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**XXXV SCAR Delegates Meeting
Davos, Switzerland, 25-26 June 2018**

Astronomy and Astrophysics from Antarctica

Report Author

Professor Anna Moore, Australian National University, Australia, on behalf of the AAA steering committee

Summary of activities and other important matters

The AAA SRP continues to satisfy the goals of the 2014-2018 operational plan. During the 2016-18 period, AAA convened and supported both a half day science session and business meeting at the SCAR open science conference in Kuala Lumpur. Four members of the steering committee were rotated as previously presented to SCAR ExCom. The fourth AAA workshop was hosted by the National Astronomical Research Institute of Thailand (NARIT) in Chiang Mai, Thailand on July 31- Aug 4, 2017. Approximately fifty participants attended this meeting from all over the globe to present their work in Antarctic Astronomy at this international forum. There was significant participation from the astronomical community of Thailand and the south-east Asia region at this meeting. AAA will convene the community for a science session and business meeting at Polar2018 in Davos. The SCAR AAA website has been significantly updated during this period to produce a web portal for all astronomical researchers to access existing data and most recent publications.

Recommendation

The AAA steering committee kindly request EXCOM and the chief officers consider the submitted proposal by the Antarctic Astronomy and Astrophysics community to create a new SCAR Science Group, called ASTRO Sciences, beginning in 2019 (see Attachment 1).

* 2019/2020 Budget contingent on SG approval

Summary Budget 2017 to 2020

	2017	2018	2019	2020
	Spent	Allocated	Request*	Request*
(US\$)	\$10,289	\$31,711	\$30,000	\$30,000

* 2019/2020 Budget contingent on SG approval



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Progress and Plans

Major Outcomes

- **International meetings/workshops**
Through the generous SCAR funding to AAA, we have hosted eight international workshops and business meetings from 2010 onwards, with roughly one per year. The meetings have enabled hundreds of AAA members from across the SCAR member and non-member communities to collaborate on new projects and initiatives, and for younger researchers to gain exposure within this international community, to name only a few benefits. SCAR AAA has enabled this large and diverse community to meet and plan for a successful future. An updated website with searchable database serves to connect the community across the globe (<http://www.astronomy.scar.org/>).
- **New science**
During the last 24 months AAA has continued to publish highly ranked science. This includes electromagnetic follow-up of the famous neutron star merger GW170817, multi-site observations of one of our closest stars harboring exoplanet/s, Beta Pic, and confirmation of the potential of the high plateau sites of Ridge A and Dome A for performing Terahertz astronomy from the ground.
- **New SCAR communities**
With the generous co-funding from our Thai Antarctic astronomy colleagues, AAA hosted its fourth international workshop in Chiang Mai. This support shows the potential for Antarctic astronomy and astrophysics to help motivate non-member countries to join SCAR, or associate members to convert to full member.

Notable Papers

There have been several hundred papers published in the past 24 months in the area of Astronomy and Astrophysics from Antarctica. The papers below highlight the diversity of the area, and work which has benefited directly from SCAR AAA activities.

- “Optical Observations of LIGO Source GW 170817 by the Antarctic Survey Telescopes at Dome A, Antarctica”, Hu, Lei, et. al., *Science Bulletin*, Vol. 62, No.21, p.1433-1438, 2017. *An optical telescope at Kunlun station at Dome A was able to detect the optical afterglow from this remarkable neutron star merger event, originally detected by gravitational wave detectors.*
- “The δ Scuti pulsations of β Pictoris as observed by ASTEP from Antarctica”, Mekarnia, D, et. al., *Astronomy & Astrophysics*, Volume 608, id.L6, 4 pp. *ASTEP is a 400mm optical telescope at the Dome Concordia station that observed a nearby star called beta Pictoris, known to harbor an exoplanet. The long term observations permitted by this observing location revealed detailed oscillation patterns within this star.*
- “Optical Sky Brightness and Transparency during the Winter Season at



