EUROPEAN ASTRONOMICAL SOCIETY
NEWSLETTER
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Contents

Editorial

The current newsletter is mainly focused on the presentation of brief reports from the various parallel sessions of JENAM 2009. As we all know by now, the meeting took place at the University of Hertfordshire (UK) and it was the best-attended meeting co-organized by EAS. It covered a wide range of science topics, and it clearly sets the bar fairly high for all our future meetings. A number of people dedicated themselves and invested a lot of energy in order to make this great meeting happen. All of them deserve our appreciation. I would like though to simply mention one name, that of Professor Elias Brinks, who was able to juggle with ease the hats of local host and Secretary of EAS, thus bringing together the best of everyone in this wonderful event.

As you will also notice, in addition to JENAM 2009 a few more news items are included in this issue. One is on Prof. Dr. Françoise Combes, the recipient of the 2009 Tycho Brahe Prize of the Society. I happened to be among of the many fortunate astronomers who have been influenced by Françoise. Originally as her Marie Curie postdoc and as a collaborator later, I understood a great deal of thanks to her in-depth knowledge in theoretical and observational astrophysics, her inspiring leadership, and most of all her drive for science. She is indeed a unique scientist!

Another item is a very interesting presentation on Ultraviolet Astronomy based on the responses of astronomers to a questionnaire distributed by the Network for Ultraviolet Astrophysics (NUVA). The goal of the questionnaire was to help in identifying the science needs of the European astronomical community in the UV part of the spectrum, and possibly influence the plans for developing future facilities.

In our upcoming issues we will move back to the old structure of the newsletter and include reviews on current and upcoming astronomical facilities. We will provide some news from Herschel and Planck, which were launched by ESA just last month, as well as from other missions. We will also resume the presentations of the EAS affiliated societies, which commenced last year.

Vassilis Charmandaris
University of Crete,
Greece

Message from the President

Dear EAS members,

The hope I expressed in my last message, that many colleagues will attend JENAM 2009, was more than fulfilled. Over 1100 participants attended this meeting, which was held together with the Royal Astronomical Society and hosted by the University of Hertfordshire in Hatfield, UK. The title of the meeting was "European Week of Astronomy and Space Science" and it already indicated that special emphasis was to be put on European aspects. Besides a large number of scientific symposia covering all science subjects – from the sun and the solar system via stars and galaxies to the ultimate cosmological questions – a broad overview of European activities on many levels was presented. Two major European institutions, the European Space Agency (ESA) and the European Southern Observatory (ESO) presented their scientific programs and the ERA Nets – Astronet, Opticon, and RadioNet – discussed their future projects. I am convinced that these European aspects were for many of us a unique attraction and were, at least in part, responsible for the overwhelmingly large participation. EAS plans to make European aspects a significant constituent for all future JENAMs.

During the meeting the second Tycho Brahe Prize was awarded to our French colleague Françoise Combes. The Society recognizes her outstanding research on extragalactic systems in which she combines, in a unique way, multiwavelength observations with theoretical studies. The basis of her work is formed by observations mostly in the optical spectral range with the Very Large Telescope of ESO and in the radio domain with telescopes of the Institut de Radioastronomie Millimétrique. These observations are then interpreted in detail with theoretical analysis and numerical simulations. Françoise Combes could be called a prototype of the "New Astronomer" who combines observations at multiple wavelengths and theory. The congratulations of the Society go to Françoise Combes.

The next call for nominations for the Tycho Brahe Prize 2010 will be sent out in the near future. As you know, all members of the EAS may nominate a candidate for the Tycho Brahe Prize. I would like to thank all off you who sent us their nominations so far and I would like to urge the EAS members to make their suggestions for next years' Prize.

At its last meeting, EAS Council decided to commence a membership recruitment campaign in order to increase the number of presently active members which is ~900. I believe that our Society ihas by now matured and presents many positive assets, providing ample incentives to all European astronomers to join it. These include a series of very successful JENAMs, the Tycho Brahe prize, as well as the Special Publication Series. The EAS has also been active in other activities such as supporting the IYA 2009, providing travel grants for young colleagues to attend the JENAMs and many more. I hope that my message in the next newsletter will include some positive news about an increased membership.

At the end of this message I would like to announce that upon an invitation from the Portuguese Astronomical Society, JENAM 2010 will take place in early September 2010 in Portugal.

