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DIVISION II. Sun and Heliosphere

PRESIDENT: David F. Webb
VICE-PRESIDENT: Donald B. Melrose
ORGANIZING COMMITTEE: Arnold O. Benz, Thomas J. Bogdan, Jean-Louis Bougeret, James A. Klimchuk, Valentin Martinez Pillet

Abstract. Division II of the IAU provides a forum for astronomers studying a wide range of phenomena related to the structure, radiation and activity of the Sun, and its interaction with the Earth and the rest of the solar system. Division II encompasses three Commissions, 10, 12 and 49, and four working groups. During the last triennia the activities of the division involved some reorganization of the division and its working groups, developing new procedures for election of division and commission officers, promoting annual meetings from within the division and evaluating all the proposed meetings, evaluating the division's reprentatives for the IAU to international scientific organizations, and participating in general IAU business.

Keywords. Sun: corona, Sun: flares, Sun: coronal mass ejections, Sun: filaments, Sun: magnetic fields, Sun: chromosphere, Sun: helioseismology, Sun: oscillations, interplanetary medium, acceleration of particles

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1. General activities

Division II includes the three Commissions, 10, 12 and 49 and four working groups. The current Commission Presidents, elected at the Sydney General Assembly, are Donald Melrose, C10, Tom Bogdan, C12, and David Webb, C49. Commission 10, Solar Activity, focuses on transient aspects of the Sun, including flares, prominence eruptions, coronal mass ejections (CMEs), particle acceleration, magnetic reconnection and topology, coronal loop heating, and shocks in the corona. Commission 12, Solar Radiation and Structure, emphasizes steady-state aspects of the Sun, including long-term irradiance, helioseismology, magnetic field generation, active regions, photosphere, and chromosphere. Commission 49, Interplanetary Plasma and Heliosphere, studies the solar wind, shocks and particle acceleration, both transient and steady-state, e.g., corotating, structures within the heliosphere, and the termination shock and boundary of the heliosphere. There can be considerable overlap among the commissions, such as in the areas of magnetic activity, solar evolution, particle acceleration, and space weather. The triennial reports of each of these commissions follows this report on Division II.

The four division working groups involve the topics of solar eclipses, solar and interplanetary nomenclature, access to solar data including virtual observatories, and space weather. These are discussed in the next section.

Revised statutes and bylaws of the IAU were adopted at the Sydney GA, XXV, in July 2003. These emphasize the role of divisions in governance of the commissions and working groups within a given division. Commissions and working groups can now be created, renamed or dissolved at the division level. (Working groups can also be created or changed by a commission.) The existence of a commission or working group must now be justified every three years by the division, with final approval by the EC.

The new statutes led to new procedures for the selection and election of presidents and organizing committees for divisions and commissions. These were discussed during the Division II business meeting held at the Sydney GA. The organizing committee (OC)

of Division II now includes the president and vice-president of the division, and the presidents and vice-presidents of the 3 commissions of Division II. A new position of division secretary is now allowed if needed. This position was debated, but it was eventually decided for now not to have a division secretary. The proposed new Division and Commission presidents, vice presidents and Organizing Committees, were all confirmed by the division members and by the general membership at the GA. See the Division II report for details of the division's activities at the Sydney GA (Benz 2005).

The following members of Division II are the current IAU representatives to these scientific organizations: Oddbjorn Engvold, International Council for Science; Marek Vandas, COSPAR Scientific Comm. D on Space Plasmas in the Solar System; Arnold Benz, COSPAR Scientific Comm. E2 on The Sun as a Star; Einar Tandberg-Hanssen, Federation of Astronomical and Geophysical Services; Helen Coffey, International Space Environment Service; Brigitte Schmieder, Scientific Committee on Solar-Terrestrial Physics; and David Webb, The International Heliophysical Year. The IHY is a new organization that was endorsed by the IAU during this triennium. IHY activities relating to the IAU are coordinated through Division II under a working group (see next section).

