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Recherche
Formation
Culture
scientifique



Credit: SKAO

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Press release

A French team achieves the top score and wins the Second SKAO Data Challenge

The SKAO will provide scientists with a wide variety of data of a quality and quantity that goes far beyond anything currently provided by radio observatories. To prepare the science community, data challenges between scientific teams from all over the world are organised. For the second edition held in 2021, a French team led by the Observatoire de Paris - PSL with CNRS, Observatoire de la Côte d'Azur and several French universities won the gold medal in the competition on the Jean Zay machine of GENCI/IDRIS.

In the framework of the on-going preparation to the scientific exploitation of the SKA Observatory (SKAO), the SKAO Data Challenges are designed to prepare future users to efficiently handle SKAO data, so that it can be exploited to its full potential as soon as the telescopes enter early operations, and to drive the development of data analysis techniques. They also assist the Observatory and its computing partners in preparing the systems and processes needed for the network of SKA Regional Centres (SRCs) which will store, process and provide access to data for astronomers globally.

Forty teams comprising 280 participants in 22 countries took part in the Second SKA Data Challenge (SDC2), which kicked off in February this year and lasted for six months. They were supported by eight supercomputing centres around the world, providing vital storage and processing resources. Teams were tasked with developing computer algorithms to identify and characterise nearly 250,000 galaxies in a simulated 1TB SKAO data cube mimicking a spectro-imaging observation including the fundamental spectroscopic line of hydrogen atoms around 1.4 GHz. They were scored on two elements: the number of objects found (with a penalty for false positives), and how accurately they measured the objects' different characteristics, for example their size or brightness. These were combined to give a final score.

Today SKAO announced that the SDC2 has been won by a French team who have benefited from the MINERVA project (<https://vm-weblerma.obspm.fr/minerva/>) funded by the Observatoire de Paris - PSL and using the resources of the French National Jean Zay supercomputer of GENCI operated by the CNRS Institut du Développement et des Ressources en Informatique Scientifique (IDRIS). The goal of MINERVA is to explore the use of Machine Learning in various fields of radioastronomy, with a focus on the preparation for the SKA. *"I am very proud of the MINERVA results for SDC2. Radioastronomy is one of the top priorities of Observatoire de Paris - PSL, its Station de Radioastronomy in Nançay (<https://www.obs-nancay.fr/>) hosting two SKA pathfinders:*

- *the FR606 LOFAR international station*
 - *and the NenuFAR array (<https://nenufar.obs-nancay.fr/en/homepage-en/>).*
- The methods developed inside the MINERVA project are very innovative and promising and I am looking forward to future development" says Fabienne Casoli, president of Observatoire de Paris - PSL. The winner team included collaborators from International School for Advanced Studies, The Canadian Institute for*

Theoretical Astrophysics, University of Toronto and Observatoire astronomique de Strasbourg.

The team won the SDC2 by developing two pipelines in parallel, both relying on Convolutional Neural Networks (CNN). The first one is an enhanced version of the YOLO object detector (<https://arxiv.org/abs/1506.02640>), adapted to the specific needs of astronomical data and generalized in 3D, while the second is a combination of several ad-hoc networks implemented solely for the SDC2. Merging the catalogues resulting from these two CNNs led to the highest score of the second data challenge. The algorithm development was performed on local resources at the Observatoire de Paris - PSL, while the handling of the full 1 To SDC2 data cube was done on the IDRIS Jean Zay computer using up to 25 GPU simultaneously.

“It is a great pleasure to see the interactions between astronomers and computer scientists in our labs fostered by the SKA project. The challenges raised by radio astronomy are attracting greater and greater attention from the computer scientist community. CNRS, with strong cross-disciplinarity capabilities, is in a very good position to bring important developments required for the advent and success of SKA” says Antoine Petit, Chairman and CEO of CNRS.

The French National Jean Zay supercomputer, owned by GENCI (Grand Equipement National du Calcul Intensif) (<https://www.genci.fr/fr>), hosted and operated by the IDRIS (CNRS), is one of the most powerful European converged HPC and AI operational supercomputers (28 PFlop/s). This success is a tremendous source of pride for GENCI and IDRIS who both engaged to support SKA-France and SKAO mid-2020 with computing resources granted to 4 international project teams among 40 in total. During this challenge these four projects benefited from a dedicated support from IDRIS AI and HPC User Support teams, covering all the aspects, from the administrative and secure procedure to access the supercomputer, to the more technical questions raised by users to master the usage of Jean Zay. In addition to the computing and human resources made available by GENCI and IDRIS, a research engineer from Observatoire de la Côte d’Azur (OCA) has provided support to SDC2 users during the different steps of the challenge. OCA has been the entry point to the IDRIS supercomputer. *“While 1,000 hours of GPU computing resources have been allocated by IDRIS to the MINERVA project to enable the development of a machine learning method in order to better suit the needs of astronomical images, this success heralds very promising future developments between HPC/AI and large-scale scientific instruments in the framework of the SKA project, in line with GENCI’ strategic plan”* says Philippe Lavocat Chairman and CEO of GENCI.