Tycho Brahe Prize Awarded to Prof. Dr. Françoise Combes

The European Astronomical Society announces that the first winner of its newly created Tycho Brahe Prize is the Swedish astrophysicist Prof. Dr. Françoise Combes. The Tycho Brahe Prize will be awarded annually in recognition of the development or exploitation of European instruments, or major discoveries based largely on such instruments. The Tycho Brahe Prize carries a monetary reward of 6000 Euros and is sponsored by the Klaus-Tschira foundation, which is based in Heidelberg, Germany. The Tycho Brahe Prize was be awarded to Prof. Combes at the opening ceremony at the European meeting JENAM2009 which took place at the Univ. of Hertfordshire (UK), from April 20-23, 2009.

Françoise Combes is one of the leading astrophysicists in the field of extragalactic astronomy in the world and holds the title of «Astronome 1ere classe Exceptionnelle» at the Observatoire de Paris (France). She is author or co-author of more than 300 refereed astronomical publications which have received over 8000 citations, along with numerous invited reviews, as well as several books including two textbooks: «Galaxies and Cosmology», and «Mystères de la formation des galaxies». She has done fundamental work in the area of dynamics of galaxies, on the interstellar medium in extragalactic systems, on molecular absorption lines in the intergalactic medium, and on Dark Matter in the Universe. The basis of her work is formed by observations in the optical using the Very Large Telescope of the European Southern Observatory (ESO) and in the radio domain with telescopes of the Institut de Radioastronomie Millimétrique (IRAM). These observations are then combined with theoretical studies. Françoise Combes is a prototype of the "New Astronomer" who efficiently combines observations at multiple wavelengths with theory and numerical modelling.

Françoise Combes has established very successful scientific collaborations with many groups in Europe and the US. Chairing one of the five panels of the European initiative ASTRONET, she has contributed substantially to the planning of future European instrumentation. She is presently editor of the European journal Astronomy & Astrophysics and was

President of the French Society of Astronomy and Astrophysics. She has received many distinctions among which that of the «Chevalier de la Legion d'Honneur», the Silver Medal of the CNRS, and the IBM Prize in physics. She is also a member of the French Académie des Sciences.

2009 Grote Reber Medal Awarded to Barry Clark

The 2009 Grote Reber Gold Medal for lifetime innovative contributions to radio astronomy has been awarded to Dr. Barry Clark, who is an Emeritus Scientist at the U.S. National Radio Astronomy Observatory (NRAO) in Socorro, New Mexico. Clark is being honored for his many pioneering developments to radio interferometry and synthesis imaging, over a career spanning more than half a century.

Barry Clark received his BS and PhD degrees in astronomy from Caltech and MIT in 1959 and 1964 respectively. His scientific career has extended over a full half a century starting with his research on the solar corona and the Galactic magnetic field while still an undergraduate student at Caltech. As a graduate student, Clark used the Caltech radio interferometer to study Galactic atomic hydrogen clouds, and suggested that interstellar hydrogen is found in two distinct temperature phases — thus leading to our current understanding of the multiple phases of the interstellar medium.

"Throughout his career he tackled only the difficult problems, leaving the easy ones for the rest of us", said Dr Ken Kellermann of the National Radio Astronomy Observatory in the U.S.
After receiving his PhD in 1964 Barry went to NRAO where he has remained until the present. Soon after he arrived at NRAO, he led the development of the world's first digital recording, software correlator Very Long Baseline Interferometer system and the subsequent enhancements to its sensitivity. He is probably best known, however, as the intellectual power behind the Very Large Array, the most powerful radio telescope system ever built. Later, he led the design of the Very Long Baseline Array, an array of ten radio telescopes spread across the U.S. which provided unprecedented angular resolution.

"Barry was a man of few words, but these were most certainly worth listening to!" said Dr David Jauncey of the Australia Telescope National Facility in Australia.

The 2009 Reber Medal will be presented to Barry Clark on August 5 at the triennial meeting of the International Astronomical Union in Rio de Janeiro, Brazil.

The Reber Medal was established by the Trustees of the Grote Reber Foundation to honor the achievements of Grote Reber and is administered by the Queen Victoria Museum in Launceston, Tasmania. Nominations for the 2010 Medal may be sent to Martin George, Queen Victoria Museum, Wellington St, Launceston, Tasmania 7250, Australia or by e-mail to: martin@qvmag.tas.gov.au to be received no later than November 15, 2009.

EURO-VO News

The European Virtual Observatory (EURO-VO), continues promoting and facilitating astronomical research through support of VO-enabled science projects in the community, workshops and schools, dedicated science talks and outreach.

