with the INAF staff involved in the calibration task, we propose to advertise the position at Arcetri (first choice) or IRA-Bologna.

2. Actions towards mid-frequency precursors

A full exploitation of SKA precursors by the Italian community is strategic in preparation to SKA *Science Key-Projects*. SKA precursors represent a unique opportunity to strenghten the technical expertise of Italian researchers, and increase their international visibility in the years to come. This will likely increase their chances to play leadership roles in future SKA projects, including the SKA *Legacy Surveys*, that will be proposed by large international teams. Joining LOFAR has been an important step forward in this direction. The current efforts to facilitate LOFAR data processing in Italy, as well as the active involvement in the development and optimization of LOFAR pipelines, will likely play an important role in view of SKA-LOW surveys. Similar efforts should be done towards the two SKA-MID precursors (ASKAP and MeerKAT). At the workshop it was highlighted that several Italian groups are involved in ASKAP and MeerKAT legacy surveys, and that are actively contributing to data processing and pipeline development efforts. This high level of participation is encouraging, but a coordinated approach is essential to avoid duplication of efforts and to optimize the use of (the limited) resources. In addition it would guarantee data processing capability access and support to a wider community. The ASKAP and MeerKAT legacy surveys are starting now and this is the time when international teams are seeking resources (man power, storage and processing power). This is therefore a critical time for INAF to take action and better organize the Italian engagement in ASKAP and MeerKAT. As a first step, we think that a *Coordination Group*

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<sup>8</sup> <https://indico.ict.inaf.it/event/685/overview>

should be established (similarly to what done for LOFAR) to investigate the best way to proceed forwards. This group will be led by the UTG-II *Advisor* for mid-frequency precursors (G. Umana), and will include other relevant UTG-II *Advisors*. The *Group* will consider solutions that exploit as much as possible the existing expertise and man power in INAF (e.g. LOFAR, ALMA Regional Center, IA2, ICT).

### 3. Engagement of Industry

Several industrial partners have been involved in SKA-related R&D activities in the framework of SKA Design Consortia. In view of the establishment of the IGO and in view of SKA construction it is important to advertise SKA opportunities to industries more widely. This can be done through the organization of industrial days and/or other initiatives. Some of the industrial partners present at the meeting were strongly impressed by the ongoing lively discussions, and suggested to repeat similar workshops, encouraging as much as possible the participation of researchers and technical staff operating in industries (also as speakers). The shared feeling was that this approach would favor an early involvement of industries in engineering and system industrialization activities, in view of the forthcoming mass production. This will in turn facilitate the development of ad hoc expertise, building on past activities carried out in the framework of other related projects. To be effective, this has to be done well in advance with respect to coming tender calls. Considering that the SKA construction proposal is now planned to be ready sometimes in 2020, such initiatives should be planned very timely.