

Communication at the SKA Observatory and the role of Open Science in dissemination

Villaverde Aparicio, M.¹, Gallardo Jiménez, J.¹, Garrido Sánchez, J.¹,
Verdes-Montenegro Atalaya, L.¹, Sánchez Expósito, S.¹,

¹ Instituto de Astrofísica de Andalucía - CSIC

Abstract

The SKA Observatory (SKAO) is the intergovernmental organisation in charge of the construction and operation of two radio telescopes in Africa and Australia, which will be astronomical infrastructures of reference in the coming decades. The construction and operation of an infrastructure such as SKAO is a scientific and technological challenge as well as a communication challenge due to its major impact on society. In addition, the SKAO will help to change the way science is done and disseminated thanks to its commitment to Open Science, an initiative that aims to improve access to and re-use of scientific data and methods. Thanks to this commitment SKAO will benefit not only the areas where the telescopes are being built, but also globally. In this talk we review some of the communication initiatives currently being undertaken by SKAO and SKA-Spain, the initiative that coordinates the participation of Spain in SKA. We also explain how the Open Science principles adopted by the observatory will play an important role in its impact.

1 Introduction

The Square Kilometre Array Observatory (SKAO) is an intergovernmental organisation in charge of the construction and operation of two radio telescopes, currently under construction, located in Africa and Australia. Specifically, these telescopes will be two radio interferometers operating in different radio frequency ranges. In South Africa, the SKA-mid telescope, will work in the intermediate range of radio waves. At the end of its first phase of construction, it will have more than 197 antennas, with a separation of 150 km between the most distant antennas. To cover the low frequency range, the SKA-low telescope is being built in Western Australia. This telescope will have more than 131,000 dipole antennas, similar in concept to the terrestrial television antennas we have in our homes. These antennas will be grouped in 512 stations spread over a radius of about 65 km. Both radio telescopes will surpass current ones in sensitivity and accuracy and will generate an enormous amount of data that will be

processed in supercomputers and analysed in a global network of computing facilities, the SKA Regional Centres Net (SRCNet). For this reasons SKAO is a next-generation radio astronomy-driven Big Data facility that will allow to address some of the most important questions in the field of astrophysics, astrobiology and fundamental physics as, for example, the formation and evolution of galaxies, the study of pulsars, black holes and general relativity or the search for exoplanets and extraterrestrial life. Building this observatory is an international effort that involves 16 countries from the five continents and in which Spain participates. In 2018 Spain became a member of the SKA Organisation which was the predecessor organisation of the Observatory. In 2021 Spain was accepted as a member of the SKAO, being approved the accession of Spain to the observatory by the Council of Ministers in April 2023. Since then our country was a *de facto* member. Finally, in August 2024 the process was completed and Spain is full member since then. Since 2011 the participation of Spain in the SKA project is being coordinated at Instituto de Astrofísica de Andalucía (IAA-CSIC) by a multidisciplinary team working under the name SKA-Spain. The team has been in continuous contact with the community to stimulate and reinforce the Spanish participation in the project, resulting in 12 Spanish research centres and 12 Spanish companies participated in the design phase and currently 66 researchers from 18 research centres participate in the Observatory's Science working groups. In addition, there are also Spanish representatives on the board and various committees of the Observatory. SKA-Spain is also in charge of coordinate communication activities related to SKAO in our country.

2 Communication and Dissemination in SKAO.

The construction and operation of an infrastructure of the size and complexity of SKAO has a great impact, especially on the environment and the communities in the areas where it is being built [1, 2]. It also has a high economic cost. Therefore, it is essential to raise awareness of its importance among different audiences: political leaders; key stakeholders; interest groups such as (scientific community, inhabitants of the construction areas, ...); multipliers (media, disseminators, influencers, ...); and, of course, the general public. The SKAO's communication team leads and coordinates the global communication strategy in collaboration with partners in the 16 countries involved in the SKA project [3]. This collaboration is articulated through the SKA communication and dissemination network (SKACON), which has a steering committee with representatives from each country. Given the diversity of target audiences and the peculiarities of each country, multiple communication channels are used.