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Dome A Antarctica from the Gattini-All-Sky Camera”, Y. Yang et al, *Astrophysical Journal* (2017), 154, 1. *A joint China-US-Australia investigation into the multi-year optical sky brightness measurements above the Dome A site. The paper formed part of a PHD thesis defence.*

- “IceCube Seeks to Expand”, Francis Halzen and Spencer Klein, CERN Courier 56 (2016) 40-41, no. 6, July/August 2016, “PINGU: A Vision for Neutrino and Particle Physics at the South Pole, IceCube-Gen2 Collaboration: M. G. Aartsen et al, *Journal of Physics G44* (2017) 054006. *This paper details the expansion plans for the IceCube facility, arguably the world’s most advanced astrophysical particle detector.*
- “Terahertz and far-infrared windows opened at Dome A in Antarctica”, Shi, S.-C., Paine, S., Yao, Q.-J., Lin, Z.-H., Li, X.-X., Duan, W.-Y., et al. *Nature Astronomy* (2016), 1, 1. The high plateau site of Dome A, as well as Ridge A, offer exceptional conditions for Terahertz astronomy from the ground. *This paper summarises the observational windows opened up from these sites, and the importance of detecting species such as atomic Carbon.*
- ” The data acquisition system of the Latin American Giant Observatory (LAGO) “Sofo Haro, et. al., *Nuclear Inst. and Methods in Physics Research, A*, Volume 820, p. 34-39.2016.
- ”Typical Profiles and Distributions of Plasma and Magnetic Field Parameters in Magnetic Clouds at 1 AU”. L. Rodriguez, et al., *Solar Physics*, Volume 291, Issue 7, pp.2145-2163.
- “Characteristics of Four Upward-pointing Cosmic-ray-like Events Observed with ANTA”. P.W.Gorham, et al., *Phys. Rev. Lett.* 117, 071101 (2016).

Main Activities

AAA can report the following major activities and progress from the past 24 months:

- **A half-day session on Astronomy and Astrophysics from Antarctica was convened at the SCAR Open Science Meeting in Kuala Lumpur** in August 2016. The oral presentations were heavily oversubscribed so an additional poster session was organized to accompany the session. Additionally, several young researchers presented at the session as a result of travel awards supported by the SCAR AAA budget. A SCAR AAA SRP business meeting was held during the OSC. A large fraction of the steering committee attended this meeting, the last to be chaired by Professor John Storey. Four of the steering committee members were rotated at this meeting as previously planned. The venue of the biannual SCAR AAA workshop was agreed by the committee to be in Chiang Mai, Thailand, following a very strong bid by our colleagues at the National Astronomical Research Institute of Thailand (NARIT). The NARIT hosted workshop was the fourth and last in a long and productive series after Sydney (2011), Sienna (2013) and Hawaii (2015). Finally, the committee discussed the future of Astronomy and Astrophysics from Antarctica post



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2018 and the steps required to gain community input in the process. This subject formed a large component of fourth workshop discussions. The fourth SCAR AAA workshop was hosted by NARIT in Chiang Mai, from July 31 – Aug 4, 2017. The workshop provided an international forum for Antarctic astronomy and astrophysics researchers to present their work, and the SRP allocated a large fraction of its yearly budget to support early career researchers in particular to attend this workshop. The workshop highlighted Antarctic Astronomy in Thailand and their future aspirations. It also provided a convenient forum for networking with a goal to create new ventures with our Thai colleagues.

- **A modernization of the AAA website and home of the Antarctic data repository** began in November 2016 and will be completed end of 2018. The goals of the work are to permit easy searching of the extensive data set contributed by our SRP community over the early stages of the SRP, and to add a new feature to permit researchers to easily access current groups working in Antarctic Astronomy. Early career researchers and researchers from developing Antarctic countries found this extremely beneficial. The breadth of Antarctic Astronomy and Astrophysics research is large, encompassing instruments for particle, neutrino, cosmic rays, and wavelengths including radio, sub-mm, microwave, infrared and optical. As little infrastructure exists around the world to capture and disseminate this information, this was a valuable activity, and highly appropriate for the SCAR AAA SRP to undertake.
- While the SCAR AAA SRP does not fund instrument activities in Antarctica, it has certainly provided a means for international groups to convene, plan and discuss large scale projects. The past two years has seen the announcement from the Chinese government for a 2.5m class optical/infrared telescope (KDUST) and a 5m class sub-mm telescope (DATE5) to be built and located at Dome A, Antarctica. The South Pole Telescope joined the Event Horizon Telescope (EHT) to directly image the regions surrounding the black hole at the centre of our galaxy and that of nearby galaxy M87. The IceCube telescope continues to monitor high energy neutrino events from the heavens.

