

# SKA-France

Monthly bulletin

December 2020

## SKA-France

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## News from Maison SKA-France

### 35<sup>th</sup> SKA Board Meeting

The 35<sup>th</sup> meeting of the SKA Board of Directors was held on December 7, 2020. Due to the COVID-19 related situation, the SKA Board members and invited guests convened for the fourth time by videoconference.

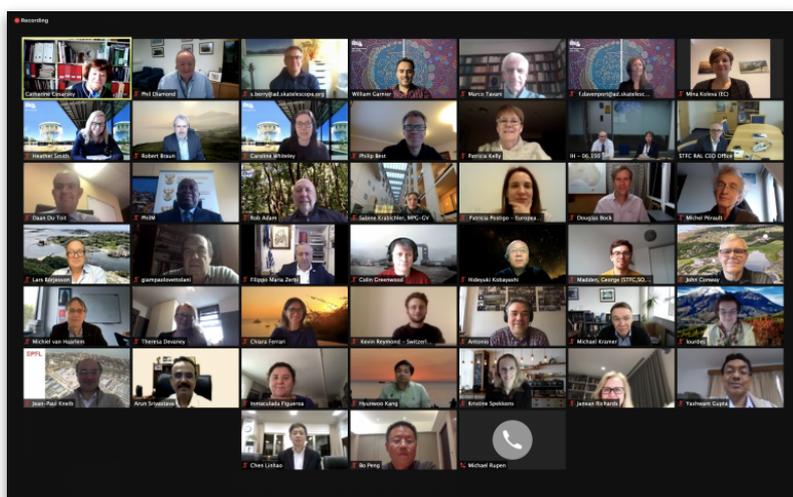
As reported by P. Diamond (SKAO DG), after a four-week national lockdown in the UK, the SKAO Headquarters re-opened on the same date of the Board, with staff able to work safely in the office on voluntary basis. Important to mention that the COVID-19 has not stopped the expected recruitment within SKAO, with 32 roles filled in 2020.

The Director General updated the Board about the continuously ongoing activities between the SKA Office, international telecommunication committees and satellite service providers, to **minimise the impact of radio frequency interferences on future SKA observation.**



### Ratifications of the SKA Observatory Convention

December 2020 has seen crucial steps forward in the final sprint before the official launch of the SKA Observatory, whose Convention entry into force needs the ratification process to be concluded by at least five nations, including the three host countries (Australia, South Africa and the UK). Thanks to two new ratifications by Portugal (on December 11, 2020) and the United Kingdom (on December 16, 2020), which followed previous ratifications by the Netherlands, Italy, Australia and South Africa, the intergovernmental organisation responsible for building and operating the SKA telescopes can now formally be established. SKA-France presents its warmest congratulations to the Office of SKAO and all the international partners of the project for this historical achievement.



Members of the SKA Board of Directors at the 35<sup>th</sup> Board meeting  
Image courtesy: SKAO

In this phase of preparation of the transition between the SKA Organisation and the SKA Observatory, the Board was asked to approve a few decisions and note preparation progresses in key areas such as finance, programme, operations and policy.

Among the most relevant decisions, the Board approved the proposed **Budget for 2021**, the **Rules of Procedure to ensure the effectiveness of the Finance Committee in the transition phase** between the Organisation and the Observatory, as well as the **text of a Memorandum of Understanding (MoU) defining governance arrangements and responsibilities** during the period when both the SKA Organisation and Observatory will co-exist as legal entities.

The Board noted the updates and progresses in the engineering programme and in the operations planning. J. McMullin (SKAO Programme Director and Deputy-DG) informed the Board that the **SKA Observatory's document set** (endorsed by the Board at its last meeting and including the Construction Proposal, the Observatory Establishment and Delivery Plan, and the SKA Prospectus) has now also been **endorsed by the Council Preparatory Task Force (CPTF)**, being therefore ready for submission to the SKA Observatory Council for approval next year. Work is underway to ensure **readiness for the beginning of construction in July 2021 (T0)**. On the operations side, A. Chrysostomou (SKAO Head of Science Operations) reported that the **MoU's between SKA Organisation and CSIRO (Australia)/SARAO (South Africa)** has now been completed to ensure a common understanding on construction, operations and business-enabling activities at the telescope sites.