2. Working Groups

The four current working groups of the division are Solar Eclipses, chaired by Jay Pasachoff, Solar and Interplanetary Nomenclature, chaired by Edward Cliver, International Solar Data Access, chaired by Robert Bentley, and International Collaboration on Space Weather, chaired by David Webb. Each has its own website which is linked under the general Division II site. At the Sydney GA the division working groups were reorganized. The working groups on Solar Eclipses and on Solar and Interplanetary Nomenclature were extended for at least another three years. The working group on Solar Data Distribution had achieved its main goals and was terminated. Two new working groups were accepted, those on International Solar Data Access and International Collaboration on Space Weather.

The IAU Working Group on Solar Eclipses advises a variety of astronomers and public organizations about the total, annular, and partial solar eclipses visible around the world, and about how to observe them safely. The Website at htp://www.totalsolareclipse.net contains links to articles about eclipses and how to observe them and to maps and guides. Working Group members Fred Espenak (USA) and Jay Anderson (Canada) provide a NASA Technical Publication every few years about the next major eclipse. (See the link at http://www.totalsolareclipse.net or go directly to
http://sunearth.gsfc.nasa.gov/eclipse/solar.html.). Other Working Group members are Iraida Kim (Russia), Hiroki Kurokawa (Japan), Jagdev Singh (India), Vojtech Rusin (Slovakia), Atila Ozguc (Turkey), Glenn Schneider (USA), Michael Gill (UK), and Jay Pasachoff (USA, Chair). Gill maintains a Solar Eclipse Mailing List, with daily exchanges of many messages among amateur and professional eclipse observers.

The total solar eclipses during the current triennium were in Antarctica (November 22, 2003) and in the mid-Pacific (April 8, 2005). Annular eclipses were in Pacific/Panama/northern South America (8 April 2005) and Spain and Africa (October 3, 2005). Partial phases are visible in countries hundreds of kilometers to either side, and provide an excellent opportunity for public education (http://www.eclipses.info), coordinated with IAU Commission 46 on Education and Development. The next total solar eclipse will be on March 29, 2006, for which totality will cross Africa from Ghana to Libya and northwestern Egypt, the Mediterranean, mid-Turkey, and then Russia, Kazakhstan, and farther to the northeast, with partial phases visible from essentially all of Europe and

Africa and much of Asia. An IAU Symposium is being planned in Cairo to immediately follow this eclipse (see next section).

The Working Group on Solar and Interplanetary Nomenclature is chaired by Edward Cliver (USA) and includes Jean-Louis Bougeret (France), Hilary Cane (Tasmania), Takeo Kosugi (Japan), Sara Martin (USA), Reiner Schwenn (Germany), and Lidia van Driel-Gestelyi (France, UK, Hungary). With the help of the broader community, the WG identifies terms used in solar and heliospheric physics that are thought to be in need of clarification, and then commissions topical experts to write essays reviewing the origins of terms and their current usage or misusage. The essays are published in EOS, the weekly publication of the American Geophysical Union. The essays published during this triennium are Gradual and Impulsive Solar Energetic Particle Events (Cliver & Cane 2002), Magnetic Storm - Still an Adequate Name (Daglis 2003), Terminology of Large-Scale Waves in the Solar Atmosphere (Vrsnak 2005), and The Last Word: The Definition of Halo Coronal Mass Ejections (St. Cyr et al. 2005).

The achievements of the former Solar Data Distribution working group were: 1) publication on the internet at http://solar.nro.nao.ac.jp/qbsa/ of the remaining data in the former Quarterly Bulletin of Solar Activity (QBSA); and 2) an internet listing of solar data available online: List of International Solar Archives (LISA). This site was put together and is maintained by Helen Coffee at:
http://www.ngdc.noaa.gov/stp/SOLAR/IAUWGdoc.html. A new working group on International Solar Data Access has been formed to take over and expand this effort. Its main task is to coordinate the international efforts being made on virtual solar observatories. It is chaired by Robert Bentley and has the following members: Frank Hill (USA), Neal Hurlburt (USA), Helen Coffey (USA), Andre Csillaghy (Switzerland), Nadge Meunier (France), Kevin Reardon (Italy), Masumi Shimojo (Japan), Hongqi Zhang (China), Alexander Stepanov (Russia), Luis Sanchez-Duarte (ESA), Dominic Zarro (USA), Aaron Roberts (USA), Adam Szabo (USA), Chris Harvey (France), Chris Perry (UK), David Webb (USA), Franciose Genova and Bob Hanisch (IVOA).