A EURO-VO AIDA School, the first of its kind in Europe, took place at ESO, Garching, on March 30 - April 2, 2009. The school was geared towards PhD students and young post-docs. Forty participants (selected from about 75 applications) and 16 tutors were divided to four groups and pursued real science cases for two full days, including the participants' own science cases. According to the feedback session held during the last day of the workshop, the School was characterized as very successful by the participants, who also requested have another one in the near future. Details about the school can be found here: http://www.euro-vo.org/aidahandson2009/

The Data Centre Alliance (DCA) is organizing what is now becoming a traditional workshop on "How to publish data in the VO" to be held at ESA, Villafranca, on June 22-29, 2009. For all the details, see:
http://www.sciops.esa.int/index.php?project=CONFERENCE&page=AIDA_VOWS2009

The Joint European and National Astronomy Meeting (JENAM), celebrated in Hatfield on April 19-24, 2009, hosted a session on "The Virtual Observatory and distributed computing". During this session updates on the access of science ready data products, advanced data pipe-lining and management systems designed to support the scientific exploitation of new missions from ESA and ESO, and the use of distributed compute grids have been presented. In parallel, the EURO-VO organized a booth where astronomers could stop by and be introduced to the VO world by means of presentations, posters, hand-outs and live demos.

The EURO-VO AIDA project is releasing its second announcement of opportunities. European teams carrying out archival research or projects that could benefit from the Virtual Observatory concept are strongly encouraged to apply. Successful applicants will receive a one-year support from EURO-VO astronomers in using the VO facilities and software to complete their projects. For more details on the call and the submission procedure, check the EURO-VO web pages: http://www.euro-vo.org/pub/

The EURO-VO recently made available on-line a series of tutorials on the use of the VO tools and services, based on real-life science cases. The tutorials, available from the EURO-VO web pages:
http://www.euro-vo.org/pub/fc/workflows.html, provide a step-by-step description of e.g. confirming a SN candidate; finding quasar or brown dwarf candidates; collecting data for a specific source and many more.

To subscribe to the EURO-VO mailing list, follow the URL:
http://help.euro-vo.org/esupport/index.php?_m=news&_a=view
and enter your e-mail address in the "Subscribe" widget.

Evanthia Hatziminaoglou,
on behalf of the EURO-VO Facility Centre

Ultraviolet Astronomy: views from the community - A report from the NUVA on-line questionnaire.

Introduction

The Network for Ultraviolet Astrophysics (NUVA) is a pan-european network set-up to identify the needs of the astronomical community in the UV domain and eventually propose actions to structure it around new projects. It has first been established within the Opticon FP6 program (financed by the European Union), but it is now continuing within a broader range. After publishing a first report entitled "Fundamental Questions in Astrophysics: Guidelines for future UV Observatories, 2006, A.I. Gomez de Castro and W. Wamsteker, Eds, Astrophysics and Space Science, 303, Ns 1-4), a new volume was prepared, focused on the UV projects being generated by the astronomical community world-wide, as a result of the first NUVA conference held at El Escorial (Spain) in May 2007 (A. I. Gomez de Castro and N. Brosch, Eds, 2009, Astrophysics and Space Science, 320, Ns 1-3).

The NUVA Network is now continuing its task in planning a roadmap exercise. Because of the diversity of interests it was felt necessary, as part of this exercise, to propose an on-line questionnaire to understand the priorities of the community. This has been proposed in the fall 2008, and its outcome is now analysed in this brief report.

The UV community

The questionnaire has received 199 answers by end of April 2009. All ages are represented rather evenly (see Fig. 1), and contrary to common thoughts, there is a genuine interest in UV science even in the young generation of astronomers. Most users have a prime interest in multi-wavelength coverage, the primary background being optical astronomy. Most of them are not involved in instrument developments.

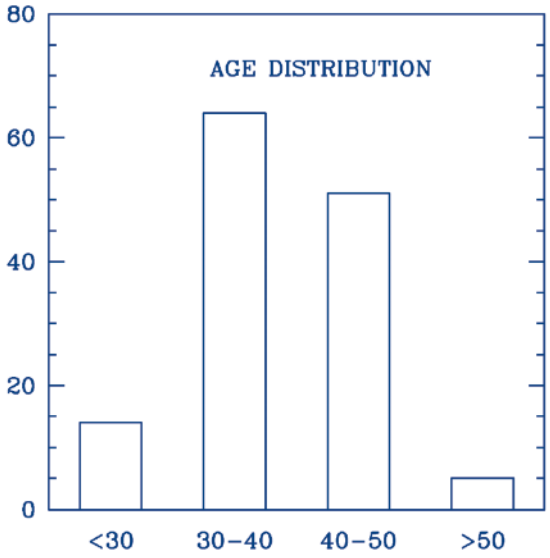

Fig. 1: Age distribution of astronomers having answered the questionnaire

The research areas are quite diverse, starting with stellar physics (as in the IUE times), but with a growing community in extragalactic astronomy and interstellar/intergalactic medium. The questionnaire was not detailed enough to allow a distinction between sub-categories, like for instance, exoplanet research or protoplanetary disks, so that very specific needs may not be represented.