These are only a fraction of the successful projects in Antarctic Astronomy with announcements over the past 24 months.

Finalization Activities

- The AAA SRP has a little under 7 months remaining and planning for the future beyond 2018 has begun. The community proposal for Antarctic astronomy and astrophysics to become a SCAR Science group from 2019 onwards has been submitted to SCAR and contact with the delegates is underway.
- The SCAR AAA updated website and data link repository will be completed by end of 2018 and will go online shortly thereafter.



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- The AAA SRP will continue to support joint activities in both the Arctic and Antarctica. Over the next few months this includes aiding in the discussion and proposal development for projects at all high plateau sites, including Dome A, Ellesmere Island, Dome C, Dome F and the South Pole. Bringing together interested parties to form collaborations is one of the major outcomes of the AAA workshops and science sessions at the SCAR OSC.
- AAA SRP science and business meetings will be convened during the SCAR Open Science Conference at Davos, Switzerland in mid-2018 and we will be supporting participation from our colleagues from around the world to attend these meetings.
- We will be supporting the SCAR AAA booth at the General Assembly of the International Astronomical Union (IAU) in Vienna, Austria, in August, 2018. Our first SCAR AAA booth appeared at the IAU general assembly in Oahu in 2015 and was a great success.

Expected Final Outcomes

- Since 2010, AAA will have hosted eight international workshops bringing together the Antarctic astronomical and astrophysics community, and enabling young researchers, in particular, to attend via dedicated travel awards.
- AAA has facilitated new collaborations across our international community, and opportunities for those from communities without logistical access to participate in Antarctic astronomy.

Through SCAR funding, AAA has a community website providing access to data products and latest publications from our community.

The AAA community supports a proposal to form a dedicated SCAR Science group specifically to coordinate and develop the activities of the ASTRO Science community.

Budget

Planned use of funds for 2018 to 2020

Month/Year (MM-YY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
01-18	Professional salaries (early career) for AAA website and data portal renovation	\$6,800	Anna Moore	anna.moore@anu.edu.au or james.madsen@uwrf.edu



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06-18	Travel awards for AAA science and business meetings at SCAR OSC 2018, Davos	\$12,000	Details to be provided separately	anna.moore@anu.edu.au or james.madsen@uwrf.edu
08-18	Travel and booth costs for AAA booth support at the International Astronomical Union General Assembly, Vienna, August 2018	\$9,000	Details to be provided separately	anna.moore@anu.edu.au or james.madsen@uwrf.edu

Briefly describe funds usage and desired results

2018:

- \$6,800 for (continued) professional salaries (early career) for developing the AAA website portal, with benefits as described above in the 2017 line item
- \$12,000 to support attendance from the Antarctic Astronomical community to attend the science and business meetings of the AAA SRP during Polar2018 in Davos, 2018
- \$9,000 to support the SCAR AAA booth and outreach at the General Assembly of the International Astronomical Union (IAU) in Vienna, Austria, 2018

Percentage of the budget to be used for support of early career researchers

2018: 60%

Percentage of the budget to be used for support of scientists from countries with developing Antarctic programmes

2018: 25%

Linkages

Direct support from outside organisations

- Our colleagues at the National Astronomical Research Institute of Thailand (NARIT) graciously hosted the AAA fourth workshop. NARIT contributed around 284,000 THB for 4 days venue, lunch, break, dinners (welcome, cultural, royal project), local transportation local, excursion, bag, badge and accessories. This amount would have normally been covered by the SRP annual budget. This meant we were able to



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augment other activities; for example, to be much more ambitious in our development of a new website and data portal for the Antarctic astronomical community.