The main communication channels are the websites and social media of both SKAO and the national initiatives. They serve as channels to reach world-wide audiences and to spread various communication products, such as videos and publications. SKAO publish its own magazine, *Contact*, as well as, fact sheets, and documents for key stakeholders. One good example of this last kind of publications is the SKAO science book which is currently being updated. In addition to its own publications, SKAO also publishes press releases and articles in public and specialised media, written by members of the observatory itself or by members of the international collaboration.

The collaboration between SKAO and its partners also produce audiovisual material es-

essential for communication through social networks and websites. Some short videos can be found in the observatory’s own repository or on its Youtube channel. The observatory also participates in multimedia productions such as ”Beyond the Milky Way”, a documentary recorded in 360 degrees to be viewed with virtual reality glasses, in which the SKA project plays an important role. A cut of this documentary has been used in the International Astronomical Union General Assembly held in South Africa in 2024 or in public outreach activities as the European Researchers’ Night where it has been used in conjunction with other virtual reality applications. (Fig. 1).

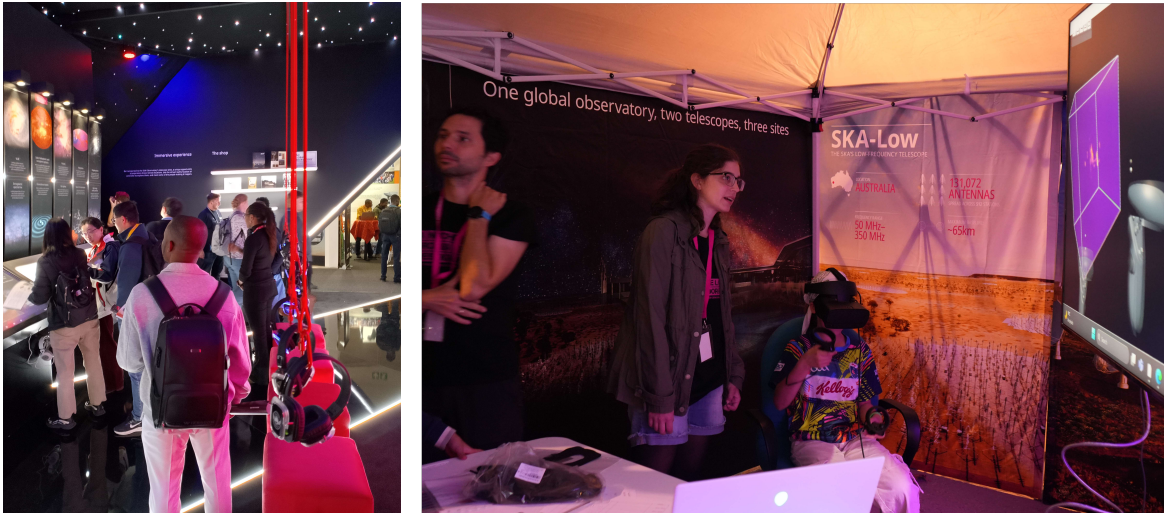


Figure 1: SKA observatory booth at 2024 IAU General Assembly (left) and virtual reality stand at 2024 European Researchers’ Night Event in Granada (Spain) where the documentary ”Beyond the Milky Way” and an application for data visualisation were shown (right).

Regarding outreach and educational activities, in addition to activities at national level, SKAO has implemented some special projects, such as those funded through joint calls for outreach projects in partnership with the International Astronomical Union’s office for the popularisation of astronomy. In the two calls so far, Spain is participating in two funded projects: From SKA to the World and Sharing a Baseline, both oriented to promote international cooperation and raise public awareness of radio astronomy and the SKA project. In particular, From SKA to the World is producing videos as well as organising workshops and tutorials. Sharing Baseline is focused on visits to radio astronomy facilities.

Visits to observatories are a very attractive activities and an efficient way to approach the public since during a visit you can talk about the infrastructure, the scientific results and the underlying science wrapping it all up with a layer of leisure activity. The remote location of the sites where the SKAO telescopes are being built makes it difficult to receive visitors. However, a few days a year the sites are open to the public to learn about the project and the SKA precursor telescopes that are already in operation there. Targeted visits to the sites are also organised for policy makers, key stakeholders and interest groups. Accredited media can also apply for visits.