By countries, the largest interest in the UV is found in Italy, Spain and Russia, followed by other countries such as France, Germany or the UK (see Fig. 2). An important contribution came from the U.S.A., though it certainly under-represents the interests in such a large community. International organisations like ESO or ESA are well represented also, and four answers were even received from the United Nations.

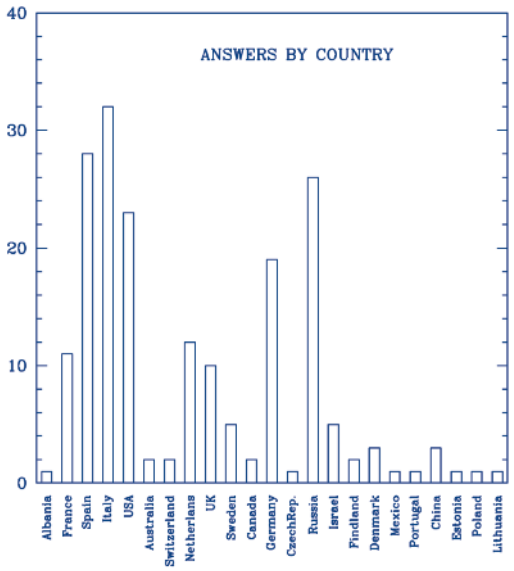

Fig. 2: Distribution of answers by countries

Recent use of UV data (less than 2 years) is mostly based on archival data rather than new observations, a fact probably due to the lack of easy accessible observing facilities.

The instrumentation needs

The community uses or requires more spectroscopy than imaging (by about a factor of 2), but it is to be noted that efficient imaging facilities in the UV were only recently made available (with the implementation of the Advanced Camera for Surveys on the Hubble Space Telescope in 2002). A small fraction of the community uses both imaging and spectroscopy.

The primary range of interest is the far (110-200nm) UV range, closely followed by the near-UV one (200-320nm). There is a substantial fraction (one third) of the community interested to go down to the Lyman limit (91.2nm) but only a small one wanting to go further down to the extreme UV (see Fig. 3).

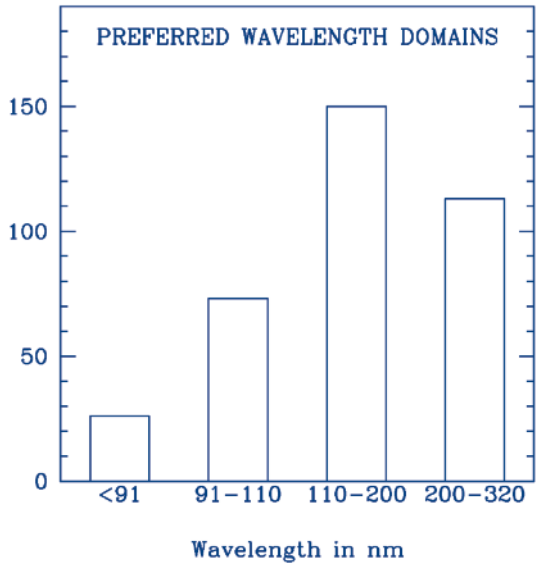

Fig. 3: Spectral range of interest

In imaging, the Field of View (FOV) requested ranges mostly from 5 to 60 arcmin. The wishes for time resolution go from 1 to 300 seconds or more, with a few requests for very high time resolution (0.1 sec or much less). There is some interest in polarimetric mode (25% of the answers).

In spectroscopy, the requests in spectral resolution can be broadly distributed into three categories: 1000-3000, 10000, or 50000. Only few users ask much more (or much less…) than that. Time resolution is not a major constraint here, although a few users ask for a few seconds or less. In terms of FOV, most users would be satisfied with a field between 1 and 5 arcmin, but some requests exist for much larger fields (up to 60 arcmin), presumably for surveys. Like for imaging, a quarter of the population is expressing an interest in spectro-polarimetry.

About half the community is requesting a long-slit mode, while about a quarter is interested in new techniques like Multi-Object of Integral Field spectroscopy.

Telescope size

The questionnaire proposed only a limited choice of possible telescope diameters: 2, 6 or 20m. An equal number of users would be satisfied with a 2m telescope (79 answers) and with a 6m telescope (75 answers). Surprisingly few (13 only) are requesting a 20m one, possibly due to fears in its feasibility. Some answers did not express a preference at all.