- Many steering committee members have travel funds supported or co-supported by other means, including institutional contributions. We will not list each one individually here, but the total amount is at least \$20,000.

Major Collaborations

The SCAR AAA has close association with the International Astronomical Union, and logistical agencies such as the Polar Research Institute of China (PRIC). The IceCube Collaboration has a representative on the steering committee and actively promotes SCAR AAA.

Outreach and Capacity Building

The SCAR AAA SRP is committed to expanding its reach and diversity. This starts with recruiting and appointing members to the steering committee from a wide range of countries and institutions, with a deliberate effort to include early career scientists. The twelve steering committee members come from eight different countries and five continents. The AAA workshops, held bi-annually, are fundamental part of AAA activities and provide an opportunity to build capacity. The workshop in Thailand continued the tradition of the last three---all have been held on a different continent with significant percentage of the budget going to support travel awards. This allows those with interest in doing research in Antarctic but limited funds to attend.

The fourth SCAR AAA workshop, hosted jointly with NARIT, attracted a significant number of Thai participants. The attendees ranged from those working with large, established international projects to single investigators hoping to establish research Antarctic astronomy or astrophysics research programs. Working in Antarctica introduces an extra dimension of difficulty. The SCAR AAA SRP is a great starting point to make connections for both new and established researchers. For example, steering committee member Madsen worked with an early career Thai scientist who submitted a proposal for a SCAR fellowship that would allow her and two undergraduates to work for a summer in the USA on data from Antarctica, and develop ideas for continued Antarctic research.

In addition to the workshops, SCAR AAA has a continual on-line presence through its website. These resources are undergoing significant revisions to better serve science and outreach goals. Opportunities for early career scientists, such as SCAR fellowships mentioned above, will be promoted. The data portal will allow access to Antarctic astronomy and astrophysics research as well as highlighting the unique opportunities the continent provides for exploring the universe.

Going forward, we are working to leverage resources to increase astrophysics and



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astronomy research in Antarctica. Having support internally from the science community is essential for establishing new facilities such as the APIO. SCAR AAA will continue to support this effort. One way we will reach beyond current Antarctic researchers is by attending and staffing a booth at the International Astronomical Union Astronomy 2018 meeting in Vienna, Austria. The 2018 SCAR OSC meeting in Switzerland will be another venue where SCAR AAA will host a science session and members will also participate in outreach and communication sessions that promote SCAR AAA activities to a broader audience.

In Latin America, we are encouraging Argentinean young researchers to join APECS and get more involved in the Antarctic Astronomy activities.

The LAGO collaboration is generating a series of on-line courses within the collaboration to perform cosmic rays simulations among the nodes (including the Antarctic one) to have a critical mass of Latin American researchers in high energy Astronomy and cosmic rays studies.

SCAR Fellowship Reviewers

- Professor Anna Moore, anna.moore@anu.edu.au
- Professor James Madsen, james.madsen@uwrf.edu

Requests to the Secretariat - None



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Membership

Leadership

Role	First Name	Last Name	Affiliation	Country	Email	Date Started	Date Term is to End
Chair of AAA steering committee	Anna	Moore	Australian National University	Australia	anna.moore@anu.edu.au	11-14	12-18
Member of AAA steering committee*	Jennifer	Adams	Univ. of Canterbury	New Zealand	jenni.adams@canterbury.ac.nz		12-18
Member of AAA Steering committee	Michael	Ashley	Univ. of New South Wales	Australia	m.ashley@unsw.edu.au		12-18
Member of AAA steering committee	Elia	Battistelli	La Sapienza, Roma	Italy	elia.battistelli@roma1.infn.it		12-18
Member of AAA steering committee (APECS Representative)	Jennifer	Cooper	Cornell/University of Kansas	United States	jrc323@cornell.edu		12-18
Member of AAA steering committee	Nicolas	Crouzet	Instituto de Astrofísica de Canarias	Spain	ncrouzet@iac.es		12-18



