EUROPEAN ASTRONOMICAL SOCIETY

NEWSLETTER

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Contents

EDITORIAL

It is a great pleasure and an exciting personal challenge to commence my activities as the new Editor of the Newsletter of the European Astronomical Society. First of all I would like to thank Prof. Mary Kontizas, the previous Editor, for nominating me, as well as the President and Council of EAS who decided to give me the opportunity to step into her position. Mary has been offering her time and energy to the activities of EAS since 1997 and through her work as the Editor of the Newsletter many of the changes that shaped our Society were brought to the attention of the international community. I am certain that it will not be an easy task to match her commitment and professionalism.

I have been reading the Newsletter of EAS since I became a member of the Society, more than a decade ago, while a graduate student in the US. At the time the information available electronically via the web on European activities was rather limited and the Newsletter was providing, at least to me, a different perspective on the astronomy related activities and initiatives taking place at the eastern side of the Atlantic. As a postdoctoral researcher in France for a period of three years and for the past five years while working again in the US with the Spitzer infrared spectrograph team at Cornell University, I noticed a number of very positive changes in the European Astronomy scene. On the science side in particular, considerable investments in terms of financial resources, both from the individual countries, as well as from the European Union were directed towards Astronomy and Astrophysics. Major research networks, such as OPTICON and RadioNet – the status of which is presented in articles included in the present newsletter – resulted from these funding possibilities. Europe also took a leading role in the development of the concept of Virtual Observatories, which facilitate the homogenization of astronomical databases. The tremendous volume of unique data from ESO's VLT is one of the datasets that populate the archive. Only now we start to see a glimpse of the science potential of the VOs in bringing high quality data to research communities in Europe and all over the word which have limited resources and/or no access to major observational facilities. Even in terms of science policy in general, it appears that in the past decade there is a conscious effort of the various European organizations directly affecting the evolution of European astronomy (such as the EU, ESA, EAS and ESO), to coordinate their activities and despite their different nature to collaborate in this effort. At least to me all this indicates that the future of astronomy, astrophysics, and space physics in Europe is bright in nearly all wavelengths!

With all this activity and our ability to rapidly disseminate information via the web, the role of the EAS Newsletter is changing. Its biannual distribution can no longer have as a sole scope to provide news that is typically already known via other avenues. It could provide though the medium which would present new ideas affecting European astronomy

science policy and trigger discussions and thoughts on how to become even more competitive in the future. With the classes of the spring semester just over, I promise not to be distracted by the pleasant Mediterranean summer and work on this direction. I also welcome all your contributions and ideas on this and any other topics you may feel that we could include in upcoming issues of our Newsletter.

Vassilis Charmandaris
University of Crete, Greece

Message from the President

I can only begin my message this issue by welcoming Vassilis Charmandaris as our new editor. Vassilis has recently returned to Greece from a period in the USA, where he was a member of the Spitzer Space Telescope infrared Spectrograph (IRS) science team at Cornell University. He now works in the Dept. of Physics at the University of Crete, Heraklion, where he continues his research on interacting galaxies and Active Galactic Nuclei. Welcome Vassilis ! We look forward to working together.

Preparations for this year's JENAM in Liège on 4-7 July are well under way. I hope most readers can attend. In addition to an exciting scientific program there has been great interest in having sessions on educational activities, on on-going Europe wide networking activities and on planning for the future. Some of these discussions will take place in parallel sessions following the EAS General Assembly on Wednesday 6 July. Several developments on the European scene are noteworthy and will form background to the discussions in Liège. Of course, a main event of importance will be the French referendum on the EU constitution on 29 May. If that vote is negative, or if another large country votes 'no', no one knows what the effect will be on preparations for the 7th Framework Programme, which is planned to start in 2007. At best there is likely to be a significant delay in decision-making. Assuming the vote is positive and that developments proceed as planned, the following developments will be of interest to our readers.

The European Research Council (ERC) has not actually been given the go-ahead to be set up during the European Commission's 7th Framework Programme. But all indications are that an ERC ultimately will be accepted by our governments. It will also likely be financed at a level that will make it an effective and important institution on the European research landscape. An independent Governing Council of distinguished scientists is foreseen and to ensure that decision-making in this Council will be completely independent of the European Commission, an Identification Committee has been mandated to consider criteria for Council membership and to identify its first members. A continent wide search is currently under way for candidates and a final report of the Identification Committee is scheduled for this summer. Of course, while the ERC is to be independent of the Commission, the Commission is planning to support the process of organizing the ERC.

An important difference with many research councils at national level is that the ERC will (at least initially) not be involved in deciding and financing major future research infrastructures. Our governments have realized that their research communities are making plans for such future facilities and that they should talk to each other about priorities and about sharing financing. The forum in which these discussions are taking place is ESFRI (the European Strategic Forum on Research Infrastructures). In principle, ESFRI participants are national governments, not working scientists, and the Forum operates independently of the European Commission.

In practice the Commission supports its activities and plans to integrate ESFRI recommendations into its own planning. The financing model for future facilities is one in which the Commission will provide a minority portion of the total costs, with interested national communities joining to contribute the remaining funding. The role of the Commission in coordinating and facilitating the planning of new facilities remains to be defined in detail.

ESFRI has actually been operating for several years now. Last fall it decided to re-constitute itself early this year and then to develop a 'road map' of essential European research infrastructures. Input to this 'road map' process will come from many sources, including national strategic plans, our OPTICON/RadioNet/ILIAS infrastructure networks will be consulted. An expert group for (optical-IR and space) astronomy, radio astronomy and astroparticle physics is to be formed to provide a critical, condensed overview for the main Forum. Current plans are to produce the first road map by the end of 2006.

