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SCAR Group AAA
Person Responsible: Tony Travouillon

XXXVII SCAR Delegates Meeting

India, September 2022

Astronomy and Astrophysics from Antarctica

2020-22 Report

Summary

Report Author(s)

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Summary of activities from 2020-22

- We organized in virtual format the 6th Workshop of the SCAR Astronomy & Astrophysics from Antarctica (AAA) a semi-yearly conference dedicated to Astronomy in Antarctica This meeting aimed to bring together all the key players in Antarctic astronomy to conclude the 2015 – 2018 Implementation Plan and to coordinate future strategies and collaborations. In 2022, our involvement in the International Astronomical Union remains and we will be able to represent AAA with a booth presence. We also provided our endorsement and support to other related scientific workshop such as the 2021 Girls and Women in science day and the Icecube science workshop in January 2021
- SCAR open science session on Astronomy and upper atmosphere research. The session was allocated 3 time slots which were over subscribed (talks limited to 10mn including questions). Attendance averaging 50 participants at any given time. The session was a forum to learn about the science potential of these regions, and techniques for conducting research in extreme environments including ground-based and balloon borne experiments. There were talks from early career scientists and nations who have recently joined SCAR and IASC as associate members, along with presentations from more established researchers to provide opportunities for mentoring and building collaborations to leverage the investment in scientific infrastructure in the Polar Regions. Talks involving polar research in Astronomy and Astrophysics were also presented.
- AAA was actively represented at the IAU general assembly including a dedicated booth to inform the community about the role of SCAR and AAA. Antarctic astronomy projects taking place in Antarctica were highlighted in all forums. Participation in outreach activities organized by venue.

Summary Budget 2021 to 2024

	2021	2022	2023	2024
	Spent	Allocated	Request	Request
(US$)	2,478	5,000	5,000	5,000

Progress and Plans

Outcomes/Activities Summary

In Latin America, an **Optical Robotic Observatory** at the Argentine Antarctic Station Belgrano II is under construction, the base and building was mounted the last summer campaign and a control system will be installed next summer. The scientific objectives are: Search or tracking of exoplanets, search or tracking of smaller bodies with polar orbits, tracking peculiar stars, monitoring of AGN's or GRB's, and provide support for space missions. In this way AAA is getting the South American astronomical community more involved in the Antarctic Astronomy activities.

The **Antarctic Node of LAGO** (Latin American Giant Observatory) is in operations since March 2019, even under the pandemic situation, while the LAMP group (Laboratorio Argentino de Meteorología del esPacio, Argentinian Space Weather Laboratory) is monitoring the functioning of the cosmic rays flux measurements. The LAGO collaboration is developing another Cherenkov detector for cosmic rays studies and expects to include an additional node, from Peruvian researchers, in the Antarctic Península when the pandemic situation allows it.

ESCAPE-AntarctiCor (Sun Coronagraph, Dome C, PI Fineschi). Its aim is to conduct polarimetic observations of the solar broadband K-corona (585-595nm) and of the coronal emission line FeXIV line (530.3nm). It can demonstrate Concordia quality field test of the space coronagraph ASPIICS

COSMO: COSmological Monopole Observer (PI: Masi-Sapienza). COSMO is an instrument to measure the distortions of the Cosmic Microwave Background (CMB) frequency spectrum. Site and instrument are being constructed. CMB spectral distortion is a unique way to look in the past and to monitor the origin of the universe. This allows us to set the thermal history of the Universe. COSMO is being constructed in the labs of Sapienza University.

Activities at **Dome A**, have seen limited progress due to the lack of access to the site in the last two years. As a whole, astronomical activities which mostly take place inland have been severely affected by the reduced access to logistical support. We expect the needed logistical support to remain limited for the foreseeable future. The South Pole is not welcoming new astronomical experiment until the end of the decade in order to focus on the maintenance and upgrade of existing facilities. Similarly, **Dome C** activities will be affected by the backlog of activities and the station upgrade work that is starting in the upcoming years.

The largest research groups, and most scientifically productive continue to be driven by the **Icecube** project and the **Cosmic Microwave Background** (CMB) experiments that have now been running and continuously upgraded at the South Pole. IceCube continued to operate with greater than 99.8%, producing a wide range of leading results on topics ranging from neutrino properties, tests of fundamental physics, cosmic ray spectrum and composition, and the first ever identification of the astronomical object that produced a high energy neutrino. The IceCube Upgrade underway will add 7 more densely instrumented strings of optical sensors and calibration devices in the center of the existing array. The pandemic severely curtailed deployments in the 2020-21 season which will delay completion of the Upgrade. A conceptual design for IceCube-Gen2, a proposed expansion to the optical array along with a radio array was given positive review by the Astro 2020 panel.

At Dome C, ASTEP in Concordia has been focused on the **follow-up of transiting planet candidates from the TESS NASA mission** and obtaining a great number of detections. **SuperDARN radar Dome C North (DCN) was successfully installed at**

Concordia during 2018-2019 campaign (PI: Marcucci-INAF). Its aim is to study the Earth-Sun relation and to investigate the Space Weather. Interactions with the solar wind makes the environment relevant for astronomy (as well as for the society).

Group Cash Flow

(*Since previous report to Delegates in 2020*)

Purpose/Activity	Allocation	Amount spent 2020	2021	2022
Online conference organization and AAA website support			$2,478	

Future Plans

It is expected to continue the construction of the Optical Robotic Observatory at Belgrano II Station through next campaigns.

It is expected the development and deployment of a second Antarctic node of the LAGO Collaboration from Peruvian colleagues in next campaigns.