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Member of AAA steering committee	Adriana	Gulisano	Instituto Antartico Argentino	Argentina	adrianagulisano@gmail.com		12-18
Member of AAA steering committee	James	Madsen	Univ of Wisconsin	United States	james.madsen@uwrf.edu		12-18
Member of AAA steering committee	Naomasa	Nakai	Univ of Tsukuba	Japan	nakai@physics.px.tsukuba.ac.jp		12-18
Member of AAA steering committee	Zhaohui	Shang	NIAOT, Nanjing	China	zshang@gmail.com		12-18
Member of AAA steering committee	Charling	Tao	Tsinghua Uni	China	tao@cppm.in2p3.fr		12-18
Member of AAA steering committee	Lifan	Wang	Texas A&M	United States	lifanwang@gmail.com		12-18



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Attachment 1

ASTRO Sciences – A proposal for a SCAR Science Group dedicated to Antarctic Astronomy



Credit: ESA/IPEV/PNRA

ASTRO Sciences

**A proposal for a SCAR Science Group
dedicated to Antarctic Astronomy**

May 2018



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EXECUTIVE SUMMARY

Antarctica offer a unique platform for astronomical science. For decades, astronomy and astrophysics have been performed there with great success. While the experimenters' goals have been diverse, Antarctic astronomers and astrophysicists share an appreciation of the unique geographical and environmental features of the southern continent; features which permit new science that would otherwise be impossible in temperate climates.

Based on this success, now is the right time for the Antarctic astronomy and astrophysics community to be elevated to a dedicated SCAR science group. The proposed science group, **ASTRO Sciences**, is based on the firm foundation laid by the long-standing Astronomy and Astrophysics from Antarctica Scientific Research Program of the Physical Sciences group

The proposal is fully endorsed by the Antarctic astronomy and astrophysics community. Establishing ASTRO Sciences is the needed next step in AAA's journey and to catalyse the international community, and fully realise its potential, which requires a higher profile, longer term entity within SCAR.

The goals of ASTRO Sciences, as laid out by the community in late 2016, include

- A strong emphasis on multi-national projects to enable cutting edge science not possible by one member alone,
- New science enabled by coordination of instrumentation at multiple stations,
- New science enabled by linking ice-based and space-based experiments,
- Coordinated approaches to the polar regions as windows to the sky in the era of low cost space missions and associated traffic management needs,
- Using astronomy and astrophysics as a way of engaging countries that are currently not members of SCAR,
- Maintaining and increasing synergistic links with our Arctic counterparts, and
- Increased public awareness of Antarctic astronomy activities.

The astronomical and astrophysical sciences are a powerful motivator for the initiation of new members into SCAR (e.g. Thailand) and new collaborative partners to the Antarctic astronomy community (e.g., the Republic of Korea). We look forward to working with SCAR in building global membership in the future.

On behalf of the global Antarctic astronomy community, we kindly request support for this initiative.

Sincerely,

The SCAR AAA SRP Steering Committee

Assoc. Prof. Jenni Adams	New Zealand
Prof. Michael Ashley	Australia
Dr. Elia Battistelli	Italy
Ms. Jennifer Cooper	USA

Dr. Nicolas Crouzet	France
Dr. Adriana Gulisano	Argentina
Prof. James Madsen (co-chief officer)	USA
Prof. Anna Moore (chief officer)	Australia
Prof. Naomasa Nakai	Japan
Dr. Zhaohui Shang	China
Prof. Charling Tao	China
Prof. Lifan Wang	USA/China

Introduction

Astronomy and Astrophysics from Antarctica ([AAA](http://www.astronomy.scar.org), www.astronomy.scar.org), became a Scientific Committee on Antarctic Research (SCAR) Science Research Program (SRP) in 2010. The group is currently led by a steering committee with twelve members from eight different countries and five continents.



