Paper No.: 10 **Agenda item: 2.4**

SCAR Sub-Group AAA EG

Person Responsible: James Madsen

SCAR Executive Committee Meeting 2023

Trieste, Italy, 15-16 September 2023

Astronomy & Astrophysics from Antarctica Expert Group

2022-23 Report

Report Author(s)

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Summary

SCAR AAA members (Tony Travouillon, Adriana Gulisano, Jennifer Cooper) together with Lucilla Alfonsi convened a full day of Astronomy, Astrophysics and Space Weather talks in a parallel session—Astronomy and geo-space observations from Antarctica—at the SCAR Open Science Conference (OSC) held virtually in September, 2022. The 32 presentations gave updates on the status and progress of a wide range of topics including optical, infrared, microwave and neutrino astronomy and astrophysics, observing potential and evaluation of various sites on Antarctica, atmospheric and space weather, and more from international groups working at Dome A, Dome C, Dome Fuji, and the Jang Bogo, Zhongshan and South Pole stations. Other SCAR AAA members (Zhaohui Shang, Yi Hu, etc.) shared their site testing data and instrumentation technology in the sessions "Polar Meteorology: Short term climate variability" and "Emerging technologies and their applications from the depth of the ocean, to the deep Antarctic fields and space", respectively, aiming to promote data mining and interdisciplinary collaborations within SCAR.

The 7th SCAR AAA topical workshop, held in odd years between the SCAR OSC, will take place in Svalbard, Norway from September 19-21, 2023. There will be 39 people attending and presenting talks in person from more than six countries, with others viewing the talks remotely. Building on the success of the last SCAR AAA meeting held virtually in 2021 and the XXXV SCAR OSC theme (Where the Poles come together), Arctic and Antarctic research were encouraged to attend.

At the 2022 International Astronomical Union General Assembly, a dedicated booth informed the community about the role of SCAR and AAA. Antarctic astronomy projects were highlighted and participated in outreach activities organized by venue.

Updates since 2022 Delegates Meeting

What has been achieved?

Date	Activity
2022	Base and Dome installation of the Antarctic Argentinean Robotic Observatory at Belgrano II Station under the polar circle for optical exoplanets observations
2022	IceCube Upgrade project rebaselined with additional budget and extended timeline to address delays from COVID.
Fall 2023	SCAR AAA meeting to be held above Arctic circle in Svalbard, Norway
2022-23	During the 39th CHINARE, the astronomy projects at Dome A were revived. The site testing instruments at Dome A were maintained and have been working well. A new Starlink system was installed that improved communication for field work.

What lies ahead?

Date	Activity
Austral Summer 2023	Installation of automatic shutters and seal mechanisms of the Antarctic Argentinean Robotic Observatory at Belgrano II Station.
Austral Summer 2023	New acquisition system setting in the Space Weather Laboratory at Marambio Station for Cosmic Rays Flux observations over the polar circle in the Antarctic peninsula.
Austral Summer 2023	The IceCube Upgrade project starts the first of three field seasons at the South Pole that will culminate with installing 7 more strings of light sensors to increase low-energy performance, enhance past and future data fidelity, and detector research and development.
Austral Winter 2024	SCAR Open Science Conference in Chile - Astronomy and Astrophysics session.
2023-24	During the 40th CHINARE, the instruments at Dome A will be serviced again.

Budget

Changes to planned use of funds for 2023 and 2024

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
No Changes				
Total				

Membership

Changes to AAA Leadership

Role	First Name	Last Name	Affiliation	Country	Email	Date Started	Date Term is to End
No changes							

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

SCAR Fellowship Reviewers

*(Please list **at least two people** (name and email address) volunteered by AAA who would be willing to serve as reviewers for the next few years, along with 1-3 keywords on their principal expertise.)*

First Name	Last Name	E-mail	Principal Expertise
Waraporn	Nuntiyakul	waraporn.n@cmu.ac.th	Galactic cosmic rays Solar Cycle Solar-terrestrial interactions
Adriana	Gulisano	adrianagulisano@gmail.com	Space Weather Cosmic Rays Solar-Terrestrial Relationship
James	Madsen	madsen@icecube.wisc.edu	Cosmic Rays Neutrino Astronomy Education and Outreach

Additional Information (optional)

Outreach, communication and capacity-building activities

A budding collaboration between the Wisconsin IceCube Particle Astrophysics Center (WIPAC) and Chiang Mai University (CMU) in Thailand took a grand turn with a visit to the Royal Palace in Bangkok. There, discussions between scientists from WIPAC, a University of Wisconsin–Madison research center and Her Royal Highness Princess Maha Chakri Sirindhorn explored how to increase research opportunities for Thai researchers and technical staff at the IceCube Neutrino Observatory.

