

Report on Space Science related activities: July 2015 – June/July 2016

02 July 2016

1. Introduction

The abstracts received within the Space Science division for SAIP 2016 were 38 of which 28 were selected for oral presentations. Out of the oral contributions, 11 and 4 are for PhD and MSc students respectively. This is a good situation for this field. We will be joined by 6 University of Michigan, USA students who will all give posters at SAIP. We managed to raise some amount of money for student prizes (Astrophysics and Space Science Division) in addition to the funds (R7500) kindly made available by SAIP. Our sponsors this year were Centre for Space Science Research, NWU; Prof Stefan Ferreira (R5000), Hartbeeshoek Radio Astronomy Observatory; Prof Ludwig Combrink (R5000), Denel Dynamics, SpaceTeq; Mr Patick Ndhlovu (R5000), South African Astronomical Observatory, Prof Ted Williams (R3000), South African National Space Agency, Space Science; Dr Lee-Anne McKinnell (R3000). With exception of Denel Dynamics, the other sponsors always support this division and we are grateful.

A call has been made for nominations of Astrophysics and Space Science co-Chairs and Treasurer (deadline of 30 June) and by the time of compiling this report, no nominations had been received.

Below are the activities which have been going on in different space science groups within the country. The following activities are not exhaustive as some other groups did not contribute or respond to emails calling for contributions. Nevertheless, the community remains vibrant and active in student development/supervision, research and instrumentation deployment among others.

2. Centre for Space Science Research, NWU:

- Unfortunately during 2015 one of our senior members and NRF A-rated researcher, Prof Harm Moraal, passed away. His leadership within the CSR and also both nationally and internationally will be greatly missed.
- Prof Adri Burger serves as member of International Union of Pure and Applied Physics (IUPAP) Commission C4 for Cosmic Rays.
- Prof Ferreira serves as vice-chair for sub-commission D1 (Heliosphere) of the Committee on Space Research (COSPAR) and was admitted to the Academy of Science of South Africa (ASSAf).
- The Application in Physics group under the leadership of the late Prof Harm Moraal and Drr Helena and Paulus Kruger made significant progress concerning our mini-neutron monitor project. Five of our mini neutron monitors are still in operation: one at the German Antarctic station Neumayer, one on the German research vessel Polarstern, two at the Finnish-Italian station at Dome C in Antarctica, and one in Mexico. There still is an international interest in our mini neutron monitor program and improvements on the electronics were done in 2015.
- Prof Marius Potgieter is chairperson of the SA National Committee for COSPAR and the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP) and represents SA on the COSPAR Council. He is also member of the COSPAR Publication Committee, SCOSTEP Awards committee, the International Steering Committee on Space Weather, the SA National Institute for Theoretical Physics. Prof Potgieter was also member of the Duggal Award Committee for Young Researchers at the (International Cosmic Ray Conference) and was also member of the Organizing and Program

Committee of the workshop on Solar Energetic Particles (SEP), Solar Modulation and Space Radiation: New Opportunities in the AMS-02 Era, Hawaii, 2015. Prof Potgieter is also member of the Organizing and Program Committee of the 28th International Conference on Computational Physics (CCP2016) to be held from 10-14 July 2016 in Centurion, Gauteng, South Africa.

- Dr DuToit Strauss received a 4 month Fullbright visiting scholar award for post-doctoral research in Space Science in Huntsville, USA.

3. SANSA Space Science

Workshops, Seminars and Conferences

- Organised the European Incoherent Scatter - 42nd annual Atmospheric Studies by Optical Methods (EISCAT-42AM) conference in September 2015 in Hermanus with 45 participants.
- The Space Weather Camp was organised between 22 June – 01 July 2016 In Hermanus. This camp brought together 32 students from Germany, South Africa and USA and the lecturers came from the 3 respective countries. There were 7 non-SANSA lecturers who came from North-West University, UKZN; USA and Germany.
- Introduction to Space Physics January Summer School: 1-6 February 2016; About 20 students from the National Astrophysics and Space Science Programme (NASSP) Honours class.
- 2016 May: Advanced space weather course for industry provided to DGI clients took place on 9 – 13 May 2016 and was coordinated by the space weather team

New projects/instrumentation.

- 2015 saw the start of the new three year funding cycle from the NRF through the SANAP programme. The SuperDARN HF Radar hardware has been running well since the digital upgrade in 2014, so the focus for next three years will be to begin the development of new operational modes and enhanced capabilities for the radar to support some new and innovative science.

Operating an advanced instrument was not without its challenges in 2015. During the autumn season, the radar was subjected to some very strong and sustained winds, which caused some damage to the main and secondary arrays. This resulted in the radar being switched off for an extended period of time towards the end of 2015.

During the summer relief voyage we completed critical maintenance on the antenna arrays and replaced all the stay ropes as well as several antenna elements, which were showing signs of deterioration. Alongside the other other routing maintenance tasks, we completed two upgrades to the hardware, which included an upgraded High Power Switch circuit, controlled by a CPLD, and an Active Current Limiting Circuit to the DC Power Supply to control the charging of the capacitor banks.

Two new Engineering Students from the University of Cape Town joined the team and will be working on Master's level projects for the radar. One project focuses on enhancing the operational mode of the radar to include spectral riometry measurements and the other project will focus on a technique to calibrate the interferometer on our digital receivers.

One new Engineering Student from the Cape Peninsula University of Technology joined the team and will also be working towards a Master's degree by designing an HF beacon that will be capable of being deployed in a remote area of Antarctica and operating unattended for an entire year. The signals from the HF Beacon will be used in propagation studies using the SuperDARN radar as the receiver.

- New optical research facility deployed to Sutherland in May 2016.
- New research projects include: (i) Deployed Scanning Doppler Imager to south pole for thermospheric wind observations, (ii) first sprite observations in South Africa from Sutherland, (iii) world first observations of thermospheric neutral density using a SuperDARN radar, (iv) world first multi-spectral observations of the anti-black auroras.

Courses

SANSA Space Science continues to be actively involved in the National Astrophysics and Space Science Programme (NASSP) offered by University of Cape Town in conjunction with a number of partner institutions.

Space Science courses given by SANSA researchers include Magnetohydrodynamics, Space Weather; Time Series and Data Analysis offered at MSc level; and Electrodynamics at Honours level.