Figure 1: The SCAR SRP “Astronomy and Astrophysics from Antarctica (AAA)” has met as an international group every year since the formation of the SRP in 2010. The last meeting of the SRP will be in Davos, Switzerland during POLAR2018.

The mission of the AAA SRP is to coordinate astronomical and astrophysical activities in Antarctica to ensure the best possible outcomes from international investment in Antarctic, and to maximize the opportunities for productive interaction with other disciplines.

The chief officer of the AAA steering committee is Professor Anna Moore, Director of the Advanced Instrumentation Technology Centre at The Australian National University. Networking and capacity building are essential AAA activities. To sustain these efforts, support from SCAR and local hosts have enabled four geographically dispersed biannual AAA workshops held in odd calendar years (2011: Sydney, Australia, 2013: Siena, Italy, 2015: Hawaii, USA, and 2017: Chiang Mai, Thailand) and have been well-attended with very wide international representation

During the even calendar years, the AAA steering committee has met prior to SCAR Open Science Conference meetings and organized productive oral and poster sessions with similar numbers of attendees representing ten or more countries (2018: Argentina, Australia, Austria, China, Columbia, France, Germany, Italy, Japan, New Zealand, Spain, Switzerland, Thailand, and USA).

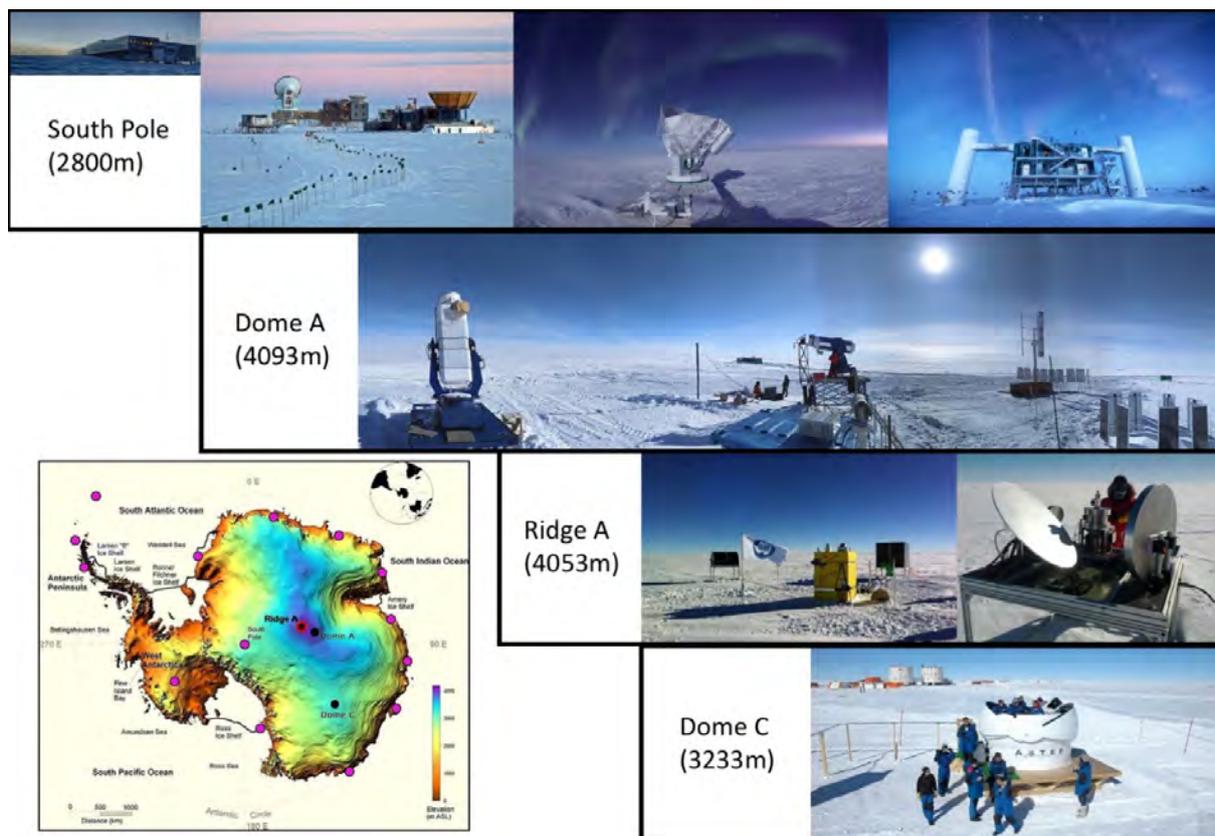


Figure 2: A selection of the on-going Astronomical experiments operating on the high Antarctic plateau. Further Antarctic Astronomy infrastructure is located in Antarctica at Dome F, and the coastal bases (primarily balloon launches), and in the Arctic including Ellesmere Island, Canada and Greenland.



SCAR AAA SRP

The SCAR AAA SRP began with four working groups: 1) Site testing, validation and data archiving, 2) Arctic site testing, 3) Science goals, and 4) Major new facilities. In addition to giving a voice to the polar astronomy and astrophysics community, the groups did important work measuring metrological and atmospheric conditions to establish the viability of sites for research. The results of these studies and other measurements are collected in a searchable, regularly updated, [database](#) of over 300 scientific papers by AAA. AAA has also maintained a regularly updated website with Antarctic astronomy news, resources and links.

Currently, AAA is one of two SRPs in the Physical Sciences Group, along with Antarctic Climate Change in the 21st Century - AntClim21. The majority (11 of 13) of the Physical Sciences Action and Expert Groups involve climate and/or environmental studies.

The need for ASTRO Sciences

While the environment is a unifying factor for all research activities in Antarctica, the focus of the AAA on ***Antarctica as a platform*** to study the Universe is fundamentally different.