The 2nd ThaisCube workshop, a program that developed from a partnership between Chiang Mai University (CMU) in Thailand, the National Astronomical Research Institute of Thailand (NARIT), and the IceCube Neutrino Observatory, was held in Chiang Mai, Thailand on August 8-11, 2023 and attended by 40 high school, undergraduate, and

master's students pursuing degrees in physics, astronomy, mathematics, computer science, engineering, or related fields.

Updates for your group's SCAR web page

(If you do not update your SCAR web page yourself, please provide us with any additional information or changes that you would like us to make to it. If your group has a website external to SCAR, please provide the URL.)

No new updates

Notable Papers

(*Three most notable papers, if applicable – see the example below, which includes a brief statement (shaded) indicating the link to the group.)*

1.Santos, N.A., Dasso, S, Gulisano, A. M. Areso, O. Pereira, M., Asorey, H., Rubinstein. L & for the LAGO Collaboration. 2023. First measurements of periocicities and anisotropies of cosmic ray flux observed with a water-Cherenkov detector at the Marambio Antarctic base. *Advances in Space Reseach.Volume 71, Issue 6, Pages 2967-2976*

A new water-Cherenkov radiation detector, located at the Argentine Marambio Antarctic Base (64.24S-56.62 W), has been monitoring the variability of galactic cosmic ray (GCR) flux since 2019. One of the main aims is to provide experimental data necessary to study interplanetary transport of GCRs during transient events at different space/time scales. In this paper it is presented the detector and the analysis of observations made during one full year.

2. Measuring CMB Spectral Distortions from Antarctica with COSMO: Blackbody Calibrator Design and Performance Forecast. Mele, L., Battistelli E. S., De Bernardis P., Bersanelli M., Columbro. F. Et al. *J.Low Temp.Phys. 209 (2022) 5-6, 912-918*

COSMO is a ground-based instrument to measure the spectral distortions (SD) of the Cosmic Microwave Background (CMB). This paper presents preliminary results of electromagnetic simulations of its reference blackbody calibrator.

3.Observation of high-energy neutrinos from the Galactic plane," The IceCube Collaboration: R. Abbasi et al., Science 380, 6652 (2023), DOI:10.1126/science.adc9818, arXiv:2307.04427

For the first time, an image of the Milky Way using neutrinos—tiny, ghostlike astronomical messengers— with energies millions to billions of times higher than those produced by the fusion reactions that power stars, were detected by the IceCube Neutrino Observatory, a gigaton detector operating at the Amundsen-Scott South Pole Station. IceCube is an active participant, regularly giving multiple presentations at SCAR AAA and SCAR OSC meetings.

4. *Data Release of the AST3-2 Automatic Survey from Dome A, Antarctica.Yang, Xu & Hu, Yi & Shang, Zhaohui & Ma, Bin & Ashley, Michael & Cui, Xiangqun & Du, Fujia & Fu, Jianning & Gong, Xuefei & Gu, Bozhong & Peng, Jiang & Li, Xiaoyan & Li, Zhengyang & Tao, Charling & Wang, Liande & Xu, Lingzhe & Yang, Shi-hai & Yu, Ce & Yuan, Xiangyan & Zhu, Zhenxi. (2023). Monthly Notices of the Royal Astronomical Society. 520. 10.1093/mnras/stad498.*

AST3-2 is the second of the three Antarctic Survey Telescopes, aimed at wide-field time-domain optical astronomy. It is located at Dome A, Antarctica, which is by many measures the best optical astronomy site on the Earth's surface. The data from the AST3-2 automatic survey in 2016 and the photometry results are presented.

5. Machine learning-based seeing estimation and prediction using multi-layer meteorological data at Dome A, Antarctica. Hou, Xu & Hu, Yi & Du, Fujia & Ashley, Michael & Pei, Chong & Shang, Zhaohui & Ma, Bin & Wang, Erpeng & Huang, Kang. (2023). Astronomy and Computing Volume 43, 100710. https://doi.org/10.1016/j.ascom.2023.100710

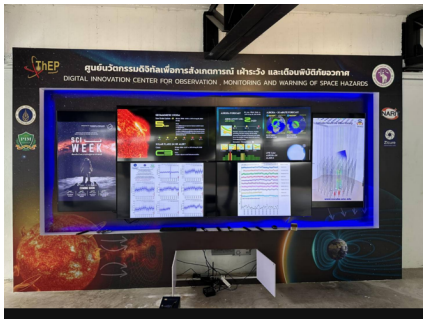
This paper presents a novel machine learning-based framework for estimating and predicting seeing at a height of 8 m at Dome A, Antarctica, using only the data from a multi-layer automated weather stations.