New players in the discussions will soon be one or more ERA-Nets. These are networking activities financed by the Commission that primarily involve national research councils. Two have been proposed from astronomy and astrophysics for EU funding: AstroNet for conventional astronomy, and Aspera for astroparticle physics. Goals of both are to consider aligning national granting schemes, opening them to researchers from other EU countries, and stimulating improved coordination of planning activities. If these proposals receive funding they should be able to start work late this year or early next, and complete the networking of representative bodies across Europe at all levels – working astronomers (OPTICON/RadioNet/ILIAS), national funding agencies (AstroNet), and government policy makers (ESFRI).

In principle our community should soon have adequate organizational mechanisms to plan our future. If we maintain good communication with the participants at each level in our national contexts we can expect effectively to influence the future development of our science.

We expect to hear more of these matters in Liège.

Harvey Butcher
President of EAS

POLICY

NEW POLICY CONCERNING EXPANDED EUROPEAN *AND* NON-EUROPEAN *A&A* MEMBERSHIPS

It is now thirty-five years since the scientific journal Astronomy & Astrophysics (A&A) was founded by the merging of six national journals from four European nations, namely France, Germany, the Netherlands and Sweden; Belgium and the other Nordic countries, Denmark, Finland and Norway, also participated. They were subsequently joined by five other westem European nations, namely Austria, Greece, Italy, Spain and Switzerland (Norway later withdrew). A&A has no international legal status as such but is represented by the European Southern Observatory (ESO), which also manages its financial transactions.

In the early nineteen-nineties, A&A with great foresight took an important step – which the European Union would follow more than a decade later – by incorporating eastern European countries into its sponsoring membership: the Czech Republic, Hungary, Poland and the Slovak Republic; Estonia became a full member in 1998. A&A was now truly "A European Journal", as then stated on the front cover.

In the meantime, A&A grew in importance as a vehicle for world-wide dissemination of astronomical research and an ever-increasing number of high-quality papers began streaming into the A&A Editorial offices from non-European countries, as well as from other European non-member countries. It became obvious to us that A&A no longer was merely a European Journal and in 2001 we removed the "A European Journal" from the front cover.

Eventually, some of these non-European countries began approaching us with queries about potential membership in A&A and in 2002 we admitted the first such country, Argentina, with an observer status. Meanwhile, the Board intensified its study of the financial and administrative consequences of a wider expansion including the admission of member countries beyond Europe – a special subcommittee was appointed.

The Board of Directors, at its meeting in Tartu, Estonia on 8 May 2004, made the important decision that "... A&A will henceforth consider applications for sponsoring membership from any country in the world with well-documented active and excellent astronomical research". Each application will be carefully treated on a case-by-case basis. Subsequently, at this meeting, the Board admitted Argentina to full membership in A&A starting on 1 January 2005. In addition, three other applicants were admitted to observer status, namely Brazil, Chile and Portugal. The above-mentioned special Board subcommittee will continue its work and submit recommendations on the restructuring of the Board and its Executive Committee, a necessary consequence of the foreseen expansion.

Aage Sandqvist
Chairman, A&A Board of Directors

NEWS

JENAM 2005

At the time this article was being prepared, the organizational activities for the upcoming Joint European and National Astronomy Meeting 2005, entitled "Distant Worlds", which will take place in 4-7 July 2005 in Liège Belgium, were in high gear. The preliminary programs were set and nearly 200 people had already registered for the meeting. For the latest information on the meeting check the dedicated web site at:

http://www.astro.ulg.ac.be/RPub/Colloques/JENAM/

THE COROT SPACE MISSION

The vast majority of the visible matter in the Universe is contained in stars, which are also the chemical factories of the Universe and the basic clock through which the age of larger aggregates (e.g. galaxies) is determined. Yet the interior structure of stars still harbors many unsolved scientific questions. Basic physical processes such as convection (which for example determines the rate at which the nuclei of massive stars are repleted with fresh fuel) still lack a good theory, and even the heavy element abundance of the Sun is currently being revised. The resolution of these open issues will require detailed 'observations' of the stellar interior, from which however no photons can escape. Sound waves however travel freely through the dense stellar interiors, and their study provides a direct diagnostic of the physical conditions of stellar interiors. Seismology (the study of stellar oscillations) is thus the needed tool to 'look inside' stars. The technique is successfully applied on the Sun, for which the observations from the SOHO satellite have allowed to even map in detail the interior rotation.

A more recent and very hot astrophysical topic is the search and study of planets orbiting other stars (exoplanets). The first exoplanet orbiting a normal star has been discovered ten years ago, through the radial velocity modulation imposed on the parent star. A decade later, this technique is still the one producing the bulk of exoplanet discoveries. The first exoplanet was a 'hot Jupiter', a massive planet orbiting very close to the parent star; over 150 exoplanet have been discovered since then, most of them rather massive, even though the increase in instrumental performance (and time baseline) have produced planets comparable in mass to Neptune (although on shorter orbits). While the ongoing advances in instrumental techniques will likely result in the discovery of large rocky planets, the 'holy grail' of exoplanet science, i.e. habitable planets (rocky planets in orbits which would allow liquid water to exist on their surface) will remain outside of their reach. The detection of the photometric signal produced when the planet transits in front of the parent star is

the most promising technique to search for small, habitable planets, and a number of ground-based searches for transiting giant exoplanets are ongoing.

The above two, apparently very different scientific goals, share the same basic observable, i.e. long, high-precision photometric time series. Indeed, the required precision cannot be achieved from the ground: scintillation-induced noise is larger than the signal expected from both stellar pulsations and rocky planet transits. The transit of the Earth in front of the Sun results in a dimming of 1 part in 10,000, lasting 13 hr, while the best ground-based photometry typically reaches millimag precision, a factor of 10 worse than the expected signal.

Such precision can on the other hand be achieved through space-based photometry, which also guarantees freedom from the day-night cycle and therefore naturally allows long, uninterrupted time series with very high duty cycles. Asteroseismology and habitable planet finding can therefore be very convenient pursued with the same space experiment. The French-European mission COROT is designed to do just that.

