

DIVISION IX OPTICAL AND INFRARED TECHNIQUES
TECHNIQUES OPTIQUES ET INFRAROUGES

Division IX provides a forum for astronomers engaged in the planning, development, construction, and calibration of optical and infrared telescopes and instrumentation, as well as observational procedures including data processing.

PRESIDENT	Rolf-Peter Kudritzki
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DIVISION IX COMMISSIONS

Commission 25	Stellar Photometry and Polarimetry
Commission 30	Radial Velocities
Commission 54	Optical and Infrared Interferometry

DIVISION IX WORKING GROUPS

Division IX WG	Detectors
Division IX WG	Site Testing Instruments
Division IX WG	Sky Surveys

INTER-DIVISION WORKING GROUP

Division IX-X WG	Encouraging the International Development of Antarctic Astronomy
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TRIENNIAL REPORT 2006 - 2009

1. Introduction

Division IX is currently in a state of transition regarding its structure and constituency, reflecting larger shifts in the way most observational astronomers carry out their work. While traditionally most optical astronomers used local telescopes and built their own instruments suited for their scientific interests, today large national and international facilities as well as space observatories dominate many fields. In this context questions revolving around the planning for future facilities and their instrumentation, access to existing observatories, and optimization of their use are becoming important topics for Division IX.

A related question concerns the education of instrumentation specialists, and the standing of instrumentalists within the astronomical community. All too often astronomy departments and observatories report that they cannot find qualified candidates for open positions that require strong technical skills, yet gifted instrument builders complain that they get short-changed in promotions and tenure review processes in a culture that uses publication and citation indices as the main criteria for academic achievement. Division IX can clearly play an important role here to maintain excellence in astronomical instrumentation and techniques, thus serving the whole astronomical community.

In response to these general considerations, Division IX has started to change its Commission and Working Group structure, following discussions in the Board, and deliberations at the 2006 IAU XXVI General Assembly in Prague. Commission 9, with a name identical to that of the whole Division was dissolved, and the successful Working Group on *Optical and Infrared Interferometry* elevated to Commission status (now Commission 54). At the same time the process of establishing new Working Groups was started by creating one on site testing instruments; discussions for several additional working groups are underway that could be established in the 2009-2012 time frame; in the long run these could become Commissions of Division IX if they prove to be successful.

2. Developments within the past triennium

2.1. *Commission 25 Photometry and Polarimetry*

Commission 25 currently has 230 members from 40 countries. The Commission's membership represents 2.4% of the total IAU membership. During the triennium 2006-2008 the Commission devoted a considerable amount of effort to updating its membership records. This was done by contacting members individually and requesting them to confirm or update their personal details. Many of the members' details were outdated or incorrect. The updated lists will be sent to the IAU Secretariat in Paris.

In 2007, the Commission's web site was moved from its previous host site at the Vrije Universiteit Brussel to the South African Astronomical Observatory. The URL of the new Commission 25 web site is <iauc.25.saa0.ac.za>. We thank Christiaan Sterken for having established the Commission's web site and for having maintained it for a number of years. The Commission plans to change the web site to bring it more in line with the 'look and feel' of the official IAU web site.

The Commission has started a long-term project to develop an IAU standard star database. This is motivated by the various large-scale surveys that are generating a flood of new standard stars and standard star observations. The Commission believes that some form of coordination among the various initiatives would be helpful to the astronomical community at large. The idea is to develop a web site that would be a one-stop location for all standard star data access. It would be a data depository and a gateway to the various recommended data servers via internet access. Such a database would be quality-controlled by a group of experts, so that observers could easily choose suitable and reliable standard stars that they need to use for their observations. The envisaged database should also be compatible with the Virtual Observatory (VO) data standards in order to take full advantage of the suite of data manipulating tools developed by the International VO Alliance.

During the triennium, there were a number of important developments and conferences in the fields of polarimetry and polarimetry. Some of the highlights are described in the report of Commission 25 following this chapter.

2.2. Commission 30 Radial Velocities

Radial velocity observations have seen tremendous developments during the past few years driven by the need of reaching higher and higher precision to detect planets of always smaller masses, or to be applied to stars of special properties. Five years of measurements with the HARPS spectrograph on the ESO 3.6 m telescope have demonstrated that a long-term stability below 1 m/s is indeed possible for solar-type stars. These high-precision measurements are now revealing the existence of a large population of Neptune-mass planets and super-Earths around solar-type stars in our neighborhood. Important progress has also been made for earlier type dwarfs (A-F), for which the high rotation rate and the smaller number of available spectral lines were considered for a long time as a hard limit for the radial-velocity precision. New dedicated techniques to extract the Doppler information are now providing good velocities for those stars, as small as a few tens of m/s for rotation rates at the 100 km/s level, on high S/N high-resolution spectra.

Several large scale consultations have been initiated by space agencies (mainly NASA and ESA) or by the community itself to plan in an efficient way their efforts for the coming decade in the field of exoplanets (e.g., the NASA *Exoplanet Task Force*; the ESA EP-RAT; the *Exoplanet Forum*; the *Blue Dot Team*). Published reports make all a strong point on intensifying ground-based radial-velocity programs, in preparation for (good target list), or complementary (e.g., for transit candidates) to future space missions. The volume of activities related to radial velocities in the domain of extrasolar planets will thus still increase in the coming years, accompanied by new instrumental developments on large facilities.

Administrative activities of Commission 30 have been rather quiet during the past three years, mainly dedicated to support conferences related to the interests of the commission (exoplanet meetings, dynamics in the Galaxy, etc.). The Working Groups in the Commission (*Stellar Radial Velocity Bibliography*; *Spectroscopic Binary Catalog SB9*; *Radial-Velocity Standards*) are progressing at their own pace, engaged in long-term efforts.