Some specific comments are made about the following points:
– The need for a high dynamic range
– The need to be immune to bright objects in the field
– The interest in high orbits for long observations

Conclusions

As expected, a broad range of interests has been expressed, pointing towards a general, observatory-type mission. It is however not clear if the diversity of requests can be satisfied with a small set of instruments only. The one challenge that remains is to close-up the technological break around 110nm, which forces to artificially separate many science cases, such as low redshift from high redshift galaxies, or the OVI resonance lines from the NV or CIV hot plasma tracers, etc.

A major breakthrough expected in UV technology is a new generation of detectors to substitute the present generation of MCP's. These will be similar to optical CCD, and will have with high quantum efficiencies, high dynamical range and will be immune to bright sources.

This questionnaire shows an active and young community, with a broad range of scientific interests, requesting new UV instrumentation. The existence of such a community is the best guarantee for a good use of the next generation facilities. As a word of caution however, there is a risk to lose those competences if the time gap between the end of Hubble's life and the next generation of instruments like ATLAS-T becomes too long. The current scarcity of UV instruments should thus be addressed rapidly by the community; in the mean time, a refurbished HST and smaller, dedicated UV missions like Tauvex, Astrosat, WSO, will help to keep the community alive.

Details on the Network for UV Astronomy can be found at http://www.ucm.es/info/nuva

A.I. Gómez de Castro, M. Dennefeld,
I. Pagano, N. Brosch, N. Kappelmann,
B. Shustov, D. de Martino and H. Henrichs

News drom JENAM 2009

Session: The IYA 2009 in Europe

The five sessions were all extremely well attended, with a full house on two occasions. The first session focused on the International aspect of IYA2009 by Pedro Russo (the International Coordinator) and the Cornerstone Projects '100 hours and 80 telescopes around the world' (Douglas Pierce-Price); 'Portal to the Universe' (Lars Lindberg Christensen) and 'SHE is an Astronomer' (Helen Walker). The latter two cornerstones had their international launch during the JENAM. The '80 telescopes around the world' event was a spectacular success and the demonstration of the 'Portal to the Universe' one-stop, astronomy news and products showed what a valuable asset this will be.

The remainder of the four sessions focused on national IYA activities and education. Presentations were given from the following countries: United Kingdom, Armenia, France, Romania, Slovenia, Slovakia, Serbia. Other presentations focused on specific activities, mostly in the UK, and the producer (Robert Priddey) of the short film 'The Starry Messenger' gave a very honest and humorous review (including many outtakes) of what it took to make it all happen. The film was given its first showing during a lunchtime at JENAM and will be distributed to schools throughout the UK.

In the education section, two of the IYA Cornerstone Projects were reviewed: UNAWE (Carolina Oddman) and the Galileo Teacher Training Programme (Rosa Doran). A highlight was the very impressive and assured presentation by four 11-12 year-old schoolchildren about their project work on archaeoastronomy. We also heard about educational activities in Benin, Spain and the UK.

A new Cornerstone Project was announced – an autumn version of the 100 hours of astronomy, this time concentrating on sidewalk astronomy and viewing the Moon and Jupiter. The audience voted overwhelmingly to call this 'Galilean Nights' and this suggestion has been passed on to the IAU Executive Working Group for consideration. Overall it was clear how much work is going on globally, and especially in Europe to promote IYA2009 and the sessions all had extensive discussion during and afterwards as people swapped ideas.

Ian Robson
Royal Observatory of Edinburgh, UK

Session: The Next Era in Radio Astronomy: the Pathway to SKA

The symposium «The next era in radio astronomy: the pathway to SKA» held at JENAM 2009 was intended to acquaint the astronomical community with activities in Europe which explore technologies and scientific areas which prepare the way for the next generation radio telescopefacility the Square Kilometre Array (SKA). The first session was dedicated to an overview of the SKA project, with emphasis on the techniques developed in Europe with partial support of the EC which focus on the application of aperture arrays, such as used in LOFAR, and focal plane arrays which expand the field of view of traditional radio telescopes such as the APERTIF system on the Westerbork Synthesis Radio Telescope. In addition attention was given to the SKA precursor telescopes at the two potential SKA sites, MeerKAT in South Africa and ASKAP in Australia.

The second session of the symposium was entirely devoted to science with e-EVN and e-MERLIN, two facilities which provide a high resolution window on SKA science. Four e-MERLIN Legacy Programmes were discussed in detail illustrating the exciting capabilities of the system: a systematic investigation of relativistic jets in various radio galaxies and quasars; the E-MERGE programme, a systematic deep high-resolution radio continuum study of the GOODS-N field; COBRaS, the Cyg OB2 Radio Survey, a programme to probe deep into a massive OB association; and PEBBLeS, Planet Earth Building Blocks, a Legacy e-MERLIN Survey geared towards studying grain growth and proto-planets.