The observatory, as an intergovernmental body, participates in major international events and forums, organises its own events (e.g. the ground-breaking ceremonies in December 2022) and is also present at local events (from science fairs to national congresses). In addition, it organises professional congresses on various topics, of course on science and technology, but also on communication. An example of the latter was the Public Awareness or Research Infrastructures conference in 2022 at the Observatory's headquarters in the UK. At the national level in Spain, congresses, meetings and seminars have been held with the scientific community and industry. One example of this is the meeting on synergies between projects being carried out at the Javalambre Observatory and future observations with SKAO organised in November 2023 in Teruel. SKA-Spain also organise training schools as the First SKAO's Open Science School and support the organisation of others like the 10th European Radio Interferometry School. Educational or informational material such as posters, brochures, tutorials or models of the SKA telescope antennas are also developed. One example is the SKAO's Table-top Radio Telescope activity which provides instructions and software to build a home-made antenna that can be used to detect the radio emission of the Milky Way. SKAO's also promote Citizen Science projects and multimedia activities developed by partners and related to radio astronomy or precursors or pathfinders telescopes, which are facilities that has been pivotal for the planning and technical design of the SKAO telescopes. Finally, it is worth mentioning, the exhibitions "Shared Sky" and "Cosmic Echoes" produced by SKAO which show Australian and South African indigenous artistic pictures inspired by modern and traditional astronomical themes.

3 Open Science, a tool for dissemination.

Since the beginning of the project SKAO and its member countries have been working to minimise the impact on the environment, promoting the use of renewable energy and reducing energy consumption, investing in education and promoting international cooperation in line with the Sustainable Development Goals. This work is already generating benefits, not only scientific ones, and efforts are being made to inform society about them. In this context, one of the aspects SKAO's commitment with Open Science will have an important impact on society. This commitment is contained in two of its key documents: the Construction Proposal [1] and the Establishment and Delivery Plan [2], where the values of Open Science and reproducibility are adopted as metrics of the impact. Open Science covers not only open access to publications and data, but also open code and open hardware development, open educational resources and citizen science projects [4]. It permeates accross science, technology development, training, education and communication activities. It is a powerful tool for the dissemination of scientific knowledge that will democratise science and contribute to sustainable development goals. In addition, reusing and sharing data and procedures leads to a better use of scientific infrastructures, which also makes them more sustainable. The principles of sustainable science are already being implemented in the prototyping of the SKA Regional Centres Network (SRCNet). The SKA regional centres (SRCs) will be the computing infrastructures that will provide not only access to SKAO data but also tools and resources for its scientific exploitation. They will be the environments where SKAO data can

be worked with, i.e. they will be the scientific core of the SKA project. The development of the Spanish SRC prototype (espSRC) is led by IAA-CSIC. It is being used for scientific projects and training purposes and it is characterised by its engagement with Open Science. In addition the espSRC is studying how to make the SRCs more sustainable in the framework of the TED4SKA project. Thanks to this project the espSRC team in collaboration with a company to apply artificial intelligence to monitor and reduce the environmental impact of the SRCs. All these questions and developments were addressed in a school on Open Science held in May 2023 co-organised by the observatory and the IAA-CSIC's Severo Ochoa training programme, which is published, following the spirit of Open Science, in open format on the IAA-CSIC's Youtube channel.

4 Conclusions.

Effective communication on major scientific infrastructures highlights their role as engines of knowledge, innovation, sustainability, and international cooperation. This reinforces the value of public investment in science, an aspect that is crucial during the construction phase of an infrastructure as SKAO, when most of the investment is made.

SKAO and SKA-Spain are spreading the word about this great adventure that is the construction of what will be one of the most important scientific infrastructures of the coming decades, about the science that the scientific community will be able to do thanks to it, and about the benefits it will bring to society. We use several channels to reach our target audiences and, in the coming years, SKAO and SKA-Spain will expand our activities as the construction of the telescopes progresses and the first science data release approaches.

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