European Astronomical Society

NEWSLETTER

Issue 25. June 2003

Editorial

The time for the summer issue of our Newsletter has come with the time for the major event of this year, the IAU meeting in Australia, next July. I understand that everything is ready for accepting the astronomical community and I am sure that our Australian colleagues will succeed to offer a very important General Assembly for the benefit of the community worldwide.

In our home Europe, the annual European Conference, the JENAM2003 is co-organized by the Hungarian Astronomical Society in Budapest at the end of August. Do not think it is too late to be registered, we welcome the late comers and they can get more information at: http://www.konkoly.hu/jenam03/

Our Hungarian colleagues are very hard working, to coordinate the various parts of the Conference and I believe it will be another successful JENAM.

This Conference has a very new feature, for us Europeans. The Job Market organized by Peter Shaver is undoubtedly a significant activity. In our University I already find our students very interested and keeping asking me, as soon as I put up the announcement. There seem to be an interest for PhD studies as well under the same activity.

Willem Baan is raising the very important issue of the pollution in radio and optical frequencies urging the active astronomers to fully support all actions.

We are also happy to have some news on Solar Astronomy and particularly the new 1m Swedish Solar telescope and its first results.

The usual news from European networks and organizations pointed out to us about the hectic period of all Scientific Communities, in order to prepare the proposals of the first FP6 calls, which are structured under a completely new philosophy. I wish the astronomical ones have a good luck.

Mary Kontizas

Job Market at JENAM

This year, for the first time, a Job Market for young astronomers will be held at the Joint European and National Astronomical Meeting (JENAM) at Budapest on 25-31 August 2003.

A wide range of job opportunities will be on display, and informal interviews between job seekers and potential employers will be possible during the meeting. In addition, an open session will be held in which employers will be able to present their employment programmes to the astronomical community.

Young astronomers — students and post-docs — are therefore especially encouraged to attend this JENAM, in order to take advantage of this special opportunity to explore the wide range of career possibilities open to them.

More information about this Job Market will be posted on the JENAM web site:

http://www.konkoly.hu/jenam03/

and the on web site of the European Astronomical Society:

http://www2.iap.fr/eas/index.html

Please forward this announcement to any others who may be interested.

We look forward to seeing you at the JENAM!

Peter Shaver

Contents

MESSAGE FROM THE PRESIDENT

This spring has seen much activity in the community – preparing proposals for the Sixth Framework Programme (FP6), considering priorities for future investment, and organizing our next big ground-based telescope project, ALMA.

December saw the first major calls for proposals in FP6. Teams from our two coordination networks – RadioNET and OPTICON – spent many hours meeting and writing during the winter to complete proposals for so-called Integrated Infrastructure Initiatives (I3). These are programmes providing finance for improving access to research facilities, for carrying out joint R&D programmes, and for coordinating research activities across the continent. Both proposals managed to meet the 15 April deadline, even though a strike in Brussels caused some tense moments!

The prospect for finance often focuses the mind and FP6 is no exception. Of particular interest to readers will be the decision of the European Northern Observatory to join with OPTICON, as have recently the national communities in Portugal, Spain and Switzerland. OPTICON is increasingly able to present a united front for all of optical-IR astronomy to the EU. Indeed, for FP6 a very broad programme of activities is being proposed, which led to a proposal some 700 pages long!

RadioNET has grown as well, now including many additional organizations in western Europe, but also now includes institutes in Latvia, Australia and the USA. RadioNET did manage to focus its plans and generate a much shorter proposal – only 300 pages in length!

On behalf of the members of the EAS, whether or not they participate formally in these proposals, I would like to thank the preparation teams for their major efforts on all our behalf.

Progress on defining investment priorities nationally has also continued to be made, although there is at the time of writing no new information to report. Bootlegged copies of our German colleagues' draft Denkschrift are circulating and the final version is eagerly awaited. The French community met as planned during the spring to define its priorities for the coming decade, and an internal presentation of their conclusions is planned in Bordeaux on 16 - 20 June next. As regular readers will be aware, we are also planning a session for the JENAM in Budapest to hear about these and other countries' priorities.

A major event for our community occurred in February, when ESO and the American NSF signed the agreement jointly to carry out the ALMA project. Dr. Massimo Tarenghi at ESO was appointed International Project Director and a world-wide search for an International Project Manager was initiated. The project is currently an equal partnership between Europe and the USA, but behind the scenes interest from Japan to join at some level remains strong. This project will be a major test of our community's ability to move effectively toward globally organized projects.

At another of our international organisations there is also a new director. On 1 January, the Joint Institute for VLBI in Europe's previous director, prof. Richard Schilizzi, became the International project director of the SKA project. A global search for a successor recently selected dr. Michael Garrett to take over the reins at JIVE.

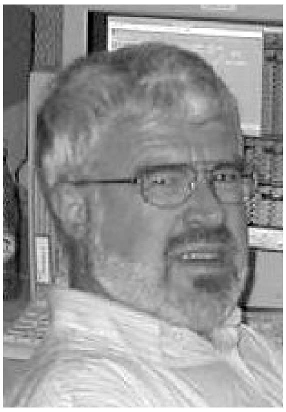
I would also like to bring to readers' attention that the OECD's Global Science Forum, in which government science policy-makers meet regularly to discuss international developments, has a proposal from Germany before its June meeting to organise a high level workshop on 'Future Large-Scale Programmes and Projects in Astronomy and Astrophysics'. There clearly is a desire among policy-makers to put our various proposals for new research facilities into a global perspective. Tentatively scheduled for late November, the output of the workshop might therefore include a 'road map' of proposed new facilities based on high-level scientific goals, and a statement of trends and concerns relevant to long-term planning and priority-setting in the global context. Such a result would then provide a background to decision-making at the national level in all our countries. EAS members interested in contacting their national representatives at the Forum are invited to email me (butcher@astron.nl) for contact information.

A similar discussion seems likely to unfold shortly at the European Strategic Forum on Research Infrastructures, which has been set up by our governments to provide policy-makers specifically in Europe with information and a forum for coordination in the European context.

In the light of these policy-level initiatives, our community's planned discussions on Future Large Scale Facilities at the IAU in Sydney in July take on additional importance.

Harvey Butcher

WHO IS WHO IN THE EAS



Prof. Dr. Joachim Krautter

His main scientific interests can be summarized as observations of 'galactic emission line objects' including Pre-main sequence stars, outburst of novae, cataclysmic variables, X-ray binaries, and mass-loss from supergiants. I did mostly spectroscopy in the UV, optical and IR range with grounbased telescopes and with many satellites like IUE, ROSAT, HST, CHANDRA, and XMM. During the last ten years he mostly carried out programmes in connection with data from X-ray satellites.

In addition, to a minor extent he was also involved in instrumental projects.

For most of his projects he is collaborating with colleagues from all over the world.In brief the main points of his career are:

1969-1975 :	Study of Physics (Stuttgart), degree diploma
1971-1978 :	Study of Astronomy (Heidelberg), degree PhD
1976-1978 :	PhD thesis, Landessternwarte, Heidelberg
1979-1980 :	Post-doc, Landesternwarte Heidelberg
1980-1982 :	Fellow, European Southern Observatory, Garching
1982-1984 :	Associate, MPI für Extraterrestrische Physik, Garching
1984- :	Associate, European Southern Observatory, Garching
1984- :	Staff member, Landessternwarte, Heidelberg
1986-1987 :	Guest scientist, Cerro Tololo Inter-American Observatory, Chile
1988-1996 :	Convenor IUE Target of the Opportunity Team for novae
1989- :	Habilitation and Privatdozent, Ruprecht-Karls-Universität, Heidelberg
1989-1991 :	German representative in the ESO Users Committee
1992-1996 :	German representative in the ESO Observing Programme Committee
1993- :	Member Compton GRO peer review panel
1993- :	Member of various ESO Working Groups
1994-1996 :	Chairman of ESO Observing Programme Committee
1995-	Außerplanmäßiger Professor, Ruprecht-Karls-Universität, Heidelberg
1996-2000 :	Councillor of the European Astronomical Society
1997- :	Chairman ESO "Survey Working Group"
2000- :	Secretary of European Astronomical Society
2000- :	Deputy of Landessternwarte Heidelberg
2000-2002 :	Vize-president of Astronomical Gesellschaft
2002- :	President of Astronomische Gesellschaft
2003- :	Member HST peer review panel

PRESERVING THE SPECTRUM FOR RADIO AND OPTICAL ASTRONOMY

1. Threats to Observational Astronomy

Observational astronomy knows a steady drive towards higher sensitivity and higher photon efficiency. While great progress has been made in the second half of the previous century in both radio and optical astronomy, our observing systems have also become much more vulnerable to outside disturbances.

For Radio astronomers these outside disturbances come in the form of man-made radio signals. As the economic prosperity of our people increases, the appetite for wireless radio applications increases dramatically. The drive towards higher data rates and greater customer convenience has produced an endless list of services to be marketed: blue-tooth, wireless local area networks, ultra-wide band applications, satellite TV and Internet services, and the third generation mobile telephone system UMTS are all becoming household concepts.