Originally formed as a group intended only to cover the solar part of Division II, the purview of the group has been extended to include the heliosphere to ensure interoperability among data sets needed to support Space Weather and related studies. Five virtual observatory initiatives from the solar and heliospheric communities are involved in the group. Discussions have focused on data models, descriptions of data resources, and coordinate systems. At least one member of the International Virtual Observatory Alliance (IVOA) participates in the working group. An internet page describing the objectives and activities of the working group can be found at:
http://www.mssl.ucl.ac.uk/grid/iau/DivII_WG_IntDataAccess.html

The Working Group for International Collaboration on Space Weather has as its main goal to help coordinate many activities related to space weather at an international level. It is chaired by the Division II President, David Webb, and its website is at http://www2.bc.edu/∼haganmp/MAIN_PAGE_From_IAU_Page.htm. The site currently includes the international activities of the International Heliospheric Year (IHY), the International Living with a Star (ILWS) program, the CAWSES (Climate and Weather of the Sun-Earth System) Working Group on Sources of Geomagnetic Activity, and Space Weather studies in China.

The International Heliospheric Year is an international program of scientific collaboration being planned for the time period around 2007, the 50th anniversary of the International Geophysical Year. After the first public session on the IHY held at the World Space Congress in Houston Texas (2002), it was decided to have an IHY working group within the IAU. The physical realm of the IHY encompasses all of the solar system

out to the interstellar medium, representing a direct connection between $in-situ$ and remote observations. The IHY working group helped enormously in the identification of national leaders for the IHY program. The IHY organization is now fully established with its International Advisory Committee headed by Roger Bonnet (France) and the International Steering Committee headed by Joseph Davila (USA). Regional coordinators have been appointed for all regions of the world and many countries have functioning national committees.

Complete information on the IHY, rapidly being updated, can be found at the main IHY site: http://ihy2007.org. Nat Gopalswamy is the Chair of the IHY subgroup within Division II. David Webb is the IAU representative for the IHY. Four key activities are planned under the IHY program: science activities, the UN Basic Space Sciences (UNBSS) initiative, IGY Gold, and Public outreach activities. The science activities are centered around Coordinated Investigation Programs (CIPs), campaigns on focused topics of heliophysical interest lasting from two weeks to an entire year in 2007-2008. The IHY disciplines are solar, solar-terrestrial, heliospheric, climate, and atmosphere/ionosphere/magnetospheric sciences. The CIPs will attempt to involve as many instruments from space and the ground as possible from around the world. The United Nations IHY effort is being led by Hans Haubold under the UNBSS program. The UNBSS activities include deployment of scientific instruments in developing nations for space science investigations by scientists from developed nations. Scientists from developing nations get the instruments free and have the opportunity to do science; scientists from developed nations can fill gaps in their data base by acquiring data from different geographical locations. The first workshop will be held in United Arab Emirates, November 20-23, 2005. Within the IAU the IHY will be discussed in a special session at the Prague GA in 2006 on support for astronomy education and research in developing countries. The IGY Gold program recognizes scientists around the world who worked for IGY 1957 programs. Public outreach activities include spreading knowledge of space science and exploration to the public and inspiring the next generation of space scientists.

The CAWSES Working Group on Sources of Geomagnetic Activity, also chaired by Nat Gopalswamy, has as its objectives to understand how solar events, such as CMEs and high speed streams, impact geospace by investigating the underlying science and developing prediction models and tools. Its first organizational meeting was held in Beijing on September 11, 2004. The purpose was to discuss the space weather aspects of solar and heliospheric physics, international collaboration, and future plans of research. Other members of this group are B. Jackson (USA), V. Obridko (Russia), A. Prigancova (Slovakia), B. Schmieder (France), K. Shibasaki (Japan), D. Webb (USA), and S. T. Wu (USA).