On the policy side, an **update on Human Resources (HR) policy development for the SKA Observatory**, including an action plan by the Equality, Diversity and Inclusion (EDI) Working Group, was presented by F. Davenport (SKAO Head of HR).

For more information we refer the reader to the [Notes from the Chair of the Board](#) (C. Cesarsky).

## Activities

### SKA-France in international meetings

December 2020 has seen the participation of SKA-France representatives in several meetings of international committees:

- \* the **SKA Board of Directors meeting** took place, as detailed above, on **December 7, 2020**;
- \* the **European SKA Forum (ESKAF)** discussed about coordinated European SKA-related actions during its meeting of **December 10, 2020**;
- \* the **Council Preparatory Task Force (CPTF)**, tasked with bridging the SKA Observatory towards the first meeting of the SKA Council, met for the 19<sup>th</sup> and last time (since March 2019) on **December 16, 2020**. This meeting saw the approval of the final CPTF report to be passed to the Council;
- \* the kick-off meetings of the Working Groups “SW Federated Computing and Data Software Services” and “Science User Engagement” of the **SKA Regional Centre Steering Committee (SRCSC)** took place on **December 18 and December 21, 2020**.

### SKA-France scientific communication

On **December 4, 2020**, the SKA-France Director (C. Ferrari) has been invited by the [Institut d'Astrophysique de Paris \(IAP\)](#) to present the SKA project and its scientific perspectives, as well as the **Maison SKA-France** structure, activities and role in preparing the positioning of French contributions to the project. The seminar has been recorded and is available on-line.

An article by C. Ferrari about the SKA, focusing mostly on the scientific and technological challenges of the project, appeared on **December 16, 2020**, in the 67<sup>th</sup> issue of “[Reflets de la Physique](#)”, the journal of the French Physical Society (“[Le Square Kilometre Array \(SKA\) : un radiotélescope géant pour étudier l'aube et l'évolution du cosmos](#)”). Very nicely, an image of the future SKA1-MID telescope was selected by the editor for the cover page of the review.



Cover of the 67th issue of “Reflets de la Physique”

## Announcements

### Abstract submission for the 2021 SKA science meeting

15-19 March 2021, on-line conference

The abstract submission for the 2021 SKA science meeting, entitled “A precursor view of the SKA sky”, is open through the new [SKAO submission portal](#).

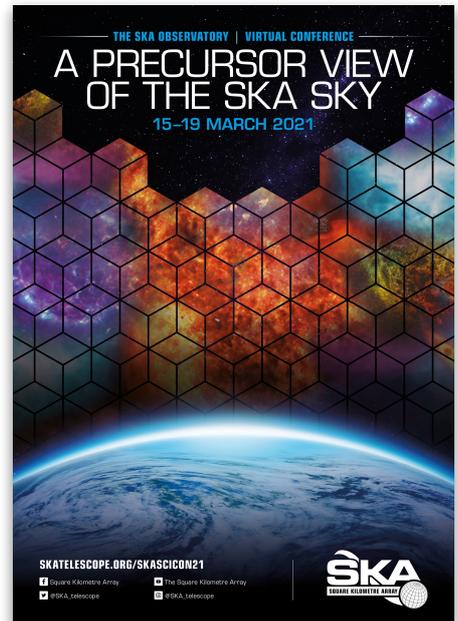
In the year that marks the establishment of the SKA Observatory, as well as the start of SKA construction activities, the SOC wants to bring the focus to science with the new and exciting results that are being produced by the SKA precursors and pathfinders and their implication for SKA. The conference will be a fully virtual event. This new virtual format will allow organisers to welcome participation across all time zones.