Some of these radio applications are directed at small windows of marketing opportunities and niche markets that will disappear in short term. The radio astronomers have for many years been concerned with mobile satellite systems, such as Iridium and Globalstar, that would provide global communication from the multi-satellite systems to handheld telephones. However, the global spreading of the GSM protocol for mobile telephony drove most of these satellite systems out of business. For comparison, the Iridium system was a 3 B$ system with 66 satellites providing telephone capacity enough for a small-sized town. From the viewpoint of a scientific user of the spectrum, wireless applications using the radio spectrum should provide service only where fixed infrastructure cannot. However, this simple rule often gets ignored when there is a market opportunity.

For optical astronomy the threat has traditionally come from terrestrial sources due to urban light pollution. The selection of remote sites on high mountains for new observatories has worked well to avoid these issues. In the urban environments of some older observatories, the "dark sky societies" have successfully battled to modify street lighting regulation and equipment. However, optical and infrared systems are now also being used effectively for short and long distance communications. Fibre optics and infrared computer ports are two examples. At several points in time proposals were floated to put giant advertising billboards with the same brightness as the Moon floating in space in order to remind us of certain products at night. Fortunately these plans seem to have been shelved (for now) but it took a lot of effort by a number of astronomers to expose these at the international level as night-sky pollutants. But the satellite manufactures are currently considering free-space infrared communication for the purpose of providing high data-rate inter-satellite communication. Because of such opportunities, some Administrations are asking that the spectrum above 3000 GHz also be regulated and divided up for commercial applications. This could mean that optical astronomy may also face the intense fights in the same political and regulatory arena that have long been familiar to the radio astronomers.

2. Regulating the Spectrum Services

Regulation of all radio spectrum services that use the radio spectrum is ultimately done by national Administrations within the boundaries of each country. For border-crossing issues, such as mobile telephone use, broadcasting, marine communication, and satellite systems, international agreements need to be made. At the highest international level the Administrations work together to agree on common regulation in the International Telecommunication Union (ITU), a United Nations organisation. The Radiocommunication Sector of the ITU (ITU-R) has been tasked to devise the regulations, definitions, spectrum allocations, operational parameters, and spectrum sharing conditions for the various operational Services it has defined. In this set-up not only all terrestrial services, the aeronautical services, the various satellite services, and the HAPS (high-altitude platform stations, balloons with transmitters hanging above major cities), are defined but also the Radio Astronomy Service and the Earth Exploration Satellite service. *Within the ITU-R the RAS is only one of the spectrum users and it has no preferred status because of its mostly passive use of the spectrum.* The two other ITU Sectors deal with technology (ITU-T) and economic development (ITU-D).

The activities of the ITU-R are multiple. Besides being a central clearinghouse for documentation and information, it also serves in the administration of national and international spectrum users and the registration of satellite systems. It serves also to organise the preparatory work necessary to generate the regulations that balance the interests of all groups of spectrum users. The ITU-R organizes regular international conferences with a long yet limited agenda on the most urgent issues in the spectrum world. One such World Radiocommunication Conferences will be held in Geneva, Switzerland, during a four-week June-July time period (WRC-2003).

For example, since the last conference WRC-2000 in Istanbul, Turkey, the ITU-R Study Groups have studied the items on the WRC-2003 Agenda and prepared an advisory report for each Agenda Item describing the issue, the background, and the possible solutions for the issue. This report was presented and discussed during the Conference Preparatory Meeting (CPM-2003) in Geneva in November 2002. Within ITU-R Study Group 7 (Science Services), Working Party 7D is actively involved in all studies relating to Radio Astronomy.

The European nations have organised themselves in the CEPT (European Conference of Postal and Telecommunications Administrations), and have study groups that parallel the ITU-R activities. The findings of these groups will be used to support the work of the ITU-R Study Groups and will help the CEPT countries to prepare well formulated and balanced European Common Proposals (ECP) for the WRC's. The well coordinated preparations by the 45 CEPT Administration in the various CEPT Project Teams and the practise of block voting have been very successful in the international arena. The Arab Group, the Asia-Pacific Group (APG), and the American countries (CITEL) now follow the voting block approach of the CEPT.

3. The Active RA Organisations

Radio astronomy is staging a relentless effort to seek protection for the radio spectrum from man-made signals. This means radio astronomers need to be present and vigilant at all meetings where relevant issues are discussed. Of course, the commercial spectrum users will gladly make decisions without the radio astronomy community present.

Within Europe the RAS community is represented by CRAF (Commission of Radio Astronomy Frequencies), a standing committee of the European Science Foundation. CRAF serves in organizing the efforts at the national radio astronomy observatories and assists in their interaction with the national administrations. In addition, CRAF is instrumental in representing the interests of the radio astronomy community in the CEPT Project Teams and working groups. The current chairman of CRAF is Dr. Wim van Driel (Observatoire de Paris). Dr. Titus Spoelstra (ASTRON, The Netherlands) serves as CRAF secretary and as CRAF Spectrum Manager and is the only radio astronomy full-time person working on spectrum issues in Europe (www.craf.nl/craf/). The European observatories and the ESF fund the work of the Spectrum Manager. The remote sensing community has a number of (nearly) fully dedicated persons working to protect the interests of the Earth Exploration community.

In North America there is the CORF (Committee on Radio Frequencies) sponsored by the US National Academy and in the Asia Pacific countries there is RAFCAP. These groups are mainly concerned with issues of regional interest. However, only in the USA there is one other full-time person working on radio astronomy spectrum issues.

On a worldwide scale, only IUCAF (Committee on the Allocation of Frequencies for Radio Astronomy and Space Science) represents permanently the community in the ITU-R arena (www.iucaf.org). The IAU, URSI and COSPAR support the work of IUCAF, a standing committee of the International Council for Science (ICSU), a UNESCO organisation. Dr. Darrell Emerson (NRAO, USA) currently leads IUCAF.

4. Important Radio Astronomy Issues

The Agenda of the upcoming WRC-2003 contains a number of issues that directly relate to the Radio Astronomy bands. Agenda Item 1.32 deals with the allocation in the 43 GHz spectral range and the protection of the RAS band from future satellite systems. Other issues relate to service-links of non-geostationary Mobile satellite system in bands close to 1400 MHz (AI 1.16) and also below 1 GHz (AI 1.20). In addition, Agenda Item 1.8.2 relates to the results of band-by-band studies for passive bands with nearby satellites. During the last three years Task Group 1-7 has studied this issues with astronomers, Earth Exploration, and satellite representatives. However, the position of the CEPT is more beneficial for the passive services than the proposals of some other countries, such as the USA and Canada.

At WRC-2000 there was a successful action to reorganize the spectrum allocations between 71 and 275 GHz. The new ITU-R Frequency Allocation Table now gives access to all low transparency windows in the spectrum. There is an Agenda Item proposed for WRC-2007 to consider the spectrum from 275 GHz to 1 THz.

Another CEPT ECP on Agenda Items for future Conferences has been initiated by The Netherlands and relates to studies of the protection criteria for the new generation telescopes ALMA and SKA. This study is aimed at providing access to a large fraction of the observing spectrum for SKA and general protection for these instruments. It also takes into account the impact it would have on the operations of the active services and particularly the satellite services. This proposal recommends studies until WRC-2007 followed by a possible Agenda Item for the following Conference in 2010.

ITU-R Working Party 7D has a number of issues for studies that relate to existing threats to radio astronomy bands and issues that look forward to future communication systems that are being proposed. In general, the representatives from the various action groups incorporate the technical work done at individual observatories into regulatory procedures. In particular, the implementation of RFI mitigation methods by the observatories and by the active communication services is an area of intense study, including everything that can be done to protect radio astronomy observations from man-made interference.

5. Important Optical Issues

For many years optical astronomers have been concerned about light pollution resulting from urban population centers. Recently the ITU Plenipotentiary Meeting in Marrakesh (2000) issued a Resolution 118 wherein it was suggested to consider *"the possibility and relevance of including in the Radio Regulations frequency bands above 3000 GHz"* (100 micron). Although these exploratory studies are just getting underway in ITU-R Study Group 1, there is a good chance that the infrared and even the optical spectrum will also be regulated for communication purposes. Working Party 7D has already produced an ITU-R Recommendation on the characteristics of ground-based astronomy systems operating in the 10 THz (30 micron) to 1000 THz (3000 Angstrom), in order to establish protection levels for astronomical detector systems on current telescopes.

The drive for increased communication bandwidths that are not available in the radio spectrum, and the availability of efficient detector systems will push the industry towards infrared for inter-satellite communication and space communication. Although the technology to be used is not yet known, it is likely that these communication systems will form a certain threat for night time observations to ground based optical and infrared telescopes and for space-based telescopes.

