

DIVISION XII / COMMISSION 46 / PROGRAM GROUP COLLABORATIVE PROGRAMMES

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TRIENNIAL REPORT 2006 - 2009

1. Introduction

The working group is pursuing activities co-organized and/or co-sponsored by UN, ESA, NASA, JAXA, UNESCO, COSPAR, IAU and others for the world-wide development of basic space science.

2. COSPAR Workshops for Capacity Building

The IAU is pleased to have been co-sponsor of the following COSPAR Capacity Building Workshops.

2.1. Sinaia, Romania, 4–16 June 2007. Solar-Terrestrial Interactions (STIINTE)

This Workshop, organized by Joachim Vogt and Octav Marghitu, was dedicated to the analysis of data from multi-satellite space missions such as *Cluster*. It was attended by 24 very motivated PhD students and post-docs coming from Central and Eastern Europe: Romania, Hungary, Bulgaria, Czech Republic, Poland, Ukraine, Russia, Armenia, and Georgia. The scientific programme focused on various aspects of multi-satellite missions, ranging from data analysis and instrument design to kinetic modeling, the analysis of boundaries, and the analysis of auroral processes. After a first and already quite intensive week, the work culminated in the preparation of scientific projects by five teams. Each team had to address a specific problem in magnetospheric physics, leading to very intensive team-work and providing an excellent opportunity for the students to interact, put together their competences and apply what had been learned. On the last day of the school, each team defended its project to a panel of senior scientists who were participating at the simultaneous *Solar Terrestrial Interactions from Microscales to Global Models* (STIMM-2) meeting. The Workshop took place in the framework of the *Plan for European Cooperating State* (PECS) agreement between Romania and ESA, which is designed to prepare for full Romanian membership of ESA.

2.2. Montevideo, Uruguay, 23 July – 3 August 2007. Planetary Science

In recent years, the community of scientists working in planetary sciences in Latin America has been growing. Collectively, it was decided to pursue a new step in the academic

development of this community by promoting the use of data from planetary space missions in its every day research. This Workshop, organized by Gonzalo Tancredi, the first in the series related to planets and small bodies of the Solar System and devoted to the use of planetary missions data bases, was designed to meet this objective. It focused on missions to comets, asteroids, satellites, rings and planets, like Mars. The participants worked for two weeks with real data from the missions and ideally started a research project with that data that they could continue after returning to their home institute.

*2.3. Alexandria, Egypt, 19 January – 1 February 2008.
X-ray Astronomy using Chandra, XMM/Newton and Swift*

This Workshop, organized by Alaa Ibrahim and Peter Willmore, took place in the prestigious new library of Alexandria, the first activity of this nature to take place in the region. The workshop activities were attended by the science minister, Prof. Hany Helal, the deputy minister Prof. Maged El Sherbiney and the president of Egyptian Academy of Science Prof. Tarek Hussein who chaired the opening session and the closing ceremonies, reflecting a recent decision to strengthen astronomy in Egypt. 31 participants from Egypt, Morocco, Turkey, Nigeria, South Africa, Ukraine, and India were admitted to the full programme while 5 more from local institutions were offered two-day participation. There was a public outreach day during which 100 high school students from Cairo and Alexandria attended a planetarium show and three public lectures. The program consisted of morning lectures and afternoon practical computer sessions. After the first few days the students started to work on research projects and they presented their results in a poster session at the end.

2.4. Kuala Lumpur, Malaysia, 1–14 June 2008. Space Optical and UV Astronomy

The programme of the Workshop, organized by Martin Barstow, included lectures on a range of topics in UV and optical astronomy, on-line data products and data processing pipelines, data reduction and analysis and analysis software, data archives, search for targets and display quick-look data for inspection purposes. Participants carried out a major project and also produced a draft guest observer proposal. A total of 30 student participants and 8 lecturers took part. The former included 9 from Malaysia, 9 from India, 4 from China, 3 from Indonesia 2 from Iran, 2 from Vietnam and 1 from Pakistan. One of the IAU's *International Schools for Young Astronomers* was held in Malaysia in 2007. The COSPAR workshop was intended to build on this as part of a general plan to strengthen Malaysian astronomy. A number of the Malaysian participants were in the early stages of research degree programmes, so their supervisors took part in the formulation of their project topics with the workshop lecturers and in discussion of possible follow-up activities after the workshop.