COROT was originally proposed to CNES back in 1993, in the context of the French small missions program as a pure asteroseismology experiment. The original selection of the mission foresaw a 1997 launch. However, political and financial difficulties postponed the mission, which only received final approval in 2000. Launch is scheduled for June 2006. This delay, while unwelcome, allowed the project to evolve and to grow to include, in parallel, exoplanet searching. In addition, the project grew, from a purely French one, to a multinational effort (still with a French majority). Partners now include ESA, Austria, Belgium, Brazil, Germany and Spain.

COROT is a small orbiting telescope (600 cm^2 entrance pupil), with two separated, contiguous focal planes of 2 CCD chips each, one for asteroseismic observations and the other for planet finding. The total sky coverage of the camera is about 1.5 by 1.5 degrees. As asteroseismology requires maximum precision, and it will concentrate on relatively bright stars, the asteroseismic focal plane is out of focus (allowing to distribute the light on a large number of CCD pixels, preventing saturation and smoothing out the effects of drifts in telescope pointing). Exoplanet finding requires observations of as many targets as possible (being a statistical enterprise), and therefore the exoplanet field of view is nearly in focus, with a grism in the camera providing dispersed images. This will allow obtaining light curves in two or three colors.

The Proteus spacecraft used for COROT will be launched on a Soyuz rocket in an inertial polar orbit. Such orbit allows long-term observations in two relatively small regions located around the orbital poles (the continuous viewing zones). To keep the background induced by Earth shine to a minimum these regions are limited to 15 deg in radius. They are located near the Galactic center and anticenter, and are nicknamed “the COROT eyes”. Each selected 1.5 deg field will be observed for 5 months (the maximum observability, a so-called long run), to obtain the maximum accuracy on the stellar oscillation frequencies and to allow to search for planets with orbital periods of up to 1.5 months (longer period planets will produce only one or two transits, preventing confirmation of the orbital period). When both Sun and Earth start becoming too close in the sky to the observed target, COROT will ‘flip over', switching to a field in the other ‘eye'. In between, shorter observations (typically 20 days) will be possible.

The lifetime of COROT is foreseen to be at least 3 years, allowing 5 long runs plus a number of short runs. The long runs will be dedicated to simultaneous asteroseismic and exoplanet finding observations, while the short runs can also have primary scientific goals other than asteroseismic and exoplanetary science. Also during the long runs, other scientific programs can be carried out in parallel as long as they do not impact the primary science goals.
The pointings for the long runs are chosen by the COROT Scientific Council, which includes scientists from each of the contributing groups. The pointings for the short runs will be open to proposals from the scientific community, through an AO released in April 2005.

The performance of COROT for asteroseismic science will be the best ever achieved for stars (other than the Sun!), with a required detection threshold of 0.66 ppm in 5 days, allowing the study of solar-like oscillations in V=6 stars. The long observation duration will result in a very high precision on the oscillation frequencies, up to 1 microHz. The general goal of the asteroseismic program of COROT is to determine the nature of the transport processes in stellar interiors, for solar mass and more massive stars. This includes convection, with overshooting, angular momentum transport and meridional circulation, and chemical fractionation. The accuracy of the COROT data will for example allow to map the interior rotation profile in A stars, constraining the additional mixing this induces in the stellar interior. COROT will concentrate on the observation of a limited number (about 50) relatively bright stars during the 5 months long runs, for which the high quality data will allow to obtain the maximum information about the interior. A similar number of objects will be observed during the short runs, which will allow (although with lower-precision data) to scale the behavior of stellar oscillations across the HR diagram.

The exoplanet search of COROT will monitor, during each 5 months long run, about 10,000 stars with magnitudes between V=12 and V=16.5, with 17 minute resolution. The performance is sufficient to allow the detection of individual transits from a planet twice as large as the Earth in front of a V=13 solar-like stars. For planets in short period orbits (few days, similar to the hot Jupiters) Earth-like planets could be detected. Thus, while the true habitable planets will remain outside of COROT's grasp, it will be the first insight into the population of rocky planets, even though on orbits too hot for habitability.

Additional science goals (including stellar activity, intrinsic variability, stellar rotation, as well as the monitoring of extra-galactic objects) will be possible, both during the short

observation (which can have primary science goals other than asteroseismology and exoplanet science) and during the long observation, in the latter case by inclusion of additional windows centered on the targets of interest.

The COROT Scientific Council, in which representative from all participating parties sit, decides the observational program for the long runs. For the short runs (as well as for additional windows in the long runs) a Call for Proposals has recently been issued, with a due date of June 2005.

With its launch in mid 2006, COROT will give a lead to the European scientific community in the research areas discussed above. COROT will be the first high-accuracy photometry mission with a broad range of scientific goals. COROT is not alone in the landscape of space missions. A small Canadian mission, MOST, is currently flying and acquiring data on a small number of very bright stars, mainly for asteroseismic science. A larger NASA mission, Kepler, is currently scheduled for a 2008 launch. Kepler's science goal is centered on the detection of habitable, Earth-like planets, with asteroseismology being considered as 'additional science'. A more ambitious ESA mission, Eddington, which would have allowed to extend COROT's approach (and the resulting lead for European scientists) into the domain of habitable planets and into asteroseismology of both more and less massive stars than accessible to COROT, was approved by ESA 2000, and removed from the program in 2003 due to financial difficulties for the ESA science program.