6. The Multi-band Survey Telescope at Zhongshan Station, Antarctica, Chao Chen et al. Monthly Notices of the Royal Astronomical Society, Volume 520, Issue 3, April 2023, Pages 4601–4608, https://doi.org/10.1093/mnras/stad310

This paper presents the Multi-band Survey Telescope (MST) that is the first multicolour simultaneous survey telescope in Antarctica. It adopts a Newtonian telescope structure which is different from other Antarctic telescopes and is matched with a new alignment scheme suitable for the harsh environment of Antarctica.

Other information for publicity purposes

(Please add here details of, or links to any other information we may use for publicity purposes, such as photos, infographics, quotes and layperson's summaries of your research.)

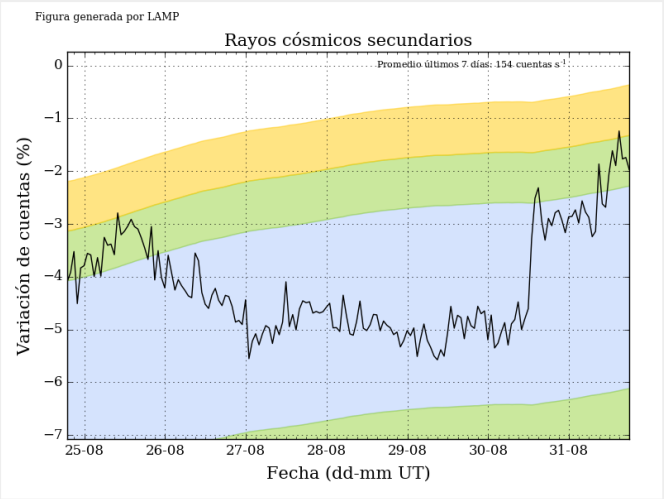


A Space Weather "War Room" is being developed in Chiang Mai, Thailand to monitor and study space weather phenomena and their potential impacts on Earth and technological systems. One primary objective is to explore methods for studying Ground Level Enhancements using the IceTop Tank located at the South Pole. We also utilize neutron monitor data from both Arctic and Antarctic regions to study space weather conditions.

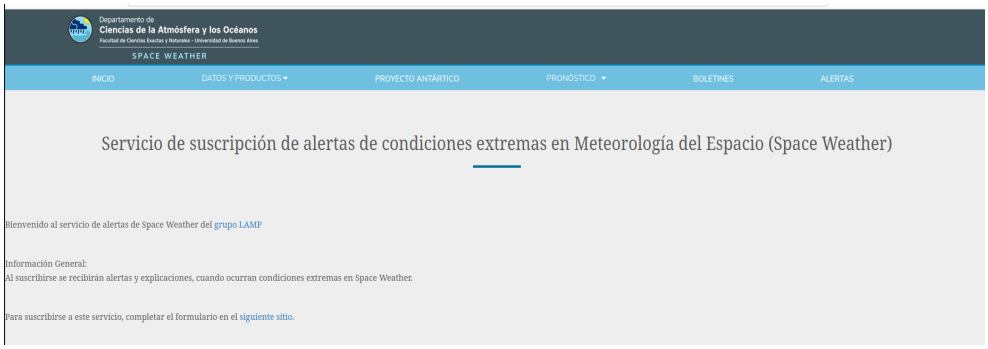
From The Argentinean Program:

Base and Dome installation of the Antarctic Argentinean Robotic Observatory at Belgrano II Station under the polar circle for optical observations of exoplanets.

Cosmic Rays Flux monitoring in quasi real time from Marambio Station for Space Weather purposes at



http://spaceweather.at.fcen.uba.ar/2/r_cosmicos.html



Space weather Alerts by email subscription

Publication of weekly bulletins on Space Weather Conditions at http://spaceweather.at.fcen.uba.ar/2/boletines.html

Summary of the IceCube Milky Way result for the general public by Jim Madsen:

https://theconversation.com/icecube-neutrino-detector-in-antarctica-spots-first-high-energy-neutrinos-emitted-in-our-own-milky-way-galaxy-208743

Any other information or issues you would like to raise
(Please add here any additional information or issues you would like to raise with the SCAR Executive Committee or SCAR Secretariat.)

None!