The fourth session was dedicated to LOFAR, the Low Frequency ARray, constructed in the Netherlands with large baselines reaching into the UK, Germany, France and Sweden. Key science projects with LOFAR include a survey of the northern sky aimed at high-z radio galaxies, starforming galaxies (which will be ubiquitous at low flux density levels), and AGN, with an emphasis on studying feedback; a transient programme including pulsars, flare stars, XRBs, GRBs and unknown sources; a dedicated programme to detect and characterise the signal of the Epoch of Reionisation; and a programme to detect and characterise ultra high energy cosmic rays which produce synchroton flashes when interacting with particles in the earth atmosphere.

Session three and five were dedicated to science with existing radio telescopes which provides a perspective towards science with the SKA, a discussion of synergies between the SKA and major instruments covering other wavebands such as ALMA and the E-ELT, and simulations of the radio sky that are relevant for SKA science exploring its capabilities in the areas of cosmology and galaxy evolution, including the formation and evolution of cosmic magnetic fields. The simulated radio sky is a product of the FP6 SKA Design Studies project and is available at URL http://s-cubed.physics.ox.ac.uk/

The presentations of the symposium will be posted at the JENAM 2009 website (http://star.herts.ac.uk/ewass/sym1.html) and at the website of the European SKA Consortium (http://www.euska.org/).

J.M. van der Hulst
Kapteyn Astronomical
Institute, The Netherlands

Session: Towards the First Detection of Gravitational Waves

The first generation of ground-based gravitational wave detectors has recently been completed, with the LIGO, GEO600 and Virgo detectors operating at or near their design sensitivities. The LIGO project has completed its fifth science run (S5), taking approximately 2 years of data in triple coincidence between the two Hanford and the Livingston interferometers. In this session, Bruce Allen, co-director of the Albert Einstein Institute in Hannover has provided us with a summary of the status of the field, with the analysis of the data products from the recent science runs nearing completion.

A selection of this analysis was reported in the talks by Matthew Pitkin, Ian Harry and Gareth Jones. Matthew Pitkin has reported on the continuing search for gravitational waves from 113 known pulsars. This work has recently been able to beat the spindown upper limit on the emission of gravitational waves from the Crab pulsar, and the limit placed on the strain amplitude of gravitational waves is on the order 10^{-26} across the sensitive region of the LIGO spectrum.

Gareth Jones has reported on the search for gravitational waves associated with gamma ray bursts, which stimulated an interesting and productive discussion with the members of the GRB community present. Ian Harry has provided us with an overview of the search for binary inspiral events, expected to be the most prominent source of gravitational waves, and also associated with short-duration GRBs. We also heard about exploratory research to search for GW emission from pulsar glitches from Ignatio Santiago.

Parallel to the ground-based detection effort, have also heard the progress that is being made toward the completion of the LISA Pathfinder spacecraft, designed to test the advanced technology required for the realisation of the LISA mission to place a 5 million km-scale gravitational wave detector in space (Daniel Hollington).

Although the current generation of detectors is not sensitive enough to detect a signal with high probability at currently plausible rates, the work on the next generation of detectors such as Advanced LIGO and Advanced Virgo is designed to produce instruments sensitive enough to probe a volume of space 1000 times larger, giving a 1000-fold increase in the detection probability. Giles Hammond reported on the advanced suspension technology being developed to allow the necessary level of isolation from the seismic noise present at low frequencies, which uses monolithic fused silica suspensions of the test masses, while Stuart Aston described the ultra-sensitive optical sensors which will be used in the isolation systems, and may lead to commercial spinoff applications in many areas. Antonia Perreca and Jonathan Hallam described current research into advanced interferometric techniques, which could be used to enhance the sensitivity of future instruments even further, which was also the topic of a poster by Paul Fulda.

John Veitch
University of Birmingham, UK

Session: Enabling Technologies for Future Space-Based Astronomy Missions

The session comprised four presentations addressing new technologies and mission concepts for enabling future astronomy and space science not currently within the programmes of the major space agencies.

Dr. Gillian Butcher (University of Leicester) presented her work on a practical X-ray interferometer capable in principle of transforming the angular resolutions of future X-ray instruments into the sub-milli-arcsecond regime. A breadboard slatted mirror has been tested with narrow-band visible light and is moving forward to investigate its performance in light of coherence lengths comparable to those of X-rays over a realistic energy resolution.