Budget

Planned use of funds for 2022 to 2024

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
2022	IAU presence	$5000	Tony Travouillon	Tony.travouillon@anu.edu.au
2022	ECR travel scholarship	$4000	TBD	TBD
2023	AAA 6th International Workshop	$5000	Tony Travouillon	Tony.travouillon@anu.edu.au
2024	Travel support for SCAR and IAU activities	$5,000	TBD	TBD

Membership

Leadership

Role	First Name	Last Name	Affiliation		Primary Language	Email	Date Started
Chief Officer	Tony	Travouillon	ANU	Australia		Tony.Travouillon@anu.edu.au	2021
Steering Committee Member	Adriana Maria	Gulisano	Instituto Antártico Argentino	Argentina	Spanish	adrianagulisano@gmail.com	2021
Steering Committee Member	Michael	Ashley	University of New South Wales	Australia		m.ashley@unsw .edu.au	2021
Steering Committee Member	Elia	Batistelli	Sapienza Università di Roma	Italy	Italian	elia.battistelli@roma1.infn.it	2021
Steering Committee Member	Zhaohui	Shang	Tianjin Normal University	China		zshang@gmail. com	2021
Steering Committee Member	Waraporn	NUNTIYAK UL	Chiang Mai University	Thailand		waraporn.n@cmu.ac.th	2021
Steering Committee Member	James	Madsen	UW-River Falls&Ice Cube	USA	English	jim.madsen@icecube.wisc.edu	2021

*(Please identify early-career researchers with * in first column)*

Additional information *(optional)*

Notable Papers

1. Gulisano, A. M. ; Dasso, S. ; Areso, O. ; Pereira, M. ; Santos, N. A. ; López, V. ; Lanabere, V. ; Ochoa, H. State of the art and challenges of the Argentine space weather laboratory (LAMP) in the Antarctic Peninsula. Boletín de la Asociación Argentina de Astronomía vol. 62, p.280 285. July 2021. ISSN 0571-328 . https://ui.adsabs.harvard.edu/#abs/2021BAAA...62..280G/abstract.

   This work provides information regarding Space Weather initiatives in the Antarctic Peninsula

2. N.A. Santoset al.Observations of the cosmic ray detector at the Argentine Marambio base in the Antarctic Peninsula. Proceedings of Science (Volume 395 - 37th International Cosmic Ray Conference (ICRC2021) https://doi.org/10.22323/1.395.0304

   Calibration of the Cherenkov detector in water to measure cosmic rays flux at the Antarctic Peninsula

3. The Event Horizon Telescope Collaboration. 5/12/2022. “First Sagittarius A* Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole in the Center of the Milky Way.” The Astrophysical Journal Letters, 930, L12

   First Image of our galaxy’s black hole

4. Abbasi, R. et al, IceCube search for neutrinos coincident with gravitational wave events from LIGO/Virgo run O3, submitted to the Astrophysical Journal (2022)

   Collaborative work with the new gravitational wave detector

5. Sayre, J.T, et al, Measurements of B -mode polarization of the cosmic microwave background from 500 square degrees of SPTpol data, Physical Review D, Vol 101, 12 (2020)

   Complete measurement of the B-mode polarization of the cosmic background radiation

Direct support from outside organisations received for your activities

IAU conference presence was also supported by Astralis that paid for some of the support and partially for the SCAR booth.

Major collaborations your group has with other SCAR groups and with organisations/groups beyond SCAR

Within SCAR:

Astronomy community within SCAR is in constant collaboration usually around scientific programs such as Icecube or the South Pole Telescope.

A Dome A, collaborations with various Chinese astronomical and Antarctic institutes for optical/infrared/THz astronomy at Kunlun Station. For example Purple Mountain Observatory, the Nanjing Institute for Astronomical Optics and Technology, the Polar Research Institute of China, the National Astronomical Observatories, Tianjin Normal University, Nanjing University, Beijing Normal University, University of Chinese Academy of Sciences. This consortium of Chinese research institution is also collaborating with Australia for over 10 years with the support of the Australian Astronomy Limited (AAL) and the Australian Antarctic Division (AAD)

At Dome C, projects such as ASTEP to generate young researchers to be involved in Astronomy from Antarctica from several institutions across Europe.

Outside SCAR:

Short examples:

1. Infrared astronomy: Collaborations with Mansi Kasliwal and Roger Smith at Caltech for development of technologies for a future Antarctic infrared survey telescope.
2. Exoplanets:Collaborations between the Laboratoire Lagrange, the University of Birmingham, the ESA and the LESIA
3. Latitude Survey: Collaboration with NARITE and CMU
4. Paul Hickson, UBC, collaboration on data analysis and instrumentation for Dome A.

Outreach, communication and capacity-building activities

The LAGO collaboration has generated a series of on-line working groups within the collaboration to perform cosmic rays simulations and machine learning techniques to analyze data, among the nodes (including the Antarctic one) to develop a Latin-American community of researchers in high energy Astronomy and cosmic rays studies.

Contributions to equality, diversity, and inclusion (EDI)

We provided our endorsement and support to the 2021 Girls and Women in science day.

SCAR Fellowship Reviewers

First Name	Last Name	Email	Principal Expertise
Adriana Maria	Gulisano	adrianagulisano@gmail.com	Space Weather, Sun-Earth relationship, cosmic rays, MHD
Zhaohui	Shang	zshang@gmail.com	Exoplanets, Dome A astronomy
Nicolas	Crouzet	Nicolas.Crouzet@esa.int	Exoplanets detection, photometry, spectroscopy
Tony	Travouillon	tony.travouillon@anu.edu.au	Astronomical and space instrumentation
Elia	Battistelli	elia.battistelli@roma1.infn.it	Cosmology, radio a long wavelength astronomy