6. Conclusions

Much work is done in Europe and in other regions to protect the spectrum for astronomy. However, much of this work is largely invisible to the astronomy community. The people active in this area do a heroic job in resisting formidable commercial, economic, and political forces that set the stage for the international negotiations on spectrum issues. It is important that the work of the astronomers concerned with spectrum management issues and protection of observatories be recognized as crucial to preserving the observational capabilities that have been built up in the past and planned for the future. It is imperative that RFI mitigation systems be part of the design of new radio telescopes.

These efforts need to be supported strongly by all active astronomers by giving their time and expertise to insure the future of astronomy. At the same time all radio and possibly optical observatories will need to have full-time people on their staff, who deal with the technical and regulatory issues relating to spectrum pollution. Funds need to be allocated to find creative remedies for this pollution. The problems that exist today will not become smaller.

W. Baan

News from Organizations

ESO

New developments are taking place on many fronts at ESO. At the same time, the regular operations at both the Paranal and La Silla observatories continue at a very high level of efficiency. The demand for service mode on the VLT keeps growing, with over 300 runs per semester supported now. The multi-object spectrograph FLAMES was released into operation in February 2003, ahead of schedule, and is working well. The first guest instrument, the spectrograph SPIFFI, was recently very successfully tested on the telescope. The installation of the Laser Guide Star related facilities on UT4 will be completed in May, and first LGS light is foreseen in March 2004.

The new VLTI instrument MIDI was commissioned on the UTs in December 2002, and interferometry with the UTs is now considered routine. Interferometry with the siderostats takes place on a nightly basis. All commissioning data taken between March 2001 and February 2003 have been released, and the second semester of shared risk science observations has begun. The Auxiliary Telescopes AT1 and AT2 should be ready for beam combination in April 2004.

At La Silla, the re-engineering of science operations is now being completed with the moving of operations from the NTT, 3.6m and 2.2m into a single new control building. The first commissioning of the "planet searcher" HARPS took place in February 2003 on the 3.6m telescope, and the instrument performance meets the very high specifications. The ESO 1.5m telescope was taken out of operations, and the FEROS spectrograph was moved to the 2.2m. A Working Group report on the future of La Silla is being prepared and will be available later this year.

The APEX project (a 12m antenna on Chajnantor for submillimeter observations) has advanced significantly. The necessary agreements between the partners and the Chilean government have been signed, and the necessary infrastructure on the site and in San Pedro is rapidly being completed. The antenna arrived in Chile in April; commissioning should start in September, and APEX, with its bolometer array and heterodyne receivers, should be available to the community in April 2004.

For ALMA, the Atacama Large Millimeter Array, an important landmark was the signing in February 2003 of the Bilateral Agreement between ESO and the U.S. National Science Foundation. The ESO-Spain agreement was also signed in January 2003. The ALMA Board, Joint ALMA Office and the overall project structure have been formally established, the Project Plan has been officially approved, and contracts are being prepared for the various work packages. An ESO-Chile Agreement was signed in October 2002 for use of the observatory site, and ratification by the Chilean parliament is pending.

Many other activities continue at ESO. Several important conceptual studies and design iterations are underway for the OWL project, the next-generation extremely large optical/infrared telescope. Work progresses in collaboration with groups around the world towards an International Virtual Observatory. Scientific activities continue at a high level in both Garching and Chile, with many workshops covering a wide variety of topics. And ESO continues its efforts in the areas of outreach and education, the latter particularly in the context of the EIROforum collaboration. As always, details on these developments can be found on the ESO website http://www.eso.org. A useful list of acronyms is given at http://www.eso.org/outreach/epr/eso-acronyms.html. Other sources of information include the numerous press releases, and ESO's quarterly publication The Messenger.

Peter Shaver (ESO)

ESA

ESA's High-Energy Astronomy Missions XMM-Newton and INTEGRAL Working Together to Study Highly Absorbed Galactic Binaries

ESA's new high-energy astronomy observatory, Integral, was launched from Baikonur on 2002 October 17. Following the commissioning and performance verification phases, the guest observer programme commenced at the end of 2002. Approximately 35% of the observing time in the first year is reserved for the many scientists who have contributed to Integral in the form of a guaranteed time programme. A major part of this programme consists of regular scans along the galactic plane to map the diffuse gamma-ray emission and to search for unusual activity and new gamma-ray sources. The first such new source, IGR J16318-4848, was found in this way on 2003 January 29. Using the IBIS/ISGRI gamma-ray imaging instrument on Integral, a position accurate to 2' was obtained (Courvoisier et al. 2003) and the flux in the 15-40 keV energy range estimated to be 50-100 mCrab. The new source is located in a crowded region of the sky with many possible counterparts within the Integral uncertainty region. Prompted by the Integral detection, re-analysis of ASCA archival data revealed that the new source position is coincident with a faint, highly absorbed, X-ray source (Murakami et al. 2003; Revnitsev et al. 2003). In order to obtain a better position, and to investigate the properties of the source in the X-ray energy range, the Integral astronomers requested, a Target of Opportunity observation with ESA's other high-energy observatory, XMM-Newton.

Two weeks after the Integral discovery, the XMM-Newton observation revealed a remarkable X-ray source which was positioned to an accuracy of 6". Its spectrum is very heavily absorbed with hardly any X-rays visible below 5 keV (Fig. 1). Because of the absorption, the source is not a strong X-ray source, in contrast to the situation at higher energies. Surprisingly, the X-ray spectrum is dominated by strong line emission (Schartel et al. 2003). The emission line complex could be resolved into three components, with centroid energies of 6.410 ± 0.003 keV, 7.09 ± 0.02 keV, and 7.47 ± 0.02 keV (de Plaa et al. 2003). These lines are most naturally interpreted as emission from the Fe K_, K_, and Ni K_ transitions. On 2003 March 14, almost one month after the XMM-Newton observation, the source was caught by the RXTE observatory at a comparable flux level as during the ASCA and XMM-Newton observations (Revnitsev 2003). This evidence may rule out the, initially proposed, "transient" nature of this source.

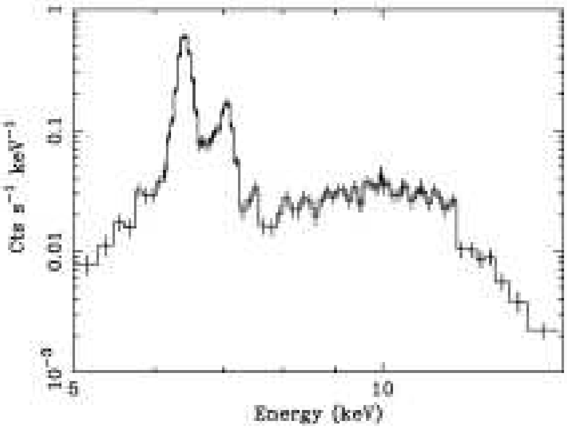


Figure 1 – The XMM-Newton EPIC PN count spectrum of IGR J16318-4848 showing the intense line emission near 6-7 keV and the steeply declining spectrum at lower energies (note the logarithmic count rate scale).

By comparing the observed XMM-Newton spectrum with Monte-Carlo simulations of X-ray transmission through neutral matter, Matt and Guainazzi (2003) conclude that the emission line complex is almost entirely produced in gas covering a central X-ray source, excited by the strong radiation field. The observed profile of the narrow core of the Fe K_ line is significantly larger than the energy resolution of the EPIC PN detector. This may be explained by blending of the Fe K_ narrow core with a Compton shoulder due to photons scattered once before escaping from the material. Matt and Guainazzi (2003) derive a line-emitting matter *average* column density of a few 10^{23} atom cm^{-2} together with a covering fraction of about 0.1-0.2. However, from X-ray spectral fits, the *line-of-sight* material has a much higher column density of 2 10^{24} atom cm^{-2}. The small value of the Compton-reflection of 3-5 10^{-3} derived by Matt and Guainazzi (2003) suggests a flat configuration for the line-emitting matter, with a large inclination angle. This can be naturally explained if the matter responsible for the obscuration of the X-ray source is located in a stream flowing through the Lagrangian point in a Roche lobe overflow, to eventually form an accretion disk. Such an idea is at variance with the probable identification as a high-mass X-ray binary with a (super)giant companion.

Even more intriguingly, IGR J16138-4848 exhibited a marked variability during the XMM-Newton observation (Fig. 2). A factor of ~3 X-ray flux "flare" was accompanied by a significant spectral hardening, which may be explained as due to an increase of the absorbing column density. The Fe K_ line varied on time scales as short as 1000 sec, implying a size of the emitting region not exceeding ~3 10^{13} cm. The line flux broadly follows the variations of the continuum, but not precisely, suggesting that the properties of the line emitting material, i.e. the covering factor and/or the average column density, are dependent on the luminosity of the X-ray source.