Dr. Malcolm Macdonald (University of Strathclyde) updated us on the technologies and mission concepts for solar sails. Many elements of the technology for solar sailing have already been demonstrated - including ultra thin mylar films and deployable booms. Malcolm has been concentrating on the mission and control aspects of solar sailing. Cases in which solar sails can effectively create useful non-Keplerian orbits include missions to investigate the Earth's magnetotail, missions that displace spacecraft from the Earth-Sun L1 point either towards the sun or out of the ecliptic, or - more boldly - to enable a «Solar Polar Orbiter» or even a probe to the heliopause that could achieve its aims of traveling 200 AU in a modest 25 years.

Two presentations then addressed the motivations and possible solutions to low-frequency radio astronomy observations with multiple small satellites. Dr. Mark Bentum (ASTRON) described a concept for an observing system between 300KHz and 30MHz based on a swarm of over 50 cubesats (each only $10x10x30cm^3$). These could conceivably fly in formation in orbit around the moon. Mark is hoping to incorporate a receiver onto an initial cubesat in 2010. An interesting discussion ensued about collision problems between members of the swarm. David Robinson (PsiTran Ltd.) and Jan Bergman (Swedish Institute of Space Physics) presented the results of a study focusing on the position-monitoring aspects of a small constellation of perhaps six 10kg satellites.

Ralph Cordey
EADS Astrium, UK

Session: UK Solar Physics Report for EAS

UK Solar Physics (UKSP) met as part of JENAM, with 9 science sessions and a Missions Forum. The Scientific Organising Committee comprised P Browning (Manchester) as Chair, with L Fletcher (Glasgow), S Poedts (KU Leuven), S Tobias (Leeds) and G de Zanna (Cambridge). The results presented displayed the breadth and vibrancy of Solar Physics in the UK, and also demonstrated that the UK plays a leading

role in the international community. There were around 60 oral contributions and over 30 posters; it was particularly pleasing that many talks and posters were presented by research students. Many sessions were joint with MIST (Magnetospheric Ionospheric and Solar-Terrestrial), reflecting the strong science links between the communities, summarised by the theme of "How does the Sun affect the Earth?".

Perhaps the most timely session was on "The unusual (?) solar minimum", concerned with the current prolonged and deep minimum of solar activity - the most obvious signature being an unusually large number of sunspot-free days. This topic has attracted much media attention. A range of observations were reported including helioseismology (Broomhall), irradiance measurements (Lockwood, Phillips, Wolfendale), hemispheric asymmetries (Zharkova) and solar wind properties, including velocity, magnetic field, CME rates and the heliospheric current sheet (Owens, Forsythe). For example, Ulysses measurements show that the solar wind has significantly lower dynamic pressure than at the previous Minimum, and the radial field strength is also reduced. It appears that there were signs that Cycle 23 was unusual, in the sense of deviating from the pattern of the previous 2 cycles, at least 5 -6 years ago (Strong). It was suggested that the current minimum is indeed unusual for the space age – but quite similar levels of activity were observed around a century ago. There is evidence that the Sun is currently in the final stages of a "grand maximum" and we may soon enter a period of lower activity levels (Lockwood).

Two sessions focussed on physical processes in the Sun and its environment: namely, "Magnetic reconnection" and "Particle acceleration and transport". These show that the Sun plays a vital role as a plasma physics laboratory, allowing fundamental processes to be studied which are relevant throughout the universe. New simulations of reconnection were presented, using both magnetohydrodynamics and Particle-in cell approaches, (Neukirch, Gordovskyy, McLaughlin, Haynes) as well as observational studies of reconnection (Grocott, Baker). There is much new information about accelerated particles in solar flares - especially from RHESSI, often combined with measurements from other spacecraft or instruments (Fletcher, Li, Liu, Bain). A new idea was also proposed - to study neutrons as evidence of ion acceleration (MacKinnon). Interpreting these results provide major challenges for theorists (Neukirch), with progress presented on this front, including Particle-in-Cell and Fokker-Plank models (Siversky, Zharkova, Hannah).

Our links with the astronomy community were illustrated through sessions on "Solar/stellar interiors" and "The Sun as a star". There are still some very fundamental questions regarding the origin of the large-scale magnetic field of the Sun, casting some doubts on the long-held ideas on mean-field dynamo theory (Hughes, Courvoisier) The role of shear flows and hydrodynamic instabilities in the solar interior were discussed (Kim, Rashid); an observational approach to understanding the solar interior using low frequency p modes was also presented (Davies). Comparisons with other stars included a study of the X-ray corona of Capella, which has a surprisingly small volume and may perhaps be similar to the current "solar minimum" corona (Phillips), accurate determinations of the whole-Sun EUV irradiance (del Zanna) and spectral studies of stellar flares (Mitra-Kraev).