Finally, the working group on Space Weather Studies in China is chaired by Jingxiu Wang. As a member of the International Space Environment Service (ISES) Regional Warning Centers, RWC-China provides users with various services, including medium and short-term prediction, observational data distribution, a speaker service, and a collaborative research. RWC-China plays an important role in space environment services for the Chinese Shenzhou series of space missions. A public service was started in July 2004 by the National Space Weather Monitoring and Warning Center from the Chinese Weather Bureau. A more specialized space weather service is provided by the new Space Weather Investigation and Prediction Center of the Chinese Academy of Sciences. Projects initiated to enhance space weather observations include the Geospace Double Star Program (DSP), with coordinated measurements between DSP and Cluster II providing important new results. Solar space projects being developed include the Chinese Space Solar Telescope (SST), the Small Explorer for Solar Eruptions (SMESE), and the

Kuafu Project, a set of three satellites to monitor space weather. The Meridian Chain Project is a Chinese multi-station chain along the 120 E meridian for monitoring space environment variations. Basic research on space weather is supported by the National Natural Science Foundation of China (NSFC), the Chinese Academy of Sciences, and the Ministry of Science and Technology of China. The "Space Weather Research Program" was selected by the NSFC as one priority research area in 2001-2005 and may be extended for the next 5 years. The Chinese Academy of Sciences strongly supports basic research on solar and space sciences aimed at establishing the physical foundation of space weather forecasting. More than 10 research groups were selected and are supported by the Chinese Academy. A major scientific project, "Explosive Solar Activity & Disastrous Space Weather", has been accepted by the National Key Basic Science Research Foundation.

3. IAU meetings

In 2002 there was an IAU Colloquium, no. 188, on "Magnetic Coupling of the Solar Atmosphere" held in Santorini, Greece on June 11-15, 2002. The Proceedings volume was published as ESA SP-505 and edited by H. Sawaya-Lacoste.

There were several Division II-sponsored meetings during the IAU GA in Sydney in July 2003. One was an IAU Symposium, no. 219, on "Stars as Suns: Activity, Evolution and Planets", July 21-25, 2003. The Proceedings volume was published by ASP and edited by A. K. Dupree & A. O. Benz. There were also three related Joint Discussions: JD03 on "Magnetic Fields and Helicity in the Sun and Heliosphere" on July 16, organized by B. Schmieder and D. Rust; JD07 on "The Sun and the Heliosphere as an Integrated System" on July 17, organized by G. Poletto and S. Suess; and JD12 on "Solar and Solar-like Oscillations: Insights and Challenges for the Sun and Stars" on July 18 and 19, organized by T. Bedding and J. Leibacher. The Proceedings volume of JD03 will be published in Highlights of Astronomy which is edited by O. Engvold. A book with the same title as the JD07 "The Sun and the Heliosphere as an Integrated System" has been published by Kluwer and edited by G. Poletto and S. Suess. This includes material from the JD as well as extra contributions. A concise report of JD07 will appear in the Highlights of Astronomy edited by O. Engvold. The Proceedings' papers of JD12 were published in the journal *SolarPhysics* (Springer) as Vol. 220, No. 2, 2004, "The physics of solar and solar-like oscillations", edited by T. Bedding and J. Leibacher.

Two IAU Symposia sponsored by Division II were held in 2004 and the Proceedings volumes have been published. The first meeting was IAU Symposium no. 223 on "Multi-Wavelength Investigations of Solar Activity" held June 14-19, 2004 in St. Petersburg, Russia. The Symposium focused on the most fundamental problems of solar activity, the solution of which requires cross-discipline investigations and discussions. The Proceedings volume was published by CUP and edited by A. V. Stepanov, E. E. Benevolenskaya, and A. G. Kosovichev. The second meeting was IAU Symposium no. 226 on "Coronal and Stellar Mass Ejections" held September 13-17, 2004 in Beijing, China. The goal of this Symposium was to discuss and summarize the latest research on coronal and stellar mass ejections. The Proceedings volume was published by CUP and edited by K. P. Dere, Jingxiu Wang & Yihua Yan.

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