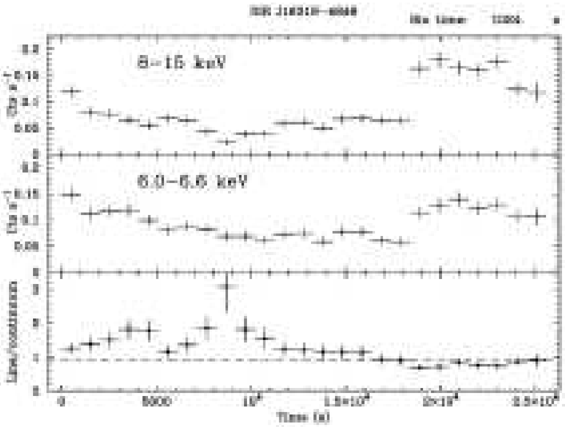


Figure 2 – EPIC PN light curves of IGRJ 16138-4848 in the 8-15 keV (upper panel) and 6-6.6 keV energy ranges (middle panel), and their ratio. In the latter band, the contribution of the Fe K_ line dominates.

The good coordination between the two ESA high-energy missions is clearly enhancing the scientific return of both. Since the discovery of IGR J16318-4848, another 3 bright gamma-ray sources have been discovered using Integral scanning and open time data. Currently it is unclear whether these "gamma-ray detected" X-ray sources all exhibit high absorption and indeed whether they are all similar types of underlying object. It is interesting that one of these new sources, IGR J16358-4726, was found to exhibit 5850 sec pulsations during a serendipitous *Chandra* observation (ref). It is unclear whether these pulsations reflect the spin or orbital period of the system, or are perhaps unusually coherent QPOs. Further, XMM-Newton observations, triggered by new Integral discoveries are expected!

References

Courvoisier T.-J., et al., 2003, IAUC 8063
De Plaa J., et al., 2003, ATEL \#119
Matt G., Guainazzi M., 2003, MNRAS, in press (astro-ph/0303262)
Murakami H., et al., 2003, IAUC 8070
Revnitsev M., 2003, Astr. Lett, submitted (astro-ph/0304253)
Revnitsev M., et al., 2003, Astr. Lett., in press (astro-ph/0303274)
Schartel N., et al., 2003, IAUC 8072

A.N. Parmar, M. Guainazzi, F. Jansen, C. Winkler
Research and Scientific Support Dept,
Directorate of the Scientific Programme, ESA

News from Networks

Opticon

It proved a busy winter and spring for OPTICON, with the release of the details of the EU 6th Framework Programme (FP6) crystallising our efforts to prepare a proposal for the April 2003 deadline. Several meetings were held, including some ad-hoc activities of the Medium Telescopes Working Group and the OPTICON Board. These culminated in a special executive meeting at ESO in Garching on the last day of February to decide the final contents of the proposal. In parallel there were discussions with our colleagues in Radio-net and the Astrophysical Virtual Observatory to ensure that the three proposals represented a coherent whole, the first step to an even more co-ordinated FP7 proposal a few years from now.

The end result all this sometimes frantic activity was very positive with an agreement to bring together the activities of OPTICON and the FP5 access programme which has provided EU funded access to telecopes in the Canaries over the last four years. This union brings together all of Europe's Optical and Infrared telescopes as well as introducing representatives of the solar and high energy astronomy communities into a single entity. To recognise this expansion of the OPTICON community it was agreed to expand the OPTICON partners to include the Max-Plank-Institute für Physik and the Kieperheuer Institut fur Sonnenphysik. Along with new partners in the form of Switzerland and the Spanish Academic Network of Astronomy and Astrophysics this brings the core partners of OPTICON to some 20 national and international agencies.

The final OPTICON proposal was written by numerous individuals across Europe and integrated by a three institute collaboration of John Davies (Edinburgh) Jesus Burgos (IAC) and Gerry Gilmore and Karen Disney (Cambridge). The 700+ page document was submitted electonically a few days before the deadline. The proposal requested support for 11 Networks, an expanded access scheme bringing in the solar, high energy and microwave facilities in the Canaries to the medium telescope network (previously known as COMET). The OPTICON access activity now includes 20 European operated telescopes across the world and in both hemispheres. The third part of the proposal was 7 Joint Research Activities covering subjects such as Adaptive Optics, Interferometry, Smart Focal Planes and Detectors and gratings for almost the whole energy range of interest to astronomy. We now await the results of the FP6 asessement and look forward to a greatly expanded programme of activities over the next few years.

In addition to the FP6 proposal preparation, other OPTICON activities continued as normal. We provided a stand at the FP6 launch conference and spent 3 days promoting our activities to some of the 7000 delegates present. OPTICON also funded various individuals to attend meetings on subjects such as Optical-Infrared Interferometry (which eventually became a major part of the FP6 proposal) and Extremely Large Telescopes.

The next partners meeting will be held in Crete in early September. As always more information can be obtained from www.astro-opticon.org or by contacting the project scientist, John Davies (jkd@roe.ac.uk) or the chairman Gerry Gilmore (gil@ast.cam.ac.uk)

John K Davies
(OPTICON Project Scientist)

RadioNet

It is now three years since RadioNet was first conceived, drawing together the main institutes in Europe that participate in radio astronomy. Funded as an EC Infrastructure Cooperation Network (ICN), RadioNet was built on the sure foundations of more than 2 decades of cooperation established via the European VLBI Network (EVN). RadioNet has provided the basis to extend that cooperation to other areas of radio astronomy, in particular activities supporting next generation instruments such as ALMA and the SKA (Square Kilometre Array).

Since the last meeting of the RadioNet Board, the main focus of RadioNet has continued to be the enhancement of the EVN as an existing and continually developing research infrastructure for European astronomy. There have been several important developments in the past few months that are set to improve the data quality provided to EVN users. In particular, the coordination of the replacement of the old magnetic tape recorders by PC disk-based recording systems, is now rapidly making progress – about half of the EVN is now able to use these new PC systems, and the first large investment in disks is now being planned. One consequence of the introduction of PC recorders is that it is now much easier to experiment with the transfer of VLBI data across standard internet connections or dedicated high-speed networks such as GEANT. It is now beginning to become possible to transfer significant quantities of VLBI data from the telescopes to the EVN correlator at JIVE, without shipping disks or tapes. As a result, we can obtain fringes between EVN telescopes on the same day that the observations were made. A significant increase in the network's reliability is expected to take place with this level of rapid feedback. A special VLBI Technical Workshop (sponsored by RadioNet) was held at the Medicina Radio Astronomy Station (Institute of Radio Astronomy, Italy), in September last year. The workshop was considered an outstanding success – specifically focusing on EVN amplitude calibration issues. Much progress has been made in this area lately, and during the workshop new software systems were demonstrated to EVN engineering and technical staff.

RadioNet has assumed responsibility for re-starting the series of Young European Radio Astronomy Conferences – better known as YERAC. YERAC 2003 will be held in Bonn in September this year, hosted by the Max-Planck-Institut für Radioastronomie (MPIfR). MPIfR also hosted the 6th EVN Symposium last year – the proceedings (published during the meeting!) are also on-line at www.mpifr-bonn.mpg.de/div/vlbi/evn2002

RadioNet has continued to support the coordination of scientific and technical input to the design and development phase of the Atacama Large Millimetre Array (ALMA). The latest meeting to be supported by RadioNet was the "Science Operations with ALMA" workshop, held at ESO Headquarters, Garching, Germany. The meeting was held at the end of last year and concentrated on various operational issues of the ALMA facility. With the recent approvals by the ESO Council and the US National Science Board of the construction of the Atacama Large Millimeter Array, it was thought timely to update the European astronomical community on the project and solicit input on the plans for science operations and user support. The viewgraphs from the invited talks given at the meeting are posted on the ALMA website www.eso.org/projects/alma/meetings/gar-nov02/

The Square Kilometre Array (SKA) is gaining momentum as the major global radio astronomy project for the coming decades. RadioNet has supported the first European-based approach to SKA configuration and data simulation studies. Progress has been limited in this area, partly because it is very difficult to realistically generate (or subsequently analyse) the enormous data sets that the SKA will actually produce. Other activities include preparation for the release of the European SKA Consortium (ESKAC) White Paper Concept. This white paper focuses on a low-frequency SKA (0.1-1.7 GHz) that uses the aperture array antenna technology pioneered by ASTRON. An SKA based on this technology would be able to observe different parts of the sky simultaneously. At least eight widely spaced multiple fields-of-view could be placed at any position on the sky. Each field-of-view would encompass an area of 1 square degree. The European SKA concept is mostly aimed at conducting deep HI and radio continuum surveys out to very high redshift. Multiple fields-of-view is a new concept for most radio astronomers, and the added value (apart from the obvious multiplicative factor associated with sky survey depth and operational flexibility) is beginning to be more widely appreciated. One possibility being explored is that the final SKA configuration will be based on a hybrid array – aperture array panels being employed at frequencies below a few GHz, and small paraboloids at higher frequencies. The ESKAC White Paper is now in the final stages of preparation and is scheduled for release in June 2003, prior to the next International SKA Meeting (to be held in Geraldton, Australia, 27 July - 2 August 2003).