3. International Heliophysical Year 2007: astrophysics and space science

In 2007, a number of major anniversaries occurred, among them the 50th anniversary of the International Geophysical Year (IGY 1957), the launch of Sputnik 1, and the 50th session of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOP-UOS). Particularly IHY 2007 is an opportunity to: *(i)* advance the understanding of the fundamental heliophysical processes that govern the Sun, Earth, and heliosphere; *(ii)* continue the tradition of international research and advancing the legacy of IGY 1957; and *(iii)* demonstrate the beauty, relevance and significance of space and Earth science to the world (<ihy2007.org>, <www.unoosa.org/oosa/en/SAP/bss/ihy2007/index.html>).

In preparation of IHY 2007, UNOOSA, in cooperation with ESA, NASA, JAXA, COSPAR, IAU, and the IHY Secretariat, held international Workshops in:

- United Arab Emirates in 2005, <www.ihy.uae.ac.ae/>
- India in 2006 www.iiap.res.in/ihy/>
- Japan in 2007 <solarwww.mtk.nao.ac.jp/UNBSS_Tokyo07/>
- Bulgaria in 2008 <www.stil.bas.bg/UNBSS-IHY/>

The starting date of IHY 2007 was 19 February 2007. On that date, during the session of the Scientific and Technical Subcommittee of UNCOPUOS, the IHY kick-off included an IHY exhibit, press briefing, and an opening ceremony in the United Nations Office Vienna (<www.lesia.obspm.fr/IHY/kickOFF/index.html>). IHY regional coordinators, Steering Committee members, and Advisory Committee members participated in the IHY kick-off event. The Austrian Academy of Sciences hosted a one-day symposium on IHY 2007 in Vienna on 20 February 2007.

The 2009 Workshop will be hosted by South Korea (<ihy.kasi.re.kr/meeting.php>). This workshop will also cover thematic areas as pursued by the *International Year of Astronomy 2009* (<www.astronomy2009.org/index.php/?option=com_content&view=article&id=112>).

Results on all above workshops have been made available, free of charge, on websites, in proceedings, UN documents, and reports in the international literature.

4. Centre for Mathematical Sciences, India: space science and mathematics

The Working Group is pursuing activities co-organized and/or co-sponsored by India and other nations for holding schools on the application of mathematical methods to astrophysics and space science. Such Schools have been organized since 1995 at the Centre for Mathematical Sciences, India. In 2006 and 2007, the cycle of five SERC Schools was successfully concluded. In 2009, a new cycle of five SERC Schools will start providing methods of mathematics applied to astrophysics and space science.

Centre for Mathematical Sciences (CMS) was established in 1977 and registered in Trivandrum, Kerala, India as a non-profit scientific society and a research and training centre covering all aspects of Mathematics, Statistics, Mathematical Physics, Computer and Information Sciences. Since 1977 CMS had executed a large number of research and training projects for various central and State governmental agencies.

CMS has a Publications Series (books, proceedings, collections of research papers, lecture notes etc; current number is 36), a Newsletter of two issues per year (current number is Volume 11, Number 1, 2008), a Modules Series (self-study books on basic topics; current number is 6) and a Mathematical Sciences for the General Public Series (current number is 2). The latest book from CMS is: A. M. Mathai & H. J. Haubold (2008), *Special Functions for Applied Scientists* (New York: Springer).

