

# The 2006 SPIE Symposium on Astronomical Telescopes and Instrumentation – Observing the Universe from Ground and Space

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The most recent of these biennial SPIE (The International Society for Optical Engineering) Symposia was held from 24–31 May in the Orlando World Center Marriott Resort & Convention Center in Florida, USA. Over the last decade, these meetings have grown to become the main forum for presenting and discussing all aspects of ground-based, airborne and space telescopes and their instrumentation, including associated advances in technology, software, operations and even astronomical results. As a consequence the meetings are large and well attended by people at all levels in the process of initiating, approving, implementing and operating astronomical projects and facilities. This year there were ~ 1700 registered participants who presented ~ 1600 papers and posters in the following 12 parallel conferences which formed the heart of the meeting.

- Space Telescopes and Instrumentation I: Optical, Infrared and Millimetre
- Space Telescopes and Instrumentation II: Ultraviolet to Gamma Ray
- Ground-based and Airborne Telescopes
- Advances in Stellar Interferometry
- Ground-based and Airborne Instrumentation for Astronomy
- Observatory Operations: Strategies, Processes and Systems
- Modelling, Systems Engineering and Project Management for Astronomy II
- Advances in Adaptive Optics
- Opto-Mechanical Technologies for Astronomy
- Advanced Software and Control for Astronomy
- Millimetre and Submillimetre Detectors and Instrumentation for Astronomy III
- High Energy, Optical and Infrared Detectors for Astronomy II

In addition were

- four invited keynote plenary talks
- a plenary conference of invited talks on the search for extrasolar planets
- six specialist workshops/technical meetings/panel discussions
- nine courses teaching special aspects of optics, detectors and software
- two major interactive poster sessions
- two networking receptions

- a special invited session featuring the best student papers
- tours of the University of Central Florida
- an exhibit featuring a full-scale model of the James Webb Space Telescope
- 68 industrial and other exhibits – including the ESO stand shown in Figure 1

The main conferences listed above covered space telescopes and instruments sensitive over the full gamma ray to radio wave range, including overview talks on the NASA and ESA programmes; ground-based and airborne telescopes again covering all wavelengths and including ALMA and future extremely large telescopes (ELTs); ground-based and airborne instrumentation with invited overview talks on the instrumentation at all the major observatories; interferometry; observatory operations; adaptive optics; opto-mechanical technologies; software and control and detectors.

ESO staff and their achievements were very much in evidence in essentially all the conferences dealing with ground-based topics. Everybody also seemed to benefit from learning what the others are doing from the highest level overviews down to the most detailed exchanges of technical details. I don't know of any other such possibility for hearing so many top-level talks covering such a range of topics in so short a time. Unfortunately, with so many parallel activities, considerable time is spent in navigating the programme and, again, the organisers have vowed next time to try and make a chronological as well as

conference based programme to facilitate this more efficiently.

In the first keynote plenary talk titled “Challenges for Astronomy and Astrophysics in a Changing Budget Environment”, Garth Illingworth illustrated the variety and strength of the current US Space Science programme but then drew attention to its anticipated reduction in the future due to the decline of the NASA budget expected following completion of the JWST. Of particular interest to many people was his list of estimated full-cycle costs, including operations, for several flagship missions which ranged from 9 billion dollars for HST down to ~ 2 billion for the airborne observatory SOFIA, recently slated for possible cancellation by NASA. Nevertheless, Garth made a strong case for retaining the concept of flagship missions rather than just trying to increase the number of smaller ones. Maybe he also put the current \$ 4.5 billion cost of JWST in perspective for some people?

The second plenary talk was devoted to a less political but currently hot scientific topic “The Central Black Hole and Nuclear Star Cluster of the Galaxy” which was delivered by Reinhard Genzel from the MPE in Garching who presented a dazzling collection of recent VLT and other data made possible by developments in ground-based adaptive optics and integral-field infrared spectroscopy. These have now established the presence and mass of the black hole at the centre of the Milky Way beyond reasonable doubt



Figure 1: Visitors to the ESO stand – another first at the Orlando 2006 meeting.

Photo: E. Janssen, ESO

and have revealed and partially characterised its associated infrared flares – which can provide further insight into its properties (e.g rotation) – but appear to have increased the mystery of the origin of its surprisingly young surrounding star cluster.