Much of the recent effort coordinated by RadioNet has focussed on the generation of a proposal to be submitted to the EC's Integrating Infrastructure Initiative (I3). Coordination meetings were held at Jodrell Bank, Berlin and Grenoble – Prof. Philip Diamond of Jodrell Bank Observatory was nominated as the overall coordinator. The final proposal was submitted in mid-April and included 9 Networking activities, 7 Transnational Access Facilities and 4 Joint Research Activities. The Research Activities were focussed on enhancing exisiting facilities in Europe, operating at cm, mm and sub-mm wavelengths. In total 25 institutes contributed to the RadioNet I3. The outcome of the proposal should be known at the end of the summer.

In January 2003, the International SKA Steering Committee appointed the first Director of the International SKA project, Prof. Richard Schilizzi, formerly Director of the Joint Institute for VLBI in Europe and Coordinator of RadioNet. Mike Garrett takes over from Richard as both JIVE Director and coordinator of RadioNet. Phil Diamond will serve as the RadioNet coordinator for FP6, assuming the new I3 RadioNet proposal is successful. Fingers crossed!

M.A. Garrett, RadioNet Coordinator (FP5)

The International Virtual Obervatory

Introduction

Astronomy faces a data avalanche. Breakthroughs in telescope, detector, and computer technology allow astronomical instruments to produce terabytes of images and catalogs (Figs. 1 and 2). These datasets will cover the sky in different wavebands, from gamma- and X-rays, optical, infrared, through to radio. In a few years it will be easier to "dial-up" a part of the sky than wait many months to access a telescope. With the advent of inexpensive storage technologies and the availability of high-speed networks, the concept of multi-terabyte on-line databases interoperating seamlessly is no longer outlandish. More and more catalogs will be interlinked, query engines will become more and more sophisticated, and the research results from on-line data will be just as rich as that from "real" telescopes. Moore's law is driving astronomy even further: new survey telescopes now being planned will image the entire sky every few days and yield data volumes measured in petabytes. These technological developments will fundamentally change the way astronomy is done. These changes will have dramatic effects on the sociology of astronomy itself.

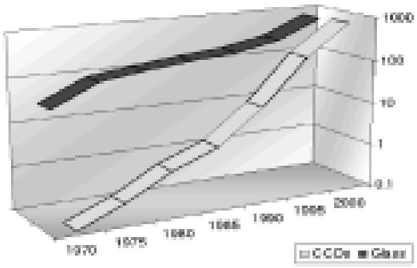


Figure 1 – The total area of astronomical telescopes in m², and CCDs measured in Gigapixels, over the last 25 years. The number of pixels and the data double every year.

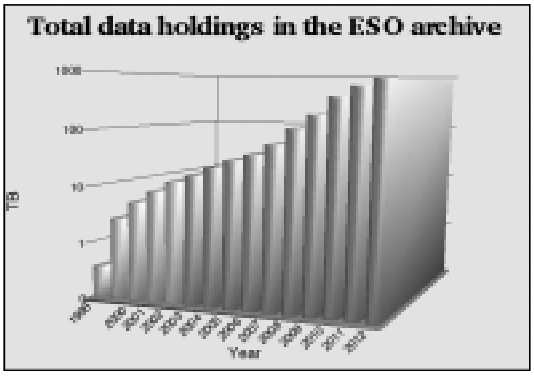


Figure 2 – The cumulative compressed data holdings of the ESO archive will reach 1 PetaByte by 2012. The change is slope around 2007/8 is due to the simultaneous availability of 2nd generation instrumentation, the wide field VISTA IR camera and ALMA.

Over the past two years the concept of the Virtual Observatory has emerged rapidly to address the data management, analysis, distribution and interoper-ability challenges. The VO is a system in which the vast astronomical archives and databases around the world, together with analysis tools and computational services, are linked together into an integrated facility. Twelve VO projects are now funded through national and international programs (Table 1), and all projects work together under the International Virtual Observatory Alliance to share expertise and develop common standards and infrastructures for data exchange and interoperability. Astronomy stands at the edge of a new frontier for discovery, enabled by modern information technology (such as the Grid) and by political and technical collaboration among international partners.

Science Goals, Science Guidance

By providing the tools to assemble and explore massive data sets quickly, the VO will facilitate and enable a broad range of science. It will make practical studies which otherwise would require so much time and resources that they would be effectively impossible. Federating massive data sets over a broad range of wavelengths, spatial scales, and temporal intervals will be especially fruitful. This will minimize the selection effects that inevitably affect any given observation or survey and will reveal new knowledge that is present in the data but cannot be recognized in any individual data set. VO-based studies would include systematic explorations of the large-scale structure of the Universe, the structure of our Galaxy, AGN populations in the universe, variability on a

International Virtual Observatory Alliance Partners May 2003
http://www.ivoa.net

Project	URL
AstroGrid (UK)	http://www.astrogrid.org
Australian Virtual Observatory	http://avo.atnf.csiro.au
Astrophysical Virtual Observatory (EU)	http://www.euro-vo.org
Virtual Observatory of China	http://www.china-vo.org
Canadian Virtual Observatory	http://services.cadc-ccda.hia-iha.nrc-cnrc.gc.ca/cvo/
German Astrophysical Virtual Observatory	http://www.g-vo.org/
Italian Data Grid for Astronomical Research	http://wwwas.oat.ts.astro.it/idgar/ IDGAR-home.htm
Japanese Virtual Observatory	http://jvo.nao.ac.jp/
Korean Virtual Observatory	http://kvo.kao.re.kr/
National Virtual Observatory (USA)	http://us-vo.org/
Russian Virtual Observatory	http://www.inasan.rssi.ru/eng/rvo/
Virtual Observatory of India	http://vo.iucaa.ernet.in/~voi/

range of time scales, wavelengths, and flux levels, and other, heretofore poorly known portions of the observable parameter space. The VO will also enable searches for rare, unusual, or even completely new types of astrophysical objects and phenomena. For the first time, we will be able to test the results of massive numerical simulations with equally voluminous and complex data sets. The VO-enabled studies will span the range from major, key project level efforts to supporting data and sample selection for new, focused studies of interesting types of targets, both for the space-based and major ground-based observatories.

Many of the IVOA projects have active Science Working Groups consisting of astronomers from a broad cross-section of the community representing optical, radio, high energy, space and ground-based astronomy. In some cases, IVOA projects have cross-membership of these groups. The common focus of SWGs is to form a clear picture of the scientific requirements for an operational virtual observatory. These requirements are a mix of new technologies and algorithmic capabilities as well as new standards that address fundamental issues of publishing data in the IVO (e.g., guidelines for describing all the aspects of data quality). Individual SWGs have identified the need for a design reference mission for the IVO which will capture the set of tools astronomers will need to do new science in the IVO as well as defining initial science cases and projects that can be run in the IVO to test and refine capabilities.

One of the main results of the SWG discussions to date has been a clarification of the role and nature of the IVO in modern astronomy. In the next few years, projects within the IVOA will build a new astronomical infrastructure with the guidance of the research community and utilizing emerging technologies. Once this fundamental infrastructure of standards and technologies is in place, the international astronomical community will be empowered to create new research programs and publish their data and results in a more pervasive and scientifically useful manner than was ever possible before. The IVO will not be an end in itself or an adjudicator, but a facilitator and an empowering agent in modern astronomy.

Demonstrations

A number of the VO projects are using science prototypes, or demonstration projects, to help guide technical developments and show the user community the benefits of the federated archives, catalogs, and computational services. The AVO's first demonstration, which debuted in January, provides astronomers with a powerful interface for exploring the GOODS (Great Observatories Origins Deep Survey) multi-spectral images, for obtaining spectral energy distributions for GOODS catalogued objects, and for measuring uncatalogued objects dynamically using a web-service front-end to Sextractor (Fig. 3). The US NVO project showed three prototypes at the January meeting of the American Astronomical Society in Seattle: 1) a transient event follow-up service, 2) a brown dwarf candidate search, and 3) a galaxy morphology analysis. These demonstrations utilized new standard interfaces and protocols for accessing catalog and image data, and the galaxy morphology demo employed grid-based computing for doing

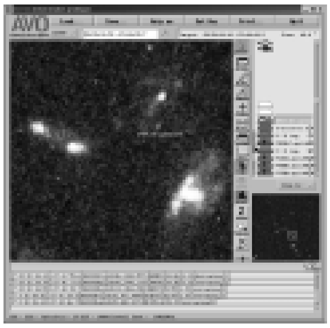


Figure 3 – The AVO Demo interface to explore multiwavelength GOODS data http://www.euro-vo.org

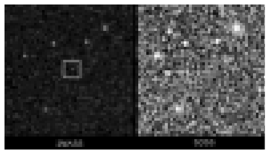


Figure 4 – The NVO brown dwarf candidate search demonstration project yielded a new brown dwarf discovery.

parallel computations. The brown dwarf search was intended to validate previous results in a fraction of the time taken for earlier candidate identifications, but yielded the exciting result of a new brown dwarf discovery (Fig. 4). The Astro-Grid project contributed to the AVO demo but also has science use cases of its own, including analysis of deep field surveys, high redshift quasars, and searches for low surface brightness galaxies. Recently the Canadian VO project released its first demonstration (available at the URL shown in Table 1).