Clare Binham, ESA

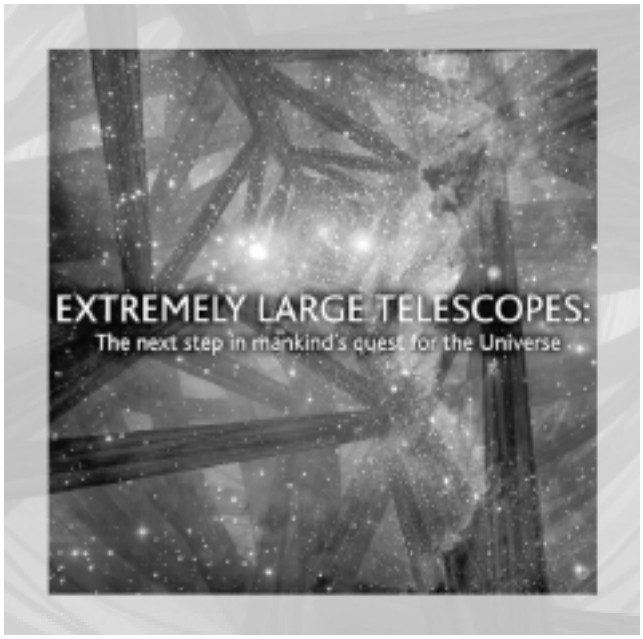
OPTICON

In this issue I shall concentrate on progress in the technology dominated Joint Research Activities, or JRAs, but first some news of other recent developments.

Progress towards a European ELT

The European Commission has launched its proposal for FP7 (see http://www.cordis.lu/fp7 for details). A significant milestone is the publication of a report from ESFRI, the European Strategy Forum on Research Infrastructures on what it sees as key opportunities for Europe in the FP7 timeframe. One of the 23 projects that it presents is an Extremely Large Telescope, costing between 600 million to one billion Euro. Of course, inclusion in a list of opportunities is not a guarantee of a successful outcome, but it is a very positive step in the right direction.

In parallel to this news, OPTICON has released its new brochure on the science case for ELTs. This large format, well illustrated, booklet is a non-technical summary of some of the ideas in the more rigorous ELT science case document. The ELT brochure, ideal for publicizing the project to wide audience, can be downloaded from the OPTICON home page at www.astro-opticon.org. Hardcopies – in quite large numbers if needed – can be supplied on request by mailing Suzanne Howard (showard@ast.cam.ac.uk) in Gerry Gilmore's team in Cambridge. The main science case document is being prepared for its first formal release. This will occur at the EU 'Astronomy Day' press conference in Dwingeloo on June 28th. For details of the Science case document, and a chance to see the current version, please contact Isobel Hook in Oxford (imh@astro.ox.ac.uk).



JRA-1 Adaptive OPTICS

JRA-1 is the largest and most complex of the six OPTICON Joint Research Activities. It features many aspects of adaptive optics that will be needed for future large ground based telescopes. The team have developed conceptual designs for extreme AO which could be used for planet finding, considered ground layer AO using laser guide stars and investigated multiple field of view systems using natural guide stars.

The team is also exploring the technologies needed for the 2nd generation of AO systems, including real time computing platforms, peizo deformable mirrors and high order wave front sensors. Progress is already excellent with the AO Real Time Computer Platform having passed its internal conceptual design review. Existing facilities are not forgotten either, there are work packages looking at adaptive secondaries for the VLT and multi object wave front sensors for the GTC. The contract for the feasibility of the VLT Adaptive Secondary is proceeding full speed and should be completed by July. JRA-1 is co-ordinated by Norbert Hubin of ESO (nhubin@eso.org) and is described in detail at http://www.eso.org/projects/aot/jra1/

JRA-2 Fast Detectors for AO

Since the OPTICON contract award was rather less than the amount originally requested the first action of this JRA was a

redefinition activity to remain within the available funding. At the same time the Instituto de Astrofisica de Canarias joined the team. The key achievement in recent months has been to write a requirements document for a fast optical detector and the issue of a call for tenders to produce such a device. E2V was the most acceptable bidder and a contract for the delivery of a 240 by 240 science grade fast readout low noise device has been concluded. A kick-off meeting was held with E2V in March 2005. There has also been significant progress on the development of a suitable controller and test facilities to evaluate the devices once they are delivered. The leader of JRA-2 is Phillippe Feautrier (feautrie@laog.obs.ujf-grenoble.fr) and the activity homepage is at http://www-laog.obs.ujf-grenoble.fr/JRA2/index.html

JRA-3 Fast Readout High Performance Optical Detectors for Astronomy

JRA-3 started comparing characteristics of the three major detector schemes currently envisioned to enable further development of high time resolution astrophysics. Electron Multiplying CCDs (EMCCDs) – also known as L3CCDs although this a proprietary name owned by E2V – were studied for by several institutes (LSW, Cambridge, the MPE and the University of Sheffield) and found to be deficient with respect to performance characteristics of currently available devices as quoted by industry. Several tests were explored to understand the reasons for these deficiencies, leading to modifications of the strategies towards exploiting EMCCDs. The architecture of PN Sensors was explored, aiming to find schemes that would reduce the effective read-out per pixel for fast applications. Several designs have been investigated by the MPE. Studies were also made of ways of using Avalanche Photo Diodes for high time resolution astrophysics. There has also been progress in controller development, common software concepts and modification of an existing camera head for use in a test facility. A first layout of a test bench for instrumentation has been developed.

Due to internal restructuring at some of the partners in this activity, the project leadership has transferred to H. Spruit (henk@mpa-garching.mpg.de) for administrative reasons.

JRA-4 Integrating Optical Interferometry into Mainstream Astronomy

JRA-4 is studying the second generation of VLTI instruments and producing software to interpret interferometric observables in terms of astrophysical parameters. The leader of JRA-4 is Alain Chelli (chelli@laog.obs.ujf-grenoble.fr) and the web page is at http://eii-jra4.ujf-grenoble.fr. The web page contains a description of the work packages, lists of contributors, working groups etc. The first phase of the project (Jan04-Jun05) consists of seven parallel concept studies of second-generation instruments for the VLTI.

In parallel with the concept studies, the Scientific Council of the Euro-Interferometry Initiative (EII-SC) was defined on 24 September 2004 in Heidelberg under the chairmanship of Thomas Henning. The EII-SC is a working group common to JRA-4 and the OPTICON interferometry network N5. This group was in charge of the evaluation of the seven experimental concepts, which took place at ESO in April 2005.