“The French participation in the Second SKA Data Challenge is a beautiful example of the kind of joint efforts that we are aiming for by coordinating SKA-related activities in France”, says Dr. C. Ferrari, SKA-France Director and Astronomer at OCA. *“Having astronomers, developers, engineers from different research institutes and infrastructures working together will be paramount for the future organisation of SKA Regional Centers, the worldwide network of computing and data infrastructures that will allow astronomers to access and fully exploit the scientific products of the SKA Observatory.”*

More about the SKAO

The SKA project is one of the largest physics machines being built on Earth. The instruments of this radio-astronomical observatory were designed between 2012 and 2020 by the SKA Organisation, a company with members from 14 countries (among which CNRS) and collaborations with about 100 organizations from more than 20 countries. Today, it is an Intergovernmental Organisation with its headquarters in the United Kingdom, the SKA Observatory (SKAO), that manages the construction and operation of the telescopes and of the infrastructures necessary to provide astrophysicists with scientific data to be analyzed. Among the latter, we mention the HPC (High Performance Computing) supercomputers that will be an integral part of the SKAO. The construction of SKAO officially started on July 1, 2021. The result will be an observatory operating two telescopes consisting of large antenna arrays (more than 131000 small antennas in Australia, SKA-LOW, and slightly less than 200 dishes about 15 m in diameter in South Africa - SKA-MID), capable of globally capturing the electromagnetic radiation emitted by celestial objects between 50 MHz and 15.4 GHz. Over the next few decades, this observatory is expected to make fundamental discoveries in cosmology, astronomy, and fundamental physics.

The position of France within the SKAO has significantly evolved in the last few years and France is now becoming a full player of this planetary project. Following the preparatory work of SKA-France (a CNRS-led national coordination of industrial, technical, and scientific activities preparatory to the participation of France to the SKA project), the French Ministry of Higher Education, Research and Innovation (MESRI) announced the French engagement in the process of applying for membership in the SKA Observatory during the first SKAO Council Meeting (February 4, 2021). In May 2021, a unanimous decision by the SKAO Council made France the first country to join the Observatory beyond its seven founding members (Australia, China, Italy, the Netherlands, Portugal, South Africa and the United Kingdom). The announcement of France's accession to the SKA Observatory was made by the French President Emmanuel Macron on occasion of his State visit to South Africa, during the press conference held together with South African President Cyril Ramaphosa on May 28, 2021. The ratification process of the accession is now underway.

List of Laboratories involved in the French participation to the SDC2:

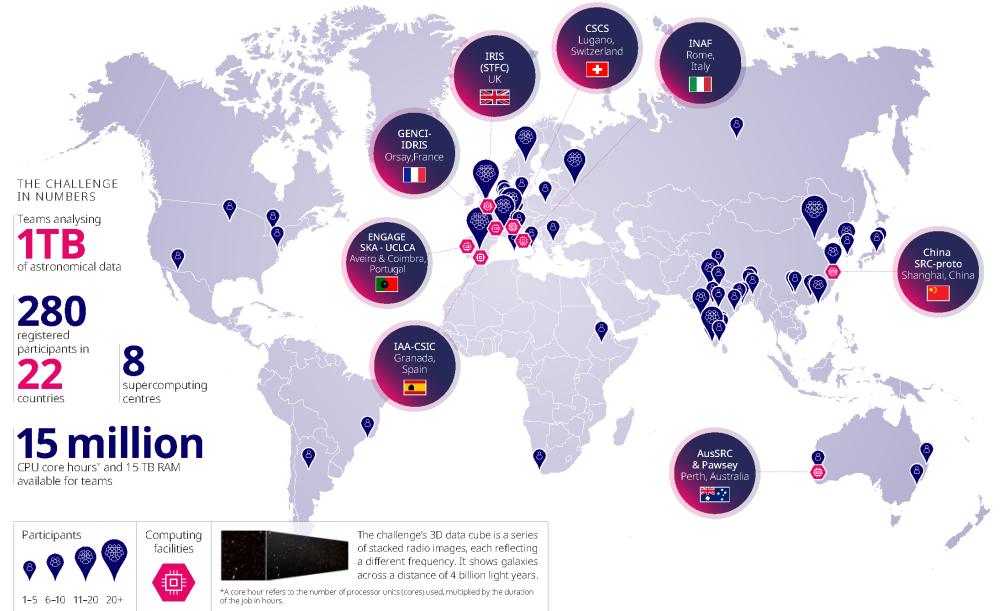
- Laboratoire d'Etude du Rayonnement et de la Matière en Astrophysique et atmosphères (Observatoire de Paris-PSL/CNRS/Sorbonne Université/CY Cergy Paris Université),
- Galaxies, Etoiles, Physique, Instrumentation laboratory (Observatoire de Paris - PSL/CNRS)
- Observatoire astronomique de Strasbourg (CNRS/Université de Strasbourg)
- Institut du Développement et des Ressources en Informatique Scientifique (CNRS)
- UAR Galilée (Université Côte d'Azur, Observatoire de la Côte d'Azur, CNRS)

Image :

SKAO Science Data Challenge 2



MAP OF WORLDWIDE PARTICIPATION



Caption: Infographic representing participation in the SKAO's Science Data Challenge 2. In total, 40 teams comprising 280 participants in 22 countries took part in the 6-months challenge. They were supported by eight computing facilities to identify and characterise nearly 250,000 galaxies in a simulated 1TB data cube.

Credit: SKAO

For more information

News published on the SKAO website: « *Second SKAO Science Data Challenge concludes with strong collaboration and innovation* »
<https://www.skatelescope.org/news/second-skao-science-data-challenge-concludes-with-strong-collaboration-and-innovation/>