Technology

In its January 2003 meeting the IVOA identified six major technical initiatives necessary to make progress toward the scientific goals of the VO.

Registries. Registries function as the "yellow pages" of the Virtual Observatory, collecting metadata about data resources and information services into a queryable database. But, like the VO resources and services themselves, the registry is also distributed. Replicas will exist around the network, both for redundancy and for more specialized collections. The VO projects are investigating a variety of industry standards for implementation of registries, including the Open Archive Initiative (OAI) developed in the digital library community. Registry metadata are using the Dublin Core definitions, also developed for the library community, wherever possible.

Data Models. Although the international astronomy community has long agreed on a common format for data, the FITS standard, there are many variations in which metadata can be encoded in FITS files, and many options for storing associated data objects (a spectrum, its wavelength scale, and its variances, for example). FITS is a syntactic standard, not a semantic standard. The VO data models initiative aims to define the common elements of astronomical data structures and to provide a framework for describing their relationships. Data models will allow software to be designed to operate on many data storage variants without needing to modify the source data structures.

Uniform Content Descriptors. The CDS in Strasbourg pioneered the development of UCDs in order to make semantic sense of its large collection of astronomical catalogs and tables. Among the tens of thousands of column names in its collection, they found that there were only about 1500 unique types of content. Astronomers are creative, having found some

250 labels for a Johnson V magnitude! UCDs will provide a lingua franca for metadata definitions throughout the VO.

Data Access Layer. Building on the VO data models and UCDs, the data access layer provides standardized access mechanisms to distributed data objects. Two initial prototypes for the DAL have been developed thus far: a ConeSearch protocol and a Simple Image Access Protocol. The former returns catalog entries for a specified location and search radius on the sky, and the latter returns pointers to sky images given similar selection criteria. Work is underway to extend the DAL to other data types and to enable legacy software systems to incorporate DAL interfaces.

VO Query Language. The many and distributed databases of the VO will need a standard query language. Although most, if not all, modern astronomical databases are queryable with SQL, SQL has limitations in areas fundamental to astronomical research, such as region specifications on the sky. The concept of a join based on spatial coordinates must be "fuzzy", allowing for uncertainties in the coordinates, differences in spatial resolution of detectors, and different physical scale sizes of objects at different wavelengths. Some groups are experimenting with very high-level query languages that would allow natural language query expressions.

VOTable. The first international agreement reached by the VO projects was VOTable, and XML mark-up standard for astronomical tables. The heritage of VOTable comes from FITS, the CDS Astrores format, and the industry-standard eXtensible Mark-up Language. The data access layer ConeSearch and SIAP services return results in VOTable. VOTable software libraries have been developed in perl, Java, and C++, and VO India has developed a general purpose VOPlot program in Java for data display. VOTable has been in use for just over a year, and the IVOA is now looking into what enhancements or extensions might be necessary.

IAU Joint Discussion and IVOA Displays

The IAU General Assembly in Sydney, Australia (July 2003) will be a focal point for IVOA activities. Joint Discussion 8 will include four sessions devoted to the Virtual Observatory, and a special session on Future Large Facilities will feature talks by the co-authors of this article on the impact of the VO on new missions and telescopes. The IVOA will also have a large display featuring demonstrations from participating organizations. We invite all participants at the IAU to stop by and see the VO prototypes in action.

Participation

The IVOA welcomes new VO projects to its membership. Please contact either of the authors of this article for more information via http://www.ivoa.net

Robert Hanisch, Project Manager, US National Virtual Observatory, and Chair, International Virtual Observatory Alliance; Space Telescope Science Institute, Baltimore, Maryland, USA.

Peter Quinn, Director, Astrophysical Virtual Observatory; European Southern Observatory, Garching, Germany.

FP6 Proposals for the EURO-VO

Eight European organizations (ESO, ESA, CDS(ULP/CNRS), ASTROGRID (U.Edinburgh), MPE, INAF, NOVA and INTA) will collaborate on Virtual Observatory initiatives by joint involvement in several FP6 proposals aimed at creating an operational European Virtual Observatory (EURO-VO). These efforts will be based on the current FP5 Astrophysical Virtual Observatory (AVO) RTD programme and the EC funded ASTROVIRTEL programme in support of access to research infrastructures.

The EURO-VO proposals seek to create three new and interacting organizational components.

- Data Centre Alliance: The largest and most important job is to bring the data centres of Europe on board. Using the VO framework implies work for data centres – deploying grid technologies, upgrading hardware, writing and publishing web services, preparing their holdings to be "VO ready", and building collaborative grids (hw+sw+physical networks).
- VO Facility Centre: This centre would build and maintain a Registry of services, as well as a capability database for data creators. They could act as a certificate authority, in collaboration with national authorities. They could also provide user support, and continue to develop the science case for further developments.
- VO Technology Centre: New technology will continually be developed. We foresee a need for continuing VO technology R&D, and rolling out of new products. This will be a specialised job that most data centres will not want to participate in, and will need interaction with computer science, industry, and other grid-application areas.

The funding for these EURO-VO components will be sought from several of the FP6 areas in calls during 2003. An Integrated Infrastructure Initiative (I3) in the Integrating Activities area, an I3 in the Communication Network Developments area and an Integrated Project in the IST Priority area on GRIDS will be employed with a total funding level of approximately 15 million _. These proposals will be coordinated with the needs of both OPTICON and RADIONET as the EURO-VO will seek to serve both communities.

P. Quinn - 18/5/03

AFFILIATED SOCIETIES

Astronomy in Hungary

Ever since the archbishop Péter Pázmány established the University of Nagyszombat in 1635, Hungary has had continuous and professional astronomical research conducted on her soil. This research was given a new impulse when, in 1871, Miklós Konkoly Thege built his observatory in Ógyalla. Not so long afterwards, Hungarian Astrophysics – only recently born – was enriched by two significant establishments: in 1877 by Kalocsa Observatory, and in 1881 by the Herény Observatory founded by J. Gothard.

Konkoly donated his institute to the Hungarian State in 1899, thereby creating the precursor to the Konkoly Observatory of the Hungarian Academy of Sciences (HAS). The current institute was built on Svábhegy, in the outskirts of Budapest, during 1921-28. The Kalocsa Episcopal Observatory finished functioning in 1951. The Gothard Observatory currently belongs to the Science Faculty of the Eötvös University in Budapest. The FOMI Satellite Geodetic Observatory in Penc was built in 1976, where the very long baseline interferometry (VLBI) networks are extensively used for radioastronomical research. In 1991, Szeged University's Observatory came into being, while in 1994 the Baja Observatory of the Konkoly Observatory of HAS became the Astronomical Institute of Bács-Kiskun county. Internationally significant research is carried out in the Astronomical and the Atomic Physics Department of the Eötvös University.

Observational Astrophysics in Hungary has traditionally specialized itself into three fields: astronomical photometry, the observation of phenomena on the solar surface, and the observation of small bodies in the Solar System. All three fields have the common property that the time at which the observations are carried out is crucial.

The researchers of Konkoly Observatory has, for several decades now, been observing the RR Lyrae-type pulsating variable stars found in globular clusters. They have discovered a close relationship between the light curves and the underlying physical parameters. Based on several decades of observations, they have determined the Blazhko period of several RR Lyrae stars. They have demonstrated that there exist variations which contradict to theoretical expectations.

In the observations of delta-Scuti type variable stars the co-operation of observatories situated at different geographical longitudes plays an important role. Based on such international co-operation and owing to a good resolution Fourier spectrum it was possible for the first time to identify g (gravitational) and p (pressure) modes of oscillations.

The researchers of Konkoly Observatory have demonstrated that over half of delta-Cephei type variable stars, which are regarded as being pivotal to the determination of the cosmological distance scale, belong to binary systems. Significant results have been achieved in the high-resolution spectroscopy of the delta-Cephei stars by teams of the Optical and Quantum-Electronic and the Experimental Physics Departments of the Szeged University.

In the Konkoly Observatory important results have been achieved in the modeling of pulsating variable stars as dynamical systems. For instance, it has been proved that the pulsation of the star R Scuti is chaotic. Commissioned by the IAU the Information Bulletin on Variable Stars (IBVS) is published by the Konkoly Observatory.

The eclipsing binaries belong to one of the traditional research areas in Hungary. Researches, carried out in the Baja Observatory concerning the existence of dark companions and the demonstration of relativistic effects, led to important results.

The Konkoly Observatory can look back over two decades of researches in stellar activities. The spotted surfaces of several stars have been determined by measuring the Doppler-distortion of spectrum lines caused by rotation. The surface patterns were compared to the integral light variations due to the spotted surface, and with the help of this, activity periods similar to the solar cycles were derived.