JRA-4 will be involved in an important event at the 2005 JENAM meeting where there will be a session on a "Technology Roadmap for Future Interferometric Facilities".
See http://www.astro.ulg.ac.be/RPub/Colloques/JENAM/interfero/interfero.html

JRA-5 Smart Focal Planes

The Smart Focal Planes JRA has started to make excellent progress. They developed a technology roadmap which was then used to plan the proposed activity. They then used this roadmap, in conjunction with instrument concept workshops, to produce outline requirements and specifications for devices and subsystems required for future instruments. All of the workpackages are already showing significant advances. In particular, in the beam manipulators activity several working "starbugs" have been demonstrated and alternative concepts for an ELT instrument based on them have been developed. The image slicer activity is also using the ELT instrument concepts to drive specifications for novel devices using conventional and replication manufacture techniques. Work on slit mechanisms, both conventional and MOEMS based, are showing promise, as is work on deployable IR fibre systems. All of the activities are now building towards a technology evaluation review in late summer, which will be used to define the Phase B prototyping program.

The Smart Focal planes JRA works in close co-operation with network N3.5, the Key Technologies Working Group and Colin Cunningham (crc@roe.ac.uk) of the UK Astronomy Technology Centre leads both activities.
The JRA-5 web page can be found at http://www.astro-opticon.org/joint_research_activities/focal_planes.html
Access to the rest of the pages requires a password that can be obtained by contacting Colin.

JRA-6 Volume Phase Holographic Gratings (VPHG)

Most of Europe's large telescopes are equipped with low-to-mid resolution imaging spectrographs in the optical and NIR (1-5 microns) wavelength domain. The major source of light loss in these instruments is the dispersing elements, generally grisms. In principle VPHGs can be designed to provide much improved performance but their behavior needs to be fully tested so their properties can be optimized for the next generation of instruments. The participants in JRA-6 are evaluating and developing prototype VPHGs for astronomical instrumentation.

In the first year of activity effort has been concentrating on the definition of the materials and the production of protocols to evaluate the prototypes. Progress so far is good and prototype manufacturing and testing will start soon. The Chair of the VPHG Joint Research Activity is F Zerbi (INAF-Brera): zerbi@merate.mi.astro.it. The link for the JRA6 homepage is http://golem.merate.mi.astro.it/projects/jra6/

JENAM 2005

Special sessions, both plenary and parallel, to discuss EU support for astronomy will take place at the JENAM meeting in Leige, 4-8 July.

As always, for more information visit the OPTICON home page at www.astro-opticon org or contact the project scientist, John Davies (jkd@roe.ac.uk).

John Davies, OPTICON Project Scientist,
UKATC, Royal Observatory, Edinburgh

RadioNet

RadioNet is an Integrated Infrastructure Initiative (I3), funded under the European Commission's Sixth Framework Programme (FP6), that has pulled together all of Europe's leading radio astronomy facilities to produce a focused, coherent and integrated project that will significantly enhance the quality and quantity of science performed by European astronomers. RadioNet has twenty partners; they range from operators of radio telescope facilities to laboratories that specialize in micro-electronics, MMIC design and superconducting component fabrication.
The general objective of RadioNet is to ensure that key developments in radio astronomy are supported on a European-wide basis, pooling together the broad range of skills, resources and expertise that exists within the RadioNet family. This provides a critical mass that will ensure that progress is not made slowly in isolation but quickly and efficiently, via a broad-based, yet well-focused scientific and engineering collaboration.

As a collective body, RadioNet provides the coordination and overview that is essential to ensure its activities are properly matched and that the end user, the astronomer, plays a major part in shaping the final overall product. The programme of activities has already catalysed the community into identifying those areas that we must invest in now, in order to maximise the performance of the existing radio telescope facilities across Europe. RadioNet includes a Transnational Access (TNA) programme to promote observing opportunities throughout Europe, three technology projects called Joint Research Activities (JRA) and eight Networking Activities (NA) covering a broad range of topics, from scientific workshops to radio spectrum management.

RadioNet has been formally active since 1 January 2004. Since then, the TNA programme has been in full swing and the JRAs and Networking Activities have made significant progress towards their goals.

The RadioNet Transnational Access (TNA) programme includes seven facilities (four of which include interferometer arrays), giving a total of 24 radio/sub-mm antennas located throughout Europe, Asia and the US. The facilities involved are the European VLBI Network (EVN), MERLIN, IRAM (both the Plateau de Bure interferometer and the Pico Veleta 30m telescope), WSRT, JCMT, the Effelsberg 100m and the Onsala 20m telescopes. This suite of mm- and cm-wave facilities (covering the frequency bands from ~100 MHz to ~1 THz) offers a unique array of capabilities, unmatched anywhere in the world. The combined investment, in today's prices, approaches 0.5 billion euros.

The TNA programme is aimed at enabling the European user community to have easy and transparent access to the entire range of radio facilities; and to offer them an integrated, professional and consistent level of user support. RadioNet's goal is, through the judicious use of EC funding, to simultaneously improve the data products delivered by these facilities and to extend the opportunities for access to a wide-range of EU and Associated State users. Applications are made through the normal facility procedures (not through RadioNet) and successful, eligible astronomers may be able to receive travel grants to support their observing runs.

The TNA facilities have been very busy during the last 18 months. In 2004, the number of user groups eligible for TNA was impressive and, in almost all cases, exceeded the contracted minimum level by large factors. During the first year of RadioNet, the TNA programme delivered over 4200 hours of access; almost six months of continuous observation. In addition, the user population saw a significant number of new users at the facilities (40%), a development which it is hoped will grow as RadioNet continues. Some early results from RadioNet-funded projects were presented at the 7th EVN Symposium held in Toledo, Spain, in October 2004 (see www.oan.es/evn2004).

