# IAU Office for Astronomy Outreach

NOCs Funding Scheme (Ed. 2020) | 2020/2021 Phase II Application
*Deadline for Delivery by 20 November 2020, submit it to lina.canas@nao.ac.jp*

# The NOCs Team

1) **Number of NOCs: 5**
2) **Name of the NOCs:** *(e.g. Name One; Name Two) (add SKACON if also involved)*

- **France:**
  - Fabrice Mottez (NOC)
  - Anne Laure Melchior (Proposer)
  - Philippe Salomé (Proposer)
  - Léa Fournier (SKACON)
- **Portugal:**
  - João Retrê (NOC)
  - Sonia Anton (SKACON)
  - Domingos da Silva Barbosa (SKACON)
- **Poland:**
  - Krzysztof Czart (NOC)
  - Krzysztof Chyży (Partner)
- **Haiti:**
  - Rulx Narcisse (NOC)
- **Cameroon:**
  - Roland Ndunge (NOC)

3) **Countries:** *(the countries that the NOCs represent)*

France, Portugal, Poland, Cameroon, Haiti

4) **Contact E-mails:**

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# The Project at a Glance

1) **Name of the Project:**
   **Observing the Milky Way at home: hands-on the radio waves**

2) **Where the project will take place (if applicable)**
   The software coding will be based in Paris Observatory (LERMA). The radio telescopes that will be included in the Web interface are located in Poland (T3m) and in France (T3m). We also propose to start a design study for the inclusion of an even larger diameter antenna (5m) in Portugal in the remote-control Web interface, similar to the 3m antenna installed for educational purposes at SARAO (South Africa). Such a feasibility study will help determine the workload for such an exciting project and plan future tasks and pave ground for the inclusion of South Africa and Portugal educational radio telescopes into the existing network.
   High school teacher training sessions will be organised in Haïti and in Cameroon. Outreach events will be organised in each participating country.
3) **Language(s) of the Project (if applicable)**
   English, French, Polish, Portuguese. It can be noted that the Web interface has been designed to be easily translated. So it is easy to include additional languages. We can provide files to be translated.
4) **When will your project be implemented (if applicable)?**
   Our project will be implemented according to the timeline given below. For instance, in Cameroon, it would take place during school time (Late April, May, early June, September and October).
   Given the sanitary situation, we expect some possible delays. We will announce an internship in January if this project is selected. We will then depend on the constraints on the French student curricula.
5) **Theme:** Radio Astronomy for high school education and outreach

# Project Overview

## 1) Project Summary

Since 2011, we have run a European network of small radio telescopes (SRT) for education. It hosts a Web interface enabling it to perform remote observations at 21cm in real time, an online archive server with a search engine, and a simulator of observations based on public archives. The control interface is user-friendly and multilingual (16 European languages). Up to now, 20163 observations have been

performed from 1400 accounts from more than 100 countries including 12 countries with more than 10 accounts (France (368 accounts), Poland (208), Portugal (19), Romania, Russia, UK, Spain, Germany, China, Honk-Kong, Holland, USA) as a fantastic showcase of radio astronomy as a citizen science and educational tool. Original pedagogical material has also been developed to understand and explain 21cm observations of the Milky Way. Beside the Web interface, various explanations have been developed with the simulator of observations, kinesthesia, videos, etc (http://www.euhou.net/index.php/exercises-mainmenu-13/radio).

It has been used in international teacher training sessions, as well as University teaching. It is also well adapted to be used in public exhibitions and events. It is hence well adapted to promote radio astronomy observations towards the young generation and the general public.

This project builds on the first and unique educational project of such SRT network available publicly (through a login) for radio astronomy, that has been operated continuously for 10 years. With little support (from our institutions), we have demonstrated our ability to design a sustainable project, with a significant impact with observations every week over 10 years. This available service can be used by the radio astronomy community for outreach (conferences, public exhibitions, museums, demonstrations in schools, etc.). The radio-astronomers can also use them for online teaching with university students.

The existing radio telescope network is interfaced on 2012 receivers. It can be replaced by new generation receivers, but the electronic is different and requires substantial modification in the interfacing with the Web site. At the moment, the new receiver can only be used locally and cannot be included in the Web interface and the SRT cannot be used remotely. We require 2500€ (partial funding) to hire a competent engineering student for six months at LERMA in Paris to re-code this interface for the new receivers. We propose to submit this project with three partners involved in the development of this European SRT network and who are active actors in LOFAR and/or SKA, and two partners active in the development of radio astronomy in their respective countries. The planned upgrade will enable to perform reliable on-line observations.

## 2) Please describe the **Project Challenge** your team aims to address and explain how this challenge is related to the Theme you chosen.

The challenge of this project is to enable a large number of students but also general citizens to observe the atomic gas in the Milky Way. We propose to improve the HI receivers to provide a robust interface for users. The idea is to couple new receivers to the existing Web interface. This will concern radio antennas from Poland and France. Once this proof of concept is demonstrated, the software will be made available for new antennas if needed and adapted to new educational radio telescopes in Portugal and South Africa. Already in the optical domain, several remote controlled telescopes for educational purposes do exist (ie Faulkes telescope, Liverpool, and others) with great

success; here this radio astronomy network fills an educational gap and will provide a remote controlled network of radio telescope resources capable of the delivery of state-of-the-art classroom experiments, greatly enhancing sciences teaching and contributing to the awareness of great radio astronomy projects like SKA.

## 3) Describe who will the project target or **Who Will Benefit** from the project?

This outreach and educational project targets the young generation through the high school systems (in Haïti and in Cameroon) but also University teaching (in Poland and in France). It can also reach more senior publics through amator clubs or general public events. Given the current complicated sanitary situation in most countries, our SRT network enables any registered user to book an observing slot and to observe at home.
The contribution for inclusion of Portuguese and potential South African antennas will enhance scientific resource availability in schools, universities and science and astronomy clubs in three continents: Central America, Africa and Europe.