The conference will include plenary sessions organised by the SOC, as well as splinter sessions organised independently by the SKA Science Working Groups.

The registration fee will be £40 per person (£20 for students) and registrations will open early 2021.

**Important dates concerning abstract submission:**

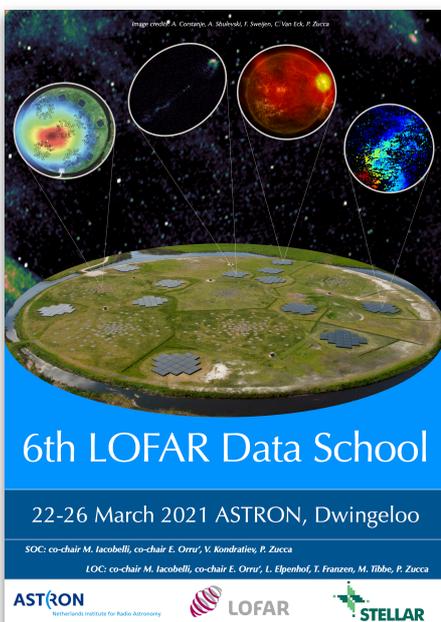
- \* 18 Dec 2020: abstract submission opens
- \* 20 Jan 2021: abstract submission closes
- \* 15 Feb 2021: abstract selection complete



### Sixth LOFAR Data School

22-26 March 2021, on-line conference

[Registration is now open](#) for the Sixth LOFAR School.



The aim of the School is to introduce the LOFAR system to new members of the LOFAR community, as well as to present the analysis techniques for processing both the interferometric and the high time resolution beamformed LOFAR data. Students (master / PhD level), postdocs, and staff are all encouraged to attend. The programme will consist of a set of lectures and demos, covering the many aspects of the LOFAR system (from the capabilities of the basic station hardware to the software pipelines and their science ready products) and will be presented by members of the LOFAR project team as well as staff from the many institutions involved in the collaboration. Online material will also be made available for a subset of topics as a replacement of the face-to-face tutorial sessions. Participants will make use of this material during offline hands-on data processing sessions. Interaction and networking between participants and lecturers will be promoted via Q&A sessions as well as team building activities.

**Presentations will be given at a level appropriate for someone new to LOFAR.** Minimum requirements should include: (i) some familiarity with the concepts of radio interferometry as well as with (ii) scripting languages and in particular Python. Familiarity with standard radio data processing software such as CASA, will be useful, but not required. **Attendance will be limited to a maximum of 100 people.** All potential LOFAR users are encouraged to apply.

Participants are expected to use fairly recent Linux or MAC OS laptops with tens of GB of disk space. In order to follow the online material during hands-on sessions, attendees are recommended to have access to computing cluster facilities at their home institutes. The recommended minimum configuration should have at least 16 cores and 128 GB RAM. In case access to computing resources is needed, participants are asked to contact the [organisers](#). Only a limited number of requests will be satisfied.

For the tutorials, participants will need to make use of the latest LOFAR software version, as well as other dedicated software packages. To this aim a container with all needed software will be made available in due course before the start of the school. Participants should install python3, Zoom and Slack on their own laptops.

Finally, organisers expect the participants to test everything 1 week in advance of the start date of the School. More information with instructions will be made available soon in the 'Software' section (still under development) of the School website.