2.3. Commission 54 Optical and Infrared Interferometry

The Commission was created at the IAU XXVI General Assembly held in Prague, August 2006. Its goal is to coordinate international collaborations on scientific and technical matters relating to long-baseline optical and infrared interferometry. The Commission continues the work begun through the Working Group on *Optical/IR Interferometry*. As a Commission within Division IX its focus is to establish scientific and technical standards that facilitate the future growth of the field.

The work of the Commission takes place primarily within the Commission's working groups. The current active working groups are:

- *Interferometry Data Format*
- *Imaging Algorithms*
- *Calibrator Stars*
- *Advances in Astronomy with Interferometry*
- *Intensity Interferometry*

The first two Working Groups were created prior to the Commission. The Working Group *Interferometry Data Format* has established the OPTICAL INTERFEROMETRY DATA EXCHANGE FORMAT (published in 2005) and its supporting software. Some work remains to update this format consistently with the needs of future instruments and software both in Europe (VLTI second generation) and in the USA (CHARA, MROI, NPOI,

KeckI). The Working Group *Imaging Algorithms* expands the original aim of optical/IR interferometry imaging contests (held in June 2004 and May 2006) towards the goal of developing and disseminating these software tools in the community. A new contest was successfully organized in June 2008. A lot of progress has been made in this field and this Working Group activity fosters exchanges and comparisons between groups.

The Working Group *Calibrator Stars* is now active. A web page has been created and discussions are taking place among its members. Methods to obtain suitable calibrators and a list of bad stars for calibrations are being put together.

The Working Group *Advances in Interferometry* has undertaken several actions among which the writing of science briefs to advertise for results obtained with interferometers (28 are available at <olbin.jpl.nasa.gov/iau/briefs/>). Other actions focus on active lobbying to get interferometry talks in relevant conferences or including stellar diameter measurements in the list of measurements of stars provided to astronomers by SIMBAD.

The Working Group *Intensity Interferometry* has been created recently. This is a newly re-born field since the end of the Intensity Interferometer in Narrabri in the 1970s. This restart is motivated by the advent of fast detectors with an increased bandwidth used by ground-based γ -ray observatories. The first goal of this Working Group is to write a white paper on the technique and discuss how it can complement amplitude interferometry.

Two other Working Groups are being discussed but have not been started yet:

- *Future Large Arrays*
- *Vademecum of Interferometry*

The Commission promotes the use and scientific impact of interferometry through collaborations with individual science Commissions within the IAU, most significantly with Commission 8 *Astrometry*, Commission 26 *Double and Multiple Stars*, Commission 27 *Variable Stars*, and Commission 36 *Theory of Stellar Atmospheres*.

The web site of Commission 54 <olbin.jpl.nasa.gov/iau/index.html> is hosted at the Optical Long Baseline Interferometry News (OLBIN). This web site and its associated Email Forum exist to further the interests of the optical interferometry community and goals of Commission 54.

The Commission currently has 14 members. However, a total of 68 IAU members have indicated their intent to become members. In addition 13 non-IAU members are applying for membership to join the Commission. After the next General Assembly, Commission 54 should be 80 members strong.

2.4. *Division IX Working Group Detectors*

Upon dissolution of Commission 9, the Working Group on *detectors* changed its status from a Commission 9 Working Group to a Division IX WG. It provides information on detectors (mainly CCDs) to the interested community. However, as optical and infrared detector technologies have matured substantially over the past years, many parallel information channels are now available. The future role of the Working Group *Detectors* will therefore have to be re-defined over the coming months.

2.5. *Division IX Working Group Site-Testing Instruments*

The Working Group has been organized following the decision of the IAU Division IX taken in 2006. A web site has been implemented where information on various techniques and their correct usage is assembled; see <www.ctio.noao.edu/science/iauSite/>. This is a distributed effort, with different techniques being covered by different groups or individuals world-wide. However, certain techniques are not yet covered by the above-mentioned web resource. A list of registered participants contains 38 WG members (not

all of them are IAU members). Two major conferences on the subject took place in Kona and San Pedro Martir in 2007, and a workshop in Sardinia as well as a SPIE meeting in 2008.

2.6. *Division IX Working Group Sky Surveys*

The Working Group *Sky Surveys* was also a Commission 9 WG before that Commission was disbanded. Now directly under Division IX, this working group maintains information on sky surveys, catalogs, astronomical data bases, and on conferences on these topics. With the advent of very large survey projects, the role of this Working Group in the coming years will have to be re-defined to reflect advances in the ways astronomers use the resulting very large data bases.

2.7. *Inter-Division IX-X Working Group Encouraging the International Development of Antarctic Astronomy*

The Inter-Division IX-X Working Group *Encouraging the International Development of Antarctic Astronomy* monitors technical activities characterizing various Antarctic sites for astronomical use, including the South Pole, Dome A, Dome C, and Dome F. In addition, it maintains contacts between the astronomical community and other agencies and scientific bodies involved in Antarctic research. In 2008, the IAU became a member of SCAR, the Scientific Committee for Antarctic Research.

3. Closing remarks

Although the restructuring and rejuvenation of Division IX is showing first results, much remains to be done in the coming years. With a new generation of extremely large telescopes on the horizon, space observatories serving large communities, and massive data bases created by digital sky surveys, the environment in which optical and infrared astronomy is conducted keeps changing profoundly. Division IX will have to put a structure into place that supports these changes and helps astronomers world wide to meet the many technological challenges.

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vice-president of the Division