In 2002 CMS Pala Campus was established in a one-floor finished building donated to CMS by the Diocese of Palai in Kerala, India. In 2006, Hill Area Campus of CMS was established. The office, CMS library and most of the facilities are at CMS Pala Campus. The other campuses, namely, the South Campus (or Trivandrum campus) and the Hill Area Campus have occasional activities and libraries are being developed at South and Hill Area campuses also.

Starting from 1985, Professor Dr. A. M. Mathai of McGill University, Canada, is the Director of CMS. After taking early retirement in 2000, Professor Mathai is spending

most of time at CMS and directing various CMS activities in an honorary capacity. CMS library is being built up by using the books and journals donated by Professor Mathai and colleagues, friends and well-wishers in Canada and USA. CMS has the best library in Kerala, India, in mathematical sciences.

In 2006 - 2007 the Department of Science and Technology, Government of India (DST), gave a development grant to CMS. Thus, starting from December 2006 CMS is being developed as a DST Centre for Mathematical Sciences. DST has similar centres at three other locations in India.

From 1977 to 2006 CMS activities are carried out by a group of researchers in Kerala, mostly retired professors, through voluntary service. Starting from 2007, DST created full time salaried positions of three assistant professors, one full professor and one Liaison Officer. They are at CMS Pala Campus. DST approved up to 15 junior research fellows (JRF) and one senior research fellow (SRF). They are the current PhD students at CMS Pala Campus. They will receive their PhD degrees from Mahatma Gandhi University (MG University) in due course, after fulfilling the residence requirement of three years. All the JRFs and SRF have got papers accepted/published in international refereed journals within one and a half years.

CMS conducts a five-week research orientation course called SERC Schools every year. The main theme for the first sequence of five schools was Special Functions and Functions of Matrix Argument and Their Applications. The theme for the second sequence of five schools is multivariable and matrix variable calculus, statistical distributions and model building. The second school in the second sequence will run in 2009 from 20th April to 22nd May 2009 at CMS Pala Campus. The total number of seats in each School is 30. International participation is allowed provided the candidates come with their own return air tickets and give an undertaking to attend all lectures, all problem-solving sessions and take all examinations (usually one examination in each week, thus five written examinations and one quiz). The local hospitality and study materials are given free of charge by CMS. All expenses are paid by DST for the nationally selected 30 participants in each School.

CMS has another activity at the undergraduate level. There are four courses in each year covering all undergraduate mathematics. Thirty motivated students are selected by CMS from among the names recommended by the college Principals in Kerala. Each course is of 10-days duration of around 40 hours of lectures and 40 hours of problem-solving sessions. Again, all expenses of the selected participants are met by DST. Apart from these two regular activities there are lecture series of three days and six days duration by international visiting faculty.

There are three categories of visitors: distinguished international visitors, distinguished national visitors, faculty and students from other institutions, colleges and universities in India. There is no provision to pay for international air tickets of the visitors. For all visitors, their local hospitality is provided free of charge by CMS. Those who wish to visit CMS Pala Campus need to write to the Director of CMS, giving the approximate dates and time that they would like to visit. The Director will then issue a formal invitation as per the availability of local accommodation. The recent, 2008, international visitors include Dr. A. A. Kilbas of Belarussian University, Belarus, Dr. Hans J. Haubold of the Office for Outer Space Affairs of the United Nations, Vienna, Austria, Dr. Serge B. Provost of the University of Western Ontario, Canada, and Dr. Peter Moschopoulos of the University of Texas at El Paso, USA.

5. Distribution of information material to the general public

The Working Group was selected as a focal point for world-wide distribution, through UN information dissemination channels, of the DVD titled *Hubble: 15 Years of Discovery*, produced by the European Space Agency (<www.spacetelescope.org/projects/anniversary/index.html>), IHY 2007 information material produced by the United Nations Office for Outer Space Affairs, and the IYA 2009 information brochure, produced by the International Astronomical Union, <www.astronomy2009.org/resources/brochures/detail/brochure03.en>.

Hans J. Haubold
chair of the Working Group