Conference website: <https://www.astron.nl/lofarschool2021/index.php>

Important dates before the meeting:

- \* February 19, 2021: deadline for registration
- \* February 26, 2021: confirmation to registered participants

## News from NenuFAR: first light of the NenuFAR-Radio-Imager

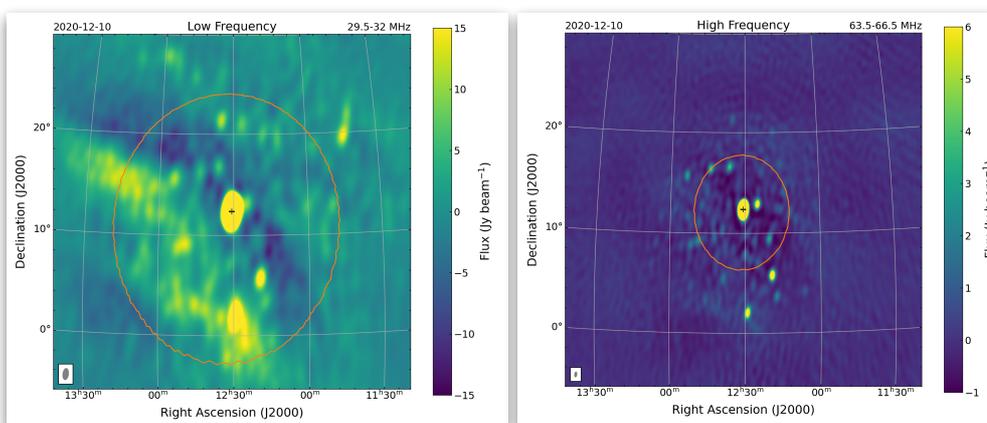
Since December 1<sup>st</sup>, 2020, the NenuFAR correlator is fully operational and thus the NenuFAR imaging mode is available. The correlator, nicknamed NICKEL (NenuFAR Imaging Compute Kluster Elaborated from LOFAR's), is a clone of LOFAR's new COBALT-2 correlator (Broekema 2018) that was scaled and adapted to NenuFAR's antenna field. Support was obtained (and much appreciated) from ASTRON to help defining, installing and debugging NICKEL. The correlator will process the signals from 102 NenuFAR Mini-Arrays, MA (96 MA within the core and 6 distant MA synchronised with the WhiteRabbit protocol, Serrano et al. 2009), in 384 subbands (of width 195 kHz, i.e. 75 MHz total bandwidth, full Stokes), and produce standard Measurement Sets. At present 56 core plus 1 distant MA are operational, and these numbers will increase to 80 core plus 4 distant MA in the coming weeks, as the newly built MA are integrated in the array.

In order to process NICKEL's large raw data stream (up to 2 TBs / hour), a pre-processing node nicknamed COPPER (Computer Oriented toward Pre-Processing Extreme Repositories) has been set up on a NICKEL-like node, that has the full suite of calibration and imaging tools available.

Late 2020, a few observations of the Virgo A (M87) region were performed in order to obtain the first-light images from the NenuFAR imager. The images displayed here result from a 10-hour observation of Virgo A in the lower part (29.5-32 MHz) and the upper part (63.5-66.5 MHz) of the NenuFAR band, using 56 core MA only. The orange ellipses show the primary beam of the instrument, i.e. the Half-Power Beam Width of the analog-phased MA accounting for projection in the target direction (cross), simulated with the nenupy package. This beam is  $-22^\circ$  wide at LF,  $-10^\circ$  at HF. At low frequencies, we can clearly see the diffuse emission from the tip of the Loop I region. Virgo A is currently unresolved and seen as a powerful point source that appears artificially extended due to the selected colour cuts. At high frequencies, main 3C radio sources are detected, including M84, very close to Virgo A. The limiting factor is presently the angular resolution of the 400m-diameter core, which will dramatically improve with the inclusion of the distant MA up to 3km from the core.

Each image was made with WSClean (Offringa 2014) from the visibilities in 16 subbands produced by NICKEL, pre-processed on COPPER with the software DPPP (van Diepen et al. 2018), and reduced on the data center of the Nançay Radio Observatory.

More images and a movie are available on the [NenuFAR news page](#). Key team members include: C. Viou, E. Tremou, A. Loh, J. Girard. The team also acknowledges the important help of: V. Pandey, C. Broekema, E. Thetas, F. Mertens, P. Zarka.