The observation of the Sun's surface is one of the fields traditionally pursued by Hungarian astrophysicists. The Debrecen Solar Physics Observatory currently houses the most complete solar surface database in the world. They have developed an accurate method of tracking the shape and location of sunspots, which at present is the only one of its kind in the world. The Astronomical Department of Eötvös University has also obtained internationally important results in the magneto-hydrodynamic modelling of processes that play a key role in the formation of sunspots. The KFKI Research Institute for Particle and Nuclear Physics of the HAS achieved world wide reputation in studying and modelling the solar and interplanetary plasma and in the propagation of Galactic cosmic radiation in the Solar System.

Between World War I and II, a significant number of asteroids was discovered in the Konkoly Observatory; several of these, consequently, have Hungarian names. At present both the Konkoly Observatory and the Szeged University conduct photometric and astrometric work on asteroids and cometary nuclei. As regards theoretical investigations, minor planets is one of the several research topics of celestial mechanics conducted at the Department of Astronomy of the Eötvös University aiming at studying the dynamics of planetary systems.

When a Schmidt telescope was put into operation on Piszkéstetö in the Mátra mountains (Northern Hungary) during the early 60's, this created the observational background for statistical astronomy in Hungary. We must make special mention of the research carried out on the distribution of young, H-alpha emitting stars. An outstanding accomplishment of the Hungarian researchers was the discovery of a far infrared ring in the Cepheus constellation, which creates a physical connection between several areas of active star-formation. Research on star formation is a co-operative effort between the Konkoly Observatory and the Astronomical Department of Eötvös University.

The researchers at Eötvös University's Gothard Observatory have also obtained significant results in the field of high-resolution stellar spectroscopy. On a homogeneous sample, they investigated the velocity field of the atmospheres of the young stars, and have demonstrated its relationship with the embedded interstellar matter left over from star formation.

Research undertaken at the Theoretical Physics and at the Atomic Physics Departments of the Eötvös University has provided a strong theoretical background for anyone wishing to investigate the early state of the Universe, and the formation of the structures that have led to the creation of galaxies. Due to this, Hungarian participation in the Sloan Digital Sky Survey, one of the most important astrophysical projects of our day, is quite important. The theoretical interpretation of cosmological data is an important topic in KFKI (Central Institute for Physical Research)'s research on general relativity.

The Theoretical Physics Department of the Eötvös University has worked out a new equation of state for the modelling of the internal structure of neutron stars. In the FOMI Satellite Geodetic Observatory, Penc, important results have been achieved concerning a variety of compact Galactic and extragalactic radio-emitting objects, particularly in the investigation of matter ejection at relativistic velocity from quasars, using radio interferometric (VLBI and space VLBI) technique.

One hopes that Hungary, during her Euro-Atlantic integration, has an important role to play in Western European research centres, in particular joining ESO (the European Southern Observatory), as well as participating as an equal partner in other European Union research programs.

Lajos Balazs

First results of the Swedish 1-m Solar Telescope

The Swedish 1-m Solar Telescope (SST) was opened to full aperture and its adaptive optics system was switched on for the first time on 21 May 2002. Already the day after that, it delivered diffraction-limited images. This meant that an often-stated "dream limit" of observational solar physics – a resolution of 0.1" – had been reached.

An angle of 0.1" corresponds to slightly more than 70 km on the solar surface. This is on the order of or less than the photospheric pressure scale height, the photon mean free path in the photosphere, and the radii of fully evacuated magnetic fluxtubes. Reaching this resolution thus promises to spatially resolving the basic physical processes in the photosphere including the basic building blocks of solar activity.

Solar magnetism

All aspects of solar activity are manifestations of magnetism. The sun provides the best available natural laboratory for studying cosmic magnetism on scales not accessible on Earth and not resolvable in distant astronomical objects. Of course, the sun cannot directly represent all astrophysical objects harbouring magnetic fields, but there is still a large variety of processes that can be studied due to the huge variation in densities and temperatures from the solar photosphere to the corona. Furthermore, the small dimensions of solar magnetic structures lead to short time scales, on the order of tens of seconds up to days for sunspots. We can thus observe a dynamic, ever-changing sun, in contrast to most other astrophysical objects from which we glimpse only a snapshot. The sun is also for this reason the best available astrophysical object for tests of numerical MHD simulations.

Solar magnetic fields are thought to be generated by dynamo action at the bottom of the solar convection zone. They eventually become unstable, rise rapidly through the convection zone and break through the photosphere as newly emerging flux, which is most obvious in the form of sunspots. Everywhere on the solar surface, tiny kilogauss flux concentrations can be seen. Contrary to intuitive expectations, solar magnetic fields have a strong tendency to concentrate and to appear in the form of bundles of fluxtubes. The presence of these concentrations of magnetic flux have been known for decades but it is only now that we can resolve them and explore their physics – one of the major motivations for the SST project.

Design of the SST

Just like night-time telescopes, solar telescopes strive towards larger apertures in order to increase the resolution and to collect more light. The latter may seem surprising – the sun is after all the brightest object in the sky at most wavelengths – but spectrometric, polarimetric, and spectropolarimetric diagnostics need high signal-to-noise ratios while the motions in the solar atmosphere calls for short exposure times when operating at the diffraction limit. The only way out is to increase the aperture.

However, the paramount importance of resolution and the adverse effects of straylight together with the necessity of observing in daytime (when seeing is more problematic than during night), poses special constraints on solar telescopes and have caused them to be more modest in size than their nocturnal sisters.

The front lens of the SST has a diameter of just under 1 m, making it the largest optical solar telescope in Europe and the second in the world, after the McMath-Pierce telescope on Kitt Peak. The goal of the SST is to provide diffraction-limited (0.1") resolution in blue light for imaging and 0.2" resolution in polarimetry and spectroscopy and thus become the world's highest resolution solar telescope. To that end, the SST is the first solar telescope designed with adaptive optics in mind.

The SST is operated by the Institute for Solar Physics of the Royal Swedish Academy of Sciences but located within the Observatorio del Roque de los Muchachos of the Instituto de Astrofisica de Canarias on the island of La Palma, Spain. It was erected in the same building as a half-sized predecessor, the SVST, the experience from which was very valuable when designing the SST.

Solar telescopes suffer from heating by sunlight of the optics and the air within the telescope tube. To cope with that, modern instruments are either vacuum telescopes, filled with helium or use careful control of the temperature of their optics.

Vacuum telescopes require a vacuum window as large as the aperture. It is then the first optical component in the telescope and has to be polished to extremely high optical quality. Manufacturing a high-quality blank is difficult because of the stress induced by the enormous difference in pressure between the air side and the inside of the vacuum window. The practical limit for vacuum telescopes is probably not very much larger than 1 m in diameter.

A telescope filled with helium has less problems with tube seeing than one filled with air because helium has a higher thermal conductivity and a less temperature-sensitive index of refraction than air. This solution avoids the large forces on vacuum windows but still requires an optical window of high quality. Such telescopes up to diameters of 2.4 m have been proposed (for example the now abandoned plans for building LEST, Large Earth-based Telescope). For future very large solar telescopes, the only viable technique seems to be open air telescopes with temperature controlled optics. Examples of telescopes that use or plan to use such design are the Dutch Open Telescope, situated next to SST on La Palma, GREGOR, a German telescope planned to be built on Tenerife and the Advanced Technology Solar Telescope of the United States, for which a site has not yet been selected.

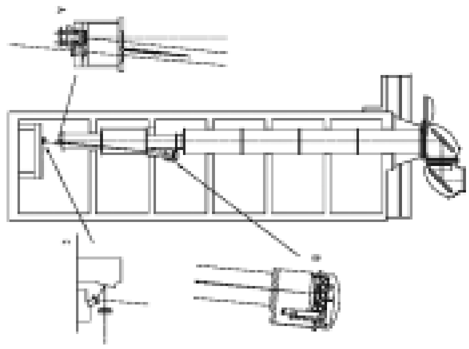
The SST is a vacuum telescope. Instead of a flat vacuum window, it uses a 1-m diameter lens to seal off the vacuum. By using a lens of a single glass, excellent image quality is obtained only through very narrow filters. This can still be useful for many solar applications where imaging within photospheric spectral lines is used.

For observations that require a broad wavelength span to be observed simultaneously, the light can be redirected to a corrector that puts all colours at a single focus. Telescopes that use such a corrector are called Schupmann telescopes after Ludwig Schupmann who proposed such optical designs 100 years ago. The Schupmann corrector also introduces the possibility of correcting for atmospheric dispersion by tilting the field lens slightly. This is essential at these high spatial resolutions when, e.g., one wants to do cospatial spectroscopy at widely separated wavelengths.