Whilst scientific merit is the factor that determines the allocation of observing time, RadioNet is committed to widening access to the TNA facilities for young astronomers, those new to a facility, those from countries or institutions less able to afford travel to the facilities, or those without access to similar infrastructures within their own countries. The RadioNet Outreach Programme is now active in promoting the TNA facilities to potential users, and interested astronomers are encouraged to contact the RadioNet office for further details (see the RadioNet website at www.radionet-eu.org)
The three JRAs are focused primarily on developing and significantly improving the existing RadioNet facilities through enhanced performance of the equipment and capabilities of the telescopes. RadioNet runs three JRAs that cover three very different technology areas. ALBUS is a JRA focused on improving the user software of Europe's major interferometers. AMSTAR is developing prototype next generation receivers for Europe's mm and sub-mm-wave telescopes. PHAROS is working on the prototype of affordable, low-noise, phased receiver arrays to be installed at the foci of large radio telescopes.

ALBUS made good progress in 2004 towards developing efficient and scaleable processing techniques for a number of imaging applications and in implementing a number of specific new calibration methods. Investigations into vectorization and parallelization schemes have also been continuing.

AMSTAR has already resulted in a number of prototype mixer devices for high frequency receivers. Progress was also made on the design of low-noise cryogenic amplifiers to be used at the output of the SIS mixers and the production of ultra-thin NbN films for THz mixers. PHAROS completed a system specification for a Focal Plane Array and continued development of cryogenic systems, RF circuitry and MMIC test structures.

The RadioNet Networking Activities (NAs) are designed to enhance the coordination and co-operation of the RadioNet partners and of European radio astronomers as a whole. They also promote the science performed with the facilities, develop and train the next generation of astronomers and provide essential fora for engineering aspects.

All of the NAs have had a significant impact on radio astronomy over the first 18 months of the programme. The Synergy group has already produced a unified Proposal Tool now in use for WSRT proposals, which will soon be expanded to cover all RadioNet TNA facilities. Through the various activities, RadioNet has funded or enabled sixteen workshops on a wide variety of topics from scientific discussions on the nature of the black holes that power active galactic nuclei, to meetings of engineers planning the next generation of digital hardware. These meetings were attended by hundreds of astronomers and engineers, many of them supported by RadioNet funding. The results of these discussions are all available on the RadioNet website (http://www.radionet-eu.org/).

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VIRTUAL OBSERVATORIES

THE AVO TO EURO-VO TRANSITION

The Virtual Observatory (VO) is an innovative, evolving system, which will allow users to interrogate multiple data centres in a seamless and transparent way, to best utilize astronomical data. The main goal of the VO is to enable new science by making easily accessible the huge amount of data available. The VO initiative is a global collaboration of the world's astronomical communities under the auspices of the recently formed International Virtual Observatory Alliance (IVOA).

The status of the VO in Europe is very good. In addition to seven current national VO projects, the European funded collaborative Astrophysical Virtual Observatory (AVO) project had the task of creating the foundations of a regional scale infrastructure by conducting a research and demonstration program on the VO scientific requirements and necessary technologies. The AVO had been jointly funded by the European Commission (under the Fifth Framework Programme [FP5]) with six European organizations (ESO, ESA, AstroGrid, CDS, TERAPIX, and Jodrell Bank) participating in a three year Phase-A work program.

The AVO project was driven by a strategy of regular scientific demonstrations of VO technology, held on an annual basis in coordination with the IVOA. We reported last year on the AVO's second demonstration, held on January 27-28, 2004 at ESO. The demonstration was so successful that it lead to the discovery of 31 new optically faint, obscured quasar candidates (the so-called QSO 2) in the two Great Observatories Origins Deep Survey (GOODS) fields. These results, in turn, led to the publication of the first refereed astronomical paper enabled via end-to-end use of VO tools and systems ("Discovery of optically faint obscured quasars with Virtual Observatory tools", Padovani, Allen, Rosati, & Walton, 2004, Astronomy & Astrophysics, 424, 545).

The third and last AVO demonstration was held on January 25-26, 2005, at the European Space Astronomy Centre (ESAC; previously known as VILSPA), near Madrid. The demonstration dealt with an extragalactic case on star formation histories in galaxies and with a Galactic scenario on the Asymptotic Giant Branch (AGN) to Planetary Nebulae (PN). Both cases, and in particular the stellar one, were put together with input from the AVO Science Working Group (SWG). This year the stellar case was the strongest one on the science side, and lead to the discovery of nearly 100 candidates in the post-AGN – young PN transition, increasing by about 50% the number of already known such (rare) sources. A paper describing these results is being written (Bayo, Garcia-Lario, Sierra, et al.).

New features, compared to last year's demonstration, included: the ability to run galaxy evolution models in a VO context, building of a Spectral Energy Distribution (SED) on-the-fly (VOSpec [ESAC]), various improvements to the AVO prototype [CDS], including multi-image/multi-wavelength display, an image cut-out service, direct SIMBAD and Vizier queries, and a new version of SpecView [STScI]. The concepts of MySpace (management of user's own space in the VO) and workflows (the possibility of running time-consuming processes remotely and using scripts; ASTROGRID) were also demonstrated, as well the usage of new IVOA standards on registries (high-level directories of astronomical catalogues, data archives, data-providing organizations, and computational services) and Web services (which allow any astronomical software to be "wrapped" and accessed through the VO).

The AVO project is now formally concluded. Links to various documents and to the software download page can be found at http://www.euro-vo.org/twiki/bin/view/Avo/.

The EURO-VO work program is the logical next step from AVO as a Phase-B deployment of an operational VO in Europe. Building on the development experience gained within the AVO Project, in coordination with the European astronomical infrastructural networks OPTICON and RADIONET, and through membership and support of the IVOA, EURO-VO will seek to obtain the following objectives.

EURO-VO-Objective 1: Technology take-up and full VO compliant data and resource provision by astronomical data centres in Europe.

EURO-VO-Objective 2: Support to the scientific community to utilize the new VO infrastructure through dissemination, workshops, project support, and VO facility-wide resources and services.

EURO-VO-Objective 3: Build an operational VO infrastructure in response to new scientific challenges via development and refinement of VO components, assessment of new technologies, design of new components and their implementation.