The next plenary talk, on “Astronomy in Europe: Status and Prospects”, was delivered by Catherine Cesarsky, Director General of ESO, whose main theme was the growth of European astronomy over the last few decades and the breadth and depth which have already been achieved by the combination of the ESO, ESA and national programmes. She also stressed Europe’s commitment to the future, including the building of an Extremely Large Telescope on the ground. The final plenary talk was on “Novel Technology for Optical and Infrared Astronomy” in which Colin Cunningham of the UKATC in Edinburgh took us on a tour of the latest ideas which may transform future ground-based instrumentation including robotic and other smart focal-plane systems, developments in integrated optics, exotic filters, etc.

The mental stress was relieved by a free Sunday in the middle when attendees could enjoy a wide range of leisure options including swimming and playing golf at the conference hotel, touring the varied attractions at the bewildering array of nearby Disney and other theme parks or visiting the Kennedy Space Center with the Memorial Day holiday crowds.

Particularly pleasing to me was the apparent success of the plenary conference on “The Search for Extrasolar Planets”. This was an innovation at these meetings, introduced to provide an opportunity for all participants to come together for half a day to hear about developments in one of the currently most exciting astronomical topics engaging and motivating both the ground and space community. More than 1000 attendees were present for the introductory keynote review by Michel Mayor (ESO Council member) of exoplanet discoveries to date which included the discovery, announced just prior to the Symposium, of an extrasolar system containing three Neptune-mass planets in which his group played a leading role using the HARPS instrument at the ESO



**Figure 2:** Catherine Cesarsky, Director General of ESO, delivering her plenary talk on “Astronomy in Europe: Status and Prospects” to a packed audience.

3.6-m telescope on La Silla (see ESO Press Release 18/06).

Other papers of particular European interest included those on the contributions to be expected in the future from astronomy with the VLT (Didier Queloz); imaging with future ELTs (Roberto Gilmozzi); results and plans for transit/eclipse observations with MOST, COROT and Kepler (Jaymie Matthews) plus the capabilities for exoplanet research of other future major space missions including Gaia (Dimitri Porbaix) and JWST (George Rieke). Other talks covered various proposed US space missions including SIM (Michael Shao) and TPF (Wesley Traub), whose time-scales may have unfortunately lengthened recently as a result of NASA’s budget forecasts, and a thought-provoking closing review by Sara Seager of the latest ideas for searching for life on extrasolar planets and a reminder that it may be vastly different from what we are used to.

Topics covered in more detail in the specialist meetings included adaptive optics and the future and relative merits of ground, space and Antarctic interferometry – which have all blossomed into large areas of interest within the last few years – plus the production of glass blanks for large lenses and filters which sounds less exciting but has become a major issue for the development of instruments for ELTs and wide-field telescopes. The special courses also featured optical interferometry; adaptive optics; optomechanics in space; astronomical optics; principles of Fourier optics and diffraction; telescope systems: materials choices for performance and stability; use of

visible and infrared sensors, CCD and CMOS imaging sensors and applications and scalable frameworks for observatory software infrastructure. As far as I can judge, all seemed well attended whenever I passed by on the way to somewhere else.

The large number of attendees and papers plus its seven-day duration reflects the feeling of most present that we are still enjoying a golden age of astronomical exploration from ground and space as echoed in the subtitle of the Symposium. The realities now include many ground-based observatories operating 8–10-m-class telescopes equipped with suites of powerful instruments plus (great) space observatories sensitive from gamma to radio wavelengths and with more to come in the near future (e.g. COROT, Herschel and Planck in Europe). Much of what was presented and discussed however still falls in the category of dreams for the future. This applies to many space projects; to the development of a new generation of extremely large ground-based telescopes; new interferometers; observatories in Antarctica, etc. In most of these cases, however, the funding has not yet been secured or is even already in doubt. Increased efforts by the astronomical community may thus be necessary to prolong the life of this golden age. It will be interesting to meet again and review how things have progressed in two years time when this Symposium series will be continued in Europe, at a location which has not yet been decided but will most probably be in a sunny, French-speaking city south of Munich. Hope to see you there.