Adaptive optics

Even at Roque de los Muchachos, a 1-m telescope requires adaptive optics for diffraction-limited performance. The principle of adaptive optics is simple but its implementation difficult. An adaptive optics system requires a deformable mirror and a wavefront sensor. The common Shack-Hartmann wavefront sensor looks at a single star through many small parts of the telescope aperture and measures the position of the star as seen through each part. When the atmosphere disturbs the image, it causes the subimages to move. The positions are measured and translated to commands to the deformable mirror. The problem is that this has to be done very accurately and at a very high frequency: at least several hundred and preferably more than 1000 Hz.

Measuring a stellar position is easy but requires the star to be sufficiently bright to do this quickly enough. Finding a bright enough star close to the object of interest is thus a major problem for night-time adaptive-optics observations. For solar telescopes, there are no stars or star-like objects that can serve as reference for a wavefront sensor. However, there is fine structure everywhere on the solar disc. The position of such structures can also be measured but this requires much more complicated calculations than just finding the position of a star.



Cutaway drawing of the SST.
A: Field mirror at primary focus. Exit window.
B: Schupmann corrector.
C: Tip-tilt mirror, adaptive mirror, reimaging lens.

During its first year of observations, the SST used a 19-electrode bimorph mirror and a Shack-Hartmann wavefront sensor with 19 microlenses. This has now been replaced with a system with 37 electrodes and 37 microlenses which is better suited for the 1-m aperture and typical seeing.

In most observation modes, image selection is used: the camera operates continuosly while the image quality is evaluated in real time and only the best exposure(s) during each time interval is (are) saved. Even so, there is room for postprocessing to improve the images. The phase-diversity technique requires two simultaneous images, one close to focus and one at a fixed and known focus offset from the first. The information from the pair (or several pairs acquired in a short time-span) is used to compute the aberrations (from the atmosphere and the optics) and an unaberrated image can be constructed. Phase-diversity requires a special optical setup which is not the case in multi-frame blind deconvolution where the information from several images close in time is used to produce one that is improved.

First observations

The natural first target of the SST was sunspots. These large-scale magnetic regions are still enigmatic in many respects and we do not know why they are formed and how they can be stable. The complicated penumbra, which surrounds the dark umbra like the petals of a flower is especially problematic to understand. The penumbra has a filamentary structure which apparently follows the magnetic field. In parts of the penumbra the strong Evershed flow channels gas outwards towards the edge of the spot where it mysteriously ceases.

Already in the very first images it was obvious that new kinds of structures were visible in sunspots. It seemed to be a rule that bright filaments in the inner penumbra (the part bordering the umbra) had dark cores within them. These cores were very narrow (about 90 km) but so consistently present that the pattern should represent some fundamental property of penumbral filaments.

A sunspot penumbra seen at 0.1” resolution still looks filamentary and there are obviously filaments of unresolved thickness. However, at least the dark-cored filaments give a strong impression of being resolved structures that one would expect, or require, to appear in sufficiently realistic simulations of magnetoconvection. The latter also applies to several other kinds of narrow dark structures that are seen in the SST images in areas around sunspots.

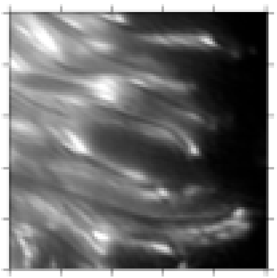
The first observations also show that the spatial resolution of the SST is sufficient to clearly reveal the 3D nature of the solar surface, in particular in active regions, by observations approaching the limb of the solar disk. One example is that light bridges in sunspots apparently protrude 200-400 km above the surrounding dark umbrae.

Future

The first season's observations were all imaging through broad or narrow filters. There are easily observed proxies for magnetic fields – like the Fraunhofer G band (CH) and H and K (Ca II). But reliable and quantitative studies of those as well as velocity information require spectroscopy and/or polarimetry. We plan to be able to do that in the near future.

The successful opening of the SST led to an effective doubling of the spatial resolution attainable in solar imaging. In doing so, new kinds of structures and processes are unveiled and old ones are seen with more clarity. But these discoveries do not necessarily by themselves lead to a deeper understanding of the physical processes that cause and shape solar activity.

Data inversions are sometimes necessary to get a first hold of what is going on, but forward solutions by comparison with sufficiently elaborate numerical models would be the most powerful method. The latter approach implies that appropriate "fingerprints" are defined in the sense of sufficiently elaborate statistical measures – like correlations between different spectral features or distribution functions of polarization signals in spectral lines. Comparisons between observed and simulated fingerprints can then provoke improvements in the theoretical treatment. When a model is sufficiently successful in this way it means that we may trust also those parts of it that represent not directly observable regions or processes. In that way the grand promise of the sun as the best test case for MHD modelling may be fulfilled.



Sunspot penumbral filaments with dark cores.
Tick mark spacing = 1000 km = 1.36".

Dan Kiselman
The Institute for Solar Physics of the Royal Swedish Academy of Sciences

INSTEAD OF OBITUARY

In October 25, 2002 a Conference was held in Poltava Pedagogical University devoted to the memory of the EAS member Yu. K. Gulak, who died a year ago and to 75 years from his birth. Scientific lectures and memoirs were presented.

Yurij Kostantinovich Gulak was born on the 11th June 1927 in the village Perekopivka of Romni, district of Sumi Oblast. His parents were teachers. In 1950 he had completed Kiev University in Physics and Astronomy and in 1953 worked for his postgraduate studies under the guidance of the noted scientist in the field of relativity prof. A.F. Bogorodsky.

Due to guiltless proposition of the Communist Party meeting in autumn 1952 in order to raise the pay of the agricultural work, talented graduates, which had many prestigious invitations for scientific work, were banished by the communist regime to inferior jobs and Yurii was employed in the provincial college as ordinary teacher. Only the Stalin death saved him from the concentration camp and premature destruction.

Having enormous teaching load (soviet and post-soviet lecturers have more than 1000 hours a year), he has been working at his favorite science only during the night and this has affected his health prematurely. Yu. K. Gulak passed away in October 19, 2001.

He was a real scientist indeed, infatuated for science till his death. He has created a theory of central gravitating systems and the distribution of gravitating matter (see Gulak, Dichko, Fedij in Kinematics and Physics of Cel. Bodies, Suppl. N 3, 2000; or Sov. Astron.- 1980.-24, 1.- P. 84-89). His colleagues, his disciples and many specialists acknowledge his outstanding scientific achievements and those who know him, we shall remember this splendid man ever.

Per pro I.A. Dichko, P.M. Fedij
Poltava, Ukraine

European Astronomical Society
P.O. Box 82, CH-1213 Petit-Lancy 2, Switzerland
http://www.iap.fr/eas/index.html

President: H. Butcher
Vice-Presidents: A. Cherepashchuk, C. Chiosi
Secretary: J. Krautter
Treasurer: B. Nordstrom
Councillors: M. Perryman, P. Shaver, M. Stavinschi, M. Dennefeld, O. Engvold

Newsletter Editor: M. Kontizas
Section of Astrophysics, Astronomy and Mechanics
Department of Physics
University of Athens
Panepistimiopolis
15783 Athens, Greece
email: mkontiza@cc.uoa.gr

Joint European and National Astronomical Meeting for 2003

J E N A M – 2003

12th European Meeting for Astronomy and Astrophysics

August 25-30, 2003, Budapest, Hungary

Second Announcement

New Deal in European Astronomy: Trends and Perspectives

The 12^{th} *Meeting of the European Astronomical Society* (**EAS**) will be held in Budapest, Hungary. The event will be hosted by the Eötvös Loránd University, Budapest.

Programme:

- Plenary Sessions Reviews + Highlight Talks
- Minisymposia
  - Radio Astronomy at 70: from Karl Jansky to microjansky
  - Gravitational Astrophysics
  - Galactic Dynamics
  - Active Stars and interacting binaries (The palette of magnetic phenomena from active stars to the Sun)
  - Dynamics of Formation, Evolution and Stability of Planetary Systems
  - Synergies in Wide Field Observations
  - The UV Sky, linking the present to the future
  - The early phases of star formation
  - Physics of Gamma-Ray Bursts
  - Astroseismology and Stellar Evolution
  - Astronomy Education in Europe
- General Assembly + Job Market

Important Deadlines & Contact address:

Registration:	May 31 (early)	August 10 (late)
Abstract submission:	May 31	
Application for Support:	May 31	
Hotel Reservation:	May 31	July 25 (payment)

JENAM-2003 ROLAND EÖTVÖS PHYSICAL SOCIETY H-1027 Budapest, Fő u. 68., HUNGARY	PHONE: (+36) (1) 201-8682 FAX: (+36) (1) 201-8682 E-MAIL: mail.elft@mtesz.hu
KONKOLY OOBSERVATORY H-1525 Budapest, Box 67, HUNGARY	PHONE: (+36) (1) 395-5866 FAX: (+36) (1) 275-4668 E-MAIL: jenam03@konkoly.hu WEBSITE: http://www.konkoly.hu/jenam03

See you in Budapest!