*10-hour integration at NenuFAR's low frequencies (29.5-32 MHz, left) and high frequencies (63.5-66.5 MHz, right). The image sensitivity is 1.04 Jy/beam r.m.s. at LF (resp. 0.27 Jy/beam at HF) and the angular resolution is  $52' \times 1.7^\circ$  (resp.  $25' \times 49'$ ) as represented in the lower-left insets.*

## Recent results from SKA precursors and pathfinders

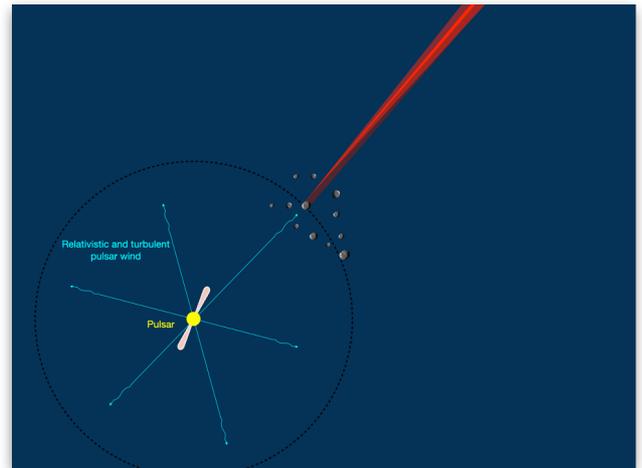
Fast Radio Bursts (FRBs) are brief (a few milliseconds) and intense radio wave bursts whose related discoveries from SKA precursors and pathfinders have often been described in the SKA-France monthly bulletins ([May 2017](#), [October 2018](#), [January 2019](#), [June 2019](#), [January 2020](#), [May 2020](#), [June 2020](#)).

While on **December 14, 2020**, three papers reporting the detection of FRB coming from a magnetar in our Galaxy have been highlighted among [the 10 remarkable discoveries from 2020](#) by the prestigious review Nature, a team from *Observatoire de Paris (OP)* proposes a model able to explain these mysterious sources.

The quasi-homogeneous distribution of FRBs in the sky and their huge time-frequency dispersion measure (DM) points to an origin in distant galaxies. Some of them are repeaters, i.e. they reoccur with the same DM from the same position in the sky, mostly non-periodically. Their generation mechanism remains a mystery. If the emission is isotropic, it implies a cataclysmic energy comparable to that released by a collision between two stars, but such events do not repeat. An alternative is that the emission is concentrated in a very narrow cone.

The *OP* team proposes an original idea for that: in their model, FRBs result from the perturbation of the very energetic plasma wind, blown by pulsars or magnetars, by asteroids orbiting around these objects. Pulsars and magnetars are highly magnetised neutron stars well-known to emit relativistic winds blowing almost at the speed of light, nearly 1000 times faster than the solar wind. One can then generalise a well-known phenomenon in the solar system: when an asteroid (or a planet) is swept by the wind, it creates a plasma wake called "Alfvén wings". This perturbation is the right place to develop instabilities capable of generating radio emission very efficiently. As the plasma wind moves at a speed close to the speed of light, strong collimation occurs due to special relativity, that concentrates the radio emission in a narrow pencil beam in the direction of the wind flow. The asteroid motion and the wind turbulence cause the beam to wander angularly in space and cross the direction of the observer for only a fraction of a second.