While polar astronomers share the goals of observing objects in space, the range of topics and techniques is quite broad, ranging from microwaves, to infrared and optical astronomy, to high energy neutrinos and cosmic rays. Instruments and observing sites also vary, from ground-based instruments that can be brought in tested and complete, to major installations that require multiple seasons to construct, to balloon-based campaigns.

The last decade has seen the completion of two major astrophysics projects at the South Pole; the IceCube Neutrino Observatory, and the South Pole Telescope. These projects have demonstrated that the challenging logistics and extreme weather conditions of the Antarctic plateau can be overcome. More recently, infrastructure has been installed at the Chinese Kunlun station at Dome A, and the French/Italian Concordia station at Dome C with the primary purpose of Astronomy and Astrophysics.

The opportunities for unique science are incredible, ranging from studies of the earliest epochs of the Universe through measurements of the cosmic microwave background radiation, to establishing and instrumenting viewing sites with unmatched performance for infrared and optical astronomy, to building next generation instruments to capture astrophysical neutrinos from the most powerful cosmic engines and extreme astrophysical environments. The experiments are not using Antarctica as “just another observing site”, but as by far the best place on earth for some types of astronomical observations.

Most of these activities require significant investments that the AAA Science group could help coordinate to ensure best use of resources and share expertise with building, operating, and maintaining equipment in the harsh climate.

We believe that the vitality of the AAA SRP, along with the diversity and breadth of activities accelerating into the future, merits the establishment of a new SCAR Science Group.

 <h1>ASTRO Sciences</h1>		
<h2>Science</h2> <ul style="list-style-type: none"> • Facilitate larger scale international projects (e.g. next gen. CMB, FIR, IR etc.) • Investigate new science from multi-base applications (e.g. THz Interferometry, 100% temporal coverage) • Investigate Antarctica as a window to the skies for satellite traffic management • Enable wider scale data sharing • Ensure SCAR is on every publication 	<h2>Collaboration</h2> <ul style="list-style-type: none"> • Improve access and awareness of projects with strong emphasis on non-SCAR member communities • Enable knowledge sharing between member and non-member communities • Create YouTube channel dedicated to knowledge dissemination • Bring researchers from bases closer in contact, especially those deploying with experiments 	<h2>Outreach</h2> <ul style="list-style-type: none"> • Build Antarctic Astronomy globally e.g. in Latin America • Provide coordinated outreach on international stage • Raise public awareness internationally • Provide updates/alerts/twitter feed

Figure 3: The goals of the SCAR ASTRO Sciences group span science, collaboration and outreach activities.