EURO-VO will seek to obtain its objectives by establishing three new interlinked structures.

The EURO-VO Data Centre Alliance (DCA): An alliance of European data centres who will populate the EURO-VO with data, provide the physical storage and computational fabric and who will publish data, metadata and services to the EURO-VO using VO technologies.

The EURO-VO Facility Centre (VOFC): An organization that provides the EURO-VO with a centralized registry for resources, standards and certification mechanisms as well as community support for VO technology take-up and dissemination and scientific program support using VO technologies and resources.

The EURO-VO Technology Centre (VOTC): A distributed organization that coordinates a set of research and development projects on the advancement of VO technology, systems and tools in response to scientific and community requirements.

The DCA will be a persistent alliance of data centre communities represented at a national level. Through membership in the DCA, a nation's community of data curators and data service providers will be represented in a forum that will facilitate the take-up of VO standards, share best practice for data providers, consolidate operational requirements for VO-enabled tools and systems and enable the identification and promotion of scientific requirements from programs of strategic national interest that require VO technologies and services. Funds for the DCA have been requested in an FP6 proposal submitted in March 2005.

The VOFC will provide a "public face" to the EURO-VO. Through outreach, support of VO-enabled science projects in the community, workshops and schools, the VOFC will represent a central support structure to facilitate the broad take-up of VO tools by the community. The VOFC will also support the EURO-VO Science Advisory Committee (SAC) to ensure appropriate and effective scientific guidance from the community of leading researchers outside the mainstream VO projects. The SAC will provide an up-to-date stream of high-level science requirements to the EURO-VO. The VOFC will further provide central services to the DCA for resource registry, metadata standards and EURO-VO access. Funding for the VO-FC has yet to be fully defined but will come partially from ESO and ESA with activities starting in 2006.

The VOTC will consist of a series of coordinated technology R&D projects conducted in a distributed manner across the member organizations of this MOU. The first project under the VOTC is the VO-TECH project, funded through the EC FP6 Proposal and contributions from the University of Edinburgh, ESO, the University of Leicester, the University of Cambridge, CNRS and INAF. It is envisioned that additional projects will be brought to the VOTC via other member organizations. The VOTC provides a mechanism to coordinate and share technological developments, a channel for DCA and VOFC requirements to be addressed and for technological developments to be distributed to the community of data centres and individual scientists in a coordinated and effective manner.

The EURO-VO project will be proactive in reaching out to European astronomers. As a first step, the EURO-VO will be making regular appearances at Joint European and National Astronomy Meetings, starting with the next one in Liège this year.

Some relevant links with more information on topics presented in this article are the following:

EURO-VO Home Page:
http://www.euro-vo.org/

AVO Science Working Group Meeting 2005:
http://www.euro-vo.org/twiki/bin/view/Avo/SwgMeeting06

AVO Prototype Download:
http://www.euro-vo.org/twiki/bin/view/Avo/SwgDownload

International Virtual Observatory Alliance:
http://www.ivoa.net/

Paolo Padovani and Peter Quinn (ESO)

VOTECH: THE NEXT WAVE OF TECHNOLOGY FOR THE EUROPEAN VIRTUAL OBSERVATORY

The Virtual Observatory (VO) vision is that the databases of the world should be at the astronomer's fingertips. It should feel as if they live inside your PC, ready to access and analyse, just as all the web pages in the world are there, ready to surf. This vision is gradually becoming a reality. Several projects round the world have been developing and debating standards and protocols, building basic infrastructure software modules, writing tools and applications, establishing registries of resources, and connecting this new software to real data and machines. On the European scene, these first prototype efforts were brought together as an FP5 funded project known as the "Astrophysical Virtual Observatory (AVO)". The results of these worldwide efforts can be seen in working systems available to all astronomers, such as those at CDS (http://cdsweb.u-strasbg.fr/), AstroGrid (http://www.astrogrid.org/), US-VO (http://www.us-vo.org/), or the Japanese VO (http://jvo.nao.ac.jp/).

The AVO project was intended as a Phase A study leading towards a mature deployment as the "European Virtual Observatory (Euro-VO)". The partners realised that in fact three related structures are needed for Euro-VO – a Data Centre Alliance (DCA); a VO Facility Centre (VOFC); and a VO Technology Centre (VOTC). The VOTC is an virtual umbrella organisation co-ordinating projects which aim at developing new technology for the VO, preparing us for the next steps in VO deployment. The first major VOTC project is now underway. This is "VOTECH", a project funded under Framework 6 as a Design Study. The partners involved are the Universities of Cambridge, Edinburgh, and Leicester, together representing the UK AstroGrid consortium; the European Southern Observatory (ESO); the CDS at Strasbourg; and INAF, representing Italian universities and laboratories. The project co-ordinator is Andy Lawrence at the University of Edinburgh. The project started formally in Jan 2005, and is coming up to full speed in summer 2005, and will complete during 2008.

Our aims are to assess new technologies; to design and build prototypes using these technologies; and then to produce final designs for new components for Euro-VO, which will then feed through into engineered modules for working deployments. Along the way we will also identify places where new standards and protocols are needed, and will then need to pursue these within a global context, through the International Virtual Observatory Alliance.

The VOTECH work plan identifies four key Design Study areas. The first is "New Infrastructure" – the need for continued development in topics such as distributed virtual storage, authentication and authorisation, workflow and so on. The second key area is "User Tools". The basic VO infrastructure is in place, but needs applications tools that can speak to the infrastructure – i.e. image analysis tools, graph plotters, etc, that can see resource registries, write results to virtual storage, and link to other tools in a workflow chain. The third key area is "Automated Resource Discovery". In the new VO systems, getting access to resources is less haphazard than before because of registries of resources, standardised metadata, and standardised table column descriptors (UCDs). However, much more flexible and powerful discovery will be possible once we have real semantics – relationships between terms, and standardised operations on terms – so that queries can begin to approach natural language. Of course this is very much the thrust of the latest developments in web technology – the so-called semantic web. VOTECH won't do any original computer science research, but rather will test out new technologies, decide which are appropriate and/or mature enough to build with, and use these to build astronomical prototypes. Finally, the fourth key area is "Data Exploration". The VO framework is making worldwide databases seamlessly on-line – but what we also want is transparent access to computing services that can do ambitious things with the data – calculate correlation functions, perform cluster searches, present multi-dimensional visualisations, and so on. Many of these ideas require supercomputer time and/or very large databases, and so will be performed not on the users desktop, but as a remote service. The algorithms and packages have already been developed elsewhere – the job of VOTECH is to work out how integrate such Data Mining Services into the VO framework.