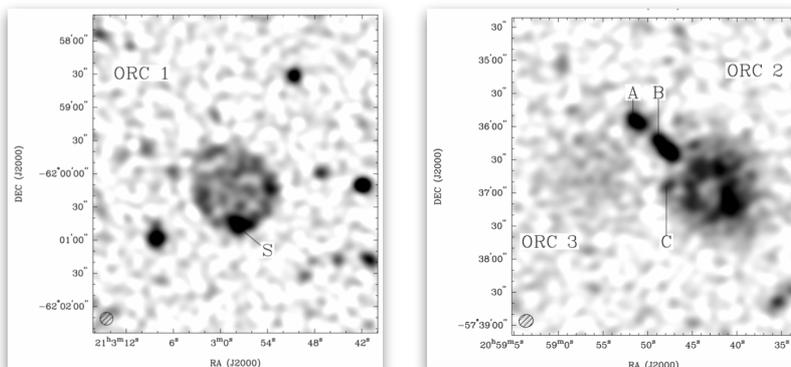
In our Solar system, asteroids are rarely isolated, but most often members of a belt or a swarm with similar trajectories and not strictly periodic. According to the *OP* team, the repeater FRB 121102 could be a young pulsar surrounded by a belt of asteroids of less than 10 km radius located between 0.03 and 1 AU, far enough from the pulsar not to be evaporated by its intense radiation. The authors of the study also conclude that this mechanism could explain some, if not all, of the other observed FRBs to date, although much theoretical and observational work is needed to demonstrate this. We refer the interested reader to the [research article](#) published in December 2020 by **Mottez and collaborators**.



*Sketch of an asteroid swarm in the pulsar wind. For clarity, only one Alfvén wing for a single asteroid is shown in bright red. When this beam crosses the observer's direction, an FRB is seen. The wind's turbulence causes the beam to jitter across the light red zone. The dark red area represents the "shadow" of the asteroid relative to the pulsar wind.*

Among the SKA pathfinders and precursors related publications in December 2020, we recall here the discovery

**of unexpected circular radio objects through observations of the Australian SKA pathfinder ASKAP.** The physical properties of these sources (such as their morphology, size, position with respect to the galactic plane, luminosity at various radio frequencies) are not easily explained by any known class of radio sources of galactic or extra-galactic origin, allowing astronomers to think about the possibility to have spotted an unknown class of objects in the radio band. More information in the [publication by Norris and collaborators](#).



*Two examples of ORCs ("Odd Radio Circles") discovered by Norris et al.*

## SKAO Publications

In addition to the rich [#6 Issue of Contact](#) (the SKA Magazine that covers the broad range of SKA-related activities taking place around the world in a single publication), December 2020 has seen the publication on the SKAO web-site of the impressive [brochure](#) providing a high level introduction to the SKA Observatory and its global collaboration.



## SKAO Current Vacancies

The following SKAO positions are currently open:

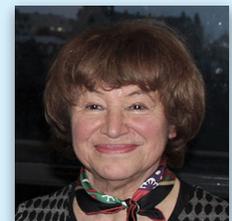
- \* [SKA Regional Centre Architect](#) - Contract Type: Permanent (closing date: January 8, 2021)
- \* [Treasury Manager](#) - Contract Type: Permanent (closing date: January 11, 2021)
- \* [Procurement Specialist \(Software and ICT\)](#) - Contract Type: Permanent (closing date: January 11, 2021)
- \* [System Engineer](#) - Contract Type: Permanent (closing date: January 25, 2021)
- \* [Product Assurance Engineer](#) - Contract Type: Permanent (closing date: February 1st, 2021)
- \* [SKA-Mid Telescope Director](#) - Contract Type: Permanent (closing date: February 8, 2021)
- \* [SKA-Low Telescope Director](#) - Contract Type: Permanent (closing date: February 8, 2021)
- \* [Senior Contracts Specialist](#) - Contract Type: Permanent (closing date: February 22, 2021)

Interested readers can [register](#) to automatically receive an e-mail as soon as a relevant job is published. More information can be found at the [SKAO webpage](#).

## Maison SKA-France warmly congratulates C. Cesarsky

On December 17, 2020, the American Institute of Physics announced the winner of the [2020 John Torrence Tate Award for International Leadership in Physics](#) to Catherine Cesarsky, Chair of the SKA Board of Directors.

The Maison SKA-France warmly congratulates Prof. Cesarsky for this prestigious award!



*Chiara Ferrari*  
for the [Maison SKA-France](#)