Horizon 2020

The Horizon 2020 report encapsulates the driving science questions for the astronomical sciences. Contained within the section “NEAR EARTH SPACE AND BEYOND EYES ON THE SKY”, these questions are:

Q69. What happened in the first second after the Universe began?

Q70. What is the nature of the dark Universe and how is it affecting us?

The answers to these questions require ambitious solutions. Next generation cosmic microwave background experiments probe the very early Universe immediately after the Big Bang. Thermal infrared telescopes obtain exquisite sensitivity, due to the cold atmosphere in Antarctica, and can unveil the dark Universe to show its riches, such as the direct detection of supernovae from the first stars formed in the Universe. Long baseline terahertz interferometers, ideally suited for Antarctica given the ultra-low water content and stability of the atmosphere, can probe dusty regions and search for the building blocks of stellar systems.



The next steps to solve some of the biggest questions in astronomy require multi-partner collaborations and accelerated coordination between existing infrastructures. This is where the SCAR ASTRO Sciences group can be uniquely positioned to facilitate such collaborations.

ASTRO Sciences' Goals

During the fourth SCAR AAA SRP workshop, hosted by our NARIT colleagues in Chiang Mai in August 2016, the polar astronomy community were consulted on the most critical goals of a potential ASTRO Sciences group. The requests broadly fall into three categories: Science, Collaboration and Outreach, as expanded in Figure 3. We introduce these themes below, as identified by the community.

Science: In addition to providing an international foundation for collaborative teams to tackle Horizon 2020 grand questions, ASTRO Sciences can offer at least three further goals that are eminently suited for a SCAR expert or action group. These are (i) investigate the applicability of polar regions as windows to the sky for space based applications, such as global satellite traffic management; (ii) maximise the scientific productivity of all polar deployed experiments by reaching out to other communities that can participate in data reduction and; (iii) by raising Antarctic astronomy to a new level, ensure as many astronomy research papers as possible acknowledge SCAR.

Collaboration: Several goals fall under the theme of collaboration, including increased knowledge dissemination between researchers from different communities and bases so as not to reinvent the wheel, increased contact especially before and during deployments, and reaching out to communities interested in polar astronomy but with currently limited access.

Outreach: Communicating polar astronomy to the public and, in particular, the younger generation of researchers worldwide, was a strong message from the community. With the profile and elevation of a SCAR science group, ASTRO Sciences can provide a coordinated outreach program using social and local news media, while tapping into existing outreach programs targeted for specific communities to get accelerated quickly.



Responsibilities

SCAR Science Group Responsibilities	AAA SRP	Astro Sciences
Sharing information on disciplinary scientific research being conducted by national Antarctic programmes	✓	✓
Identifying research areas or fields where current research is lacking		✓
Coordinating proposals for future research by national Antarctic programmes to achieve maximum scientific and logistic effectiveness		✓
Identifying research areas or fields that might be best investigated by a SCAR Scientific Research Programme and establishing Scientific Programme Planning Groups to develop formal proposals to the Executive Committee		✓
Establishing Action and Expert Groups to address specific research topics within the discipline	✓	✓

Figure 4: ASTRO Sciences fulfils all five responsibilities set by SCAR for a science group. The AAA SRP is included for reference and, as an SRP, is expected to fulfil only a portion of requirements.

Budget and timeline

The requested budget for the SCAR ASTRO Sciences group is in line with existing Science Groups: around \$30k/yr to establish priority action and expert groups. As with the AAA SRP, we expect a high degree of financial leveraging across the community towards this international effort.

The current AAA SRP committee will establish the ASTRO Sciences leadership team in late 2018, with action and expert groups beginning start of Jan 2019, based on topics presented above.

Future ASTRO Science SRPs will be competed on an as-needed basis.