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University of Edinburgh
on behalf of the VOTECH consortium

US National Virtual Observatory Update

The US National Virtual Observatory project is now midway through the fourth year of a five year development initiative. This winter NASA and NSF announced to the Astronomy and Astrophysics Advisory Committee (AAAC) their intentions to jointly fund an ongoing NVO Facility, beginning in October 2006, such that there will be continuity between the development and operations phases of the NVO. The NVO project heard this as very encouraging news, though budget pressures remain on both agencies and one cannot take anything, especially a new program, for granted.

In January 2005 the NVO project released a suite of scientific applications to the community for general use. These are described fully on the US NVO web site (http://www.us-vo.org), but briefly they include

- An interface to the resource registry, allowing astronomers to locate data collections or services of interest through keyword-based searches.
- A data location and integration service, DataScope, which uses the resource registry to search hundreds of data collections for the user and locate all information of interest associated with a particular location on the sky.
- A spectrum database and interactive analysis environment that provides access to ~1M spectra from the Sloan Digital Sky Survey, 2dF, and other spectral data collections.
- An interface to OpenSkyNodes (VO-compliant database interfaces) called OpenSkyQuery through which astronomers can query and cross-correlate objects from a number of large survey catalogs.
- An object detection and identification service, WESIX, which runs the SExtractor program on behalf of the user and automatically compares the output source list against any of the available OpenSkyNodes.

We encourage researchers world-wide to try these new tools and report their experiences to the US NVO project at feedback@us-vo.org.

Since January our attention has turned back to technical issues, interface definitions, and contributions to the international standards developments coordinated through the International Virtual Observatory Alliance (IVOA). In particular, significant progress has been made on the

VOStore concept, by which users of the virtual observatory can store data files and tables in a distributed and secure manner. Results from remote services will have their results stored in VOStore, with location transparency, and the results can be shared with collaborators. VOStore motivates the implementation of authentication and authorization capabilities, and various approaches are being evaluated.

Work has also progressed on the spectral data model and the associated Simple Spectrum Access Protocol (SSAP), with both to be presented and discussed at the spring (May 2005) IVOA Interoperability workshop in Kyoto. A number of prototype implementations of spectral data access services and spectral data display and analysis tools have been deployed, and these have helped to inform and refine the data model and SSAP work.

An IVOA VOEvent workshop was held at Caltech in April and concluded with an agreement by an international team on an information infrastructure to support the burgeoning field of event-based astronomy. The objective of the VOEvent working group is to build an open standard for exchanging messages about immediate astronomical events, including publication, archiving, query, subscription, and aggregation. The VOEvent standard has been agreed in rough form at the workshop, and has buy-in from projects including GCN, LSST, Pan-STARRS, Palomar-Quest, LIGO, eStars, Raptor, Pairitel, ATEL, and Hands-On Universe.

Planning for the second NVO Summer School has gotten underway. A site has been secured (Aspen Meadows Resort, Aspen, Colorado), dates have been set (6-15 September 2005), the faculty has been recruited, and announcements have been sent out. A detailed curriculum is under development. Full details are available on the NVO Summer School website at http://www.us-vo.org/summer-school/2005/.

Applications are welcome from anyone interested in using VO tools and developing their own VO applications for astronomical research.

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ANNOUNCEMENTS

WEBDA: IN SEARCH OF A NEW MANAGER

As many astronomers are already aware, WEBDA (http://obswww.unige.ch/webda/) is a website devoted to the collection of observational data on stars in galactic open clusters. It is the online version of the database known as BDA. The website is intended to provide a reliable image of the available data and up to date knowledge on these objects, as well as to offer a wide access to the existing observations. It has been developed and maintained for many years by Dr. Jean-Claude Mermilliod at the Laboratory of Astrophysics of EPFL (Switzerland). The database has been very useful for many astronomers interested in star clusters by permitting an easy access to the existing data as well as the ability to contribute and enhance it with new observations. A number of changes in the academic duties of Dr. Mermilliod at EPFL, and the fact that he is also approaching retirement, made him decide to request the assistance of another astronomer or research group, who would wish to continue the maintenance and future improvements of the online database. If someone is interested to take a leading role in helping preserve this very useful resource for the astronomical community, please contact Dr. Mermillon at

jean-claude.mermilliod@obs.unige.ch

XXVITH GENERAL ASSEMBLY OF THE IAU

The 26th General of Assembly of the International Astronomical Union will be held in Prague, Czech Republic, on August 14-25, 2006. Several IAU Symposia have been scheduled in parallel with the General Assembly.

These are:

IAU Symposium No. 236
Near Earth Objects, our Celestial Neighbors: Opportunity and Risk
15-18 August 2006

IAU Symposium No. 237
Triggered Star Formation in a Turbulent ISM
15-18 August 2006

IAU Symposium No. 238
Black Holes: from Stars o galaxies – across the Range of Masses
22-25 August 2006

IAU Symposium No. 239
Convection in Astrophysics
22-25 August 2006

IAU Symposium No. 240
Binary Stars as Critical Tools and Tests in Modern Astrophysics
22-25 August 2006

In addition a number of Joint IAU Discussion Sessions will also take place in Prague over the same two weeks. For details on all the events, as well as registration information, visit the web site of the meeting at http://www.astronomy2006.com/.