## 4) Explain what is the **Role of the NOCs** in the project and how the national communities of the countries involved in the project will benefit from it? *(add SKACON role if also involved)*

In each country, the IAU-NOC will contribute to the promotion of the project and will distribute the information and resources to teachers using his/her national network.
In Cameroon and Haiti, the NOCs scheduled a 4-month project aiming at presenting the non-visible light to students of 6 selected high schools (3 in each country), in remote areas. "Mini-projects" will be attributed to subgroups in each of the selected sites in both countries. The knowledge acquired and the project will be both evaluated through quiz and survey for each participant. Other IAU resources we plan to share with the schools are hard copies of "Big Ideas In Astronomy" and manuals for the EUHOU network.
Benefits for local communities in Poland: teachers, students and astronomy amateurs will gain better access to educational radio telescopes and to an online tool which allows to analyse data from these telescopes, which might be used for example during classes.
As the radio telescope network has a multilingual web interface and the pedagogical resources are translated in several languages including English, French, Polish, Portuguese, these resources can be disseminated through the whole IAU network.

## 5) What are/is the **Project Core Idea(s) and Deliverables**? (How does it align with the Theme proposed?)

The funding will be used for the software development needed to improve the quality of the receivers used for the antenna accessible through the Web interface. Indeed the SRT network is the core of the project as it enables any registered user to observe the HI in the Milky Way 24 hours a day, 7 days a week.

6) **What are the Intended Outcomes of your project? (For each outcome, state how you will measure these outcomes?)**

The intended outcome of this project is to initiate the young generation to radio astronomy using existing radio dishes. In Europe, the motivation is to train University students, while in Haïti and in Cameroon, intensive teacher training will be organised. This radio telescope network can also be used by the international radio astronomy community to present hands-on activities to the general public, through e.g. national events like Science Festivals.

# Project Timeline

Please present a timeline for the deliverables of your project.

| | **Software developments** | **Outreach and education actions** |
|---|---|---|
| *Jan-Apr 2021* | Announcement of the call for a software developer | Training of the (Cameroon, Haiti) partners to the pedagogical material, available on the EUHOU- |
| Apr-Sept 2021 | Software development of a new software interface for | Training sessions for high school students (Cameroun, Haiti)<br>Public outreach events (all) |
| Sept-Dec 2021 | Software installation on Polish and French radio | |

# Project Budget

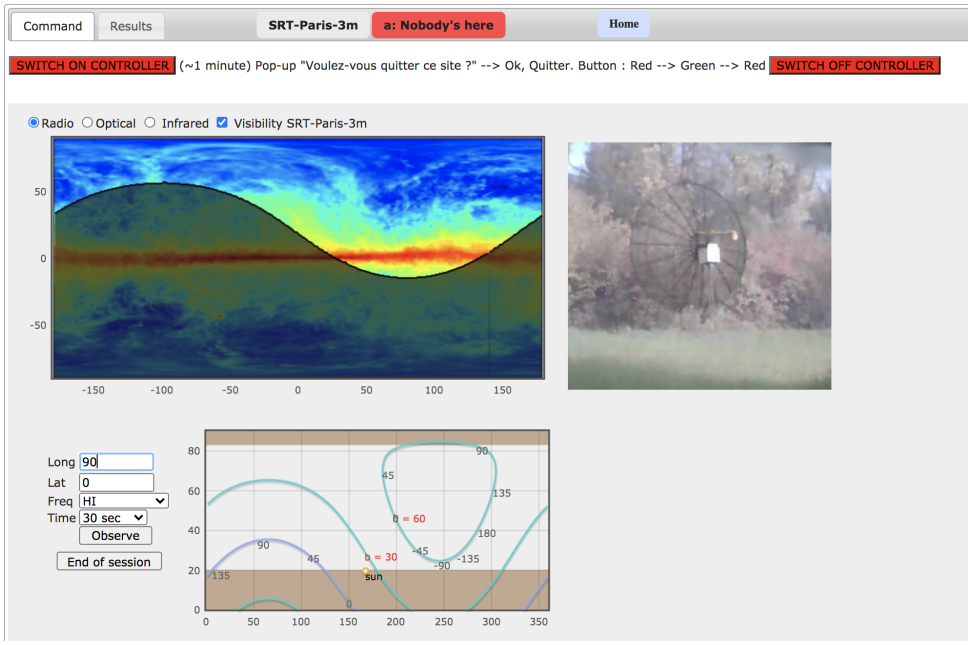
Please provide: a) the total budget request to the IAU, b) the total budget of the project and c) an itemized budget of items with short description and cost for each item.

| | | |
|---|---|---|
| Total budget request to the IAU | 2500€ | Internship for a developer student who will be asked to interface the new electronic card to the web interface. The student will be hired in LERMA, Observatoire de Paris (France). |
| Other budget request to SF2A (French national society) | 2500€ | |
| Total budget of the project | 5000€ | |

About the Funding Allocation: If your proposal is approved; how will the funding be attributed? *(e.g. 2000Euros to Institution 1 and 1500Euros to Individual 2)*

# Let us know any other information

The Web interface proposed to the partnership is presented on the right hand side.
Interested users can register. The site is moderated by France. Registered users can control the chosen radio telescope, point a position in the sky, and integrate a spectra. The telescope is seen through a webcam and the spectra can be seen once the integration is completed. All the spectra are stored in a public archive and can be downloaded for local use.

Below: photo of the Portuguese Observatory. At the bottom, the PT educational telescope that will join the HOU-MW network.