The dynamic and active solar atmosphere, and its magnetic connection to the interior, was the subject of the sessions "Structure and activity in the solar atmosphere" and "The dynamics of the solar magnetic field". Beginning in the photosphere with studies of the absorption and scattering of p mode waves by sunspots (Gascoyne), the main focus was, however, on coronal activity and structure, including an empirical model of the F-corona, to be used for interpretation of Stereo Heliospheric Imager results (Brown) and a spectroscopic study of an Active Region on the limb using Hinode EIS (O'Dwyer). Detailed new results on flares and Coronal Mass Ejections from current space missions – Hinode, TRACE and RHESSI – were presented (Labrosse, Matthews and Zuccarello). The question of filament formation was discussed, with a simulation of the global corona providing excellent agreement between models and observations (Mackay). New models of coronal heating by nanoflares were presented, based both on 3D numerical simulations and relaxation theory (Hood, Bareford); also, MHD simulations were presented suggesting an alternative origin for Active Region upflows, and showing the effects of anisotropic resistivity on chromospheric reconnection (Botha). Moving outwards, a short session "From the Sun to the Earth" considered the wider heliosphere, including studies of Coronal Mass Ejections (Breen, Steed) and the heliospheric current sheet (Foullon).

Magnetohydrodynamic waves have become a valuable tool for determining the properties of the solar atmosphere, and a session was devoted to the burgeoning subject of "Solar coronal seismology" (joint with the MHD Seismology symposium). Considerable attention has been devoted to transverse loop oscillations (Verwichte, Van Doorselare), as well as oscillations in prominence threads (Arregui). The damping mechanism of these oscillations remains controversial, and it was suggested that this may be due to loop cooling (Erdelyi). It was also demonstrated that care must be taken in applying simple analytical formulae for dispersion relations in order to derive coronal properties (De Moortel) – it seems that coronal seismology still faces some challenges.

Complementary to the science sessions, a Missions Forum provided information about new opportunities for space missions and other large projects in solar and solar-terrestrial physics. Continuing and upcoming space missions are as follows. STP: Cluster, Themis, MMS and Cross-scale (Owen); solar wind in situ and solar remote: Stereo, Solar Orbiter, Solar Probe Plus (Harrison, Fludra); solar corona: SoHO, Hinode, Solar C, RHESSI, Coronas-Photon, SDO data centre (Fludra, Harra, Phillips, Walsh). On the ground-based side, there are opportunities with ROSA, ATST and EST in solar, and EISCAT in STP (Mathioudakis, Crothers). The future seems to be bright for solar physics, with many exciting new discoveries expected as new missions are launched.

Philippa Browning
University of Manchester, UK

Session: Mercury: Recent insights and future goals

David Rothery (Open University) presented an overview of Mercury, focusing on changes in our perception thanks to recent ground-based observations and the first two MESSENGER fly bys. It differs from the Moon in its large core, iron-poor surface, dynamo-generated magnetic field, prolonged history of volcanic activity and thrust-dominated tectonics. Mercury's earliest crust is proving elusive to find, and if it is ever found it is no longer thought likely to be a flotation cumulate 'primary crust' as envisaged in the 20 year-old primary/secondary/tertiary crust paradigm for terrestrial planets of S R Taylor.

John Bridges (Leicester University) considered constraints on Mercury's origin that could be placed by measurements to be made from orbit by NASA's MESSENGER probe and more fully by the ESA/JAXA mission BepiColombo, whose instruments will have the higher spatial resolution needed to identify and characterise small targets on the surface. Adrian Martindale (Leicester University) illustrated what a powerful tool will be provided by the Mercury Imaging Xray Spectrometer (MIXS) to be carried by BepiColombo and currently being assembled in Leicester. The focussed instrument (MIXS-T) will provide spatial resolution of about 1km for the most abundant elements during solar flares, whereas MIXS-C (using a microchannel pore plate slumped collimator) will have higher grasp able to map the abundance of about ten elements at 100 km pixel size, in contrast to fewer elements and 1000 km resolution likely for MESSENGER's Xray spectrometer.

A poster by Johan Warell (University of Upsalla) discussed disc-resolved spectra in the range 0.8-5.2 microns obtained using the SpeX medium-resolution spectrograph at the NASA Infrared Telescope Facility (IRTF). Such studies will continue to be important at least until BepiColombo achieves orbit (2020) because the mineralogically diagnostic region beyond 1.3 microns is not covered by MESSENGER spectroscopy. There was a lively discussion between papers, and a general feeling that MESSENGER has raised, and will continue to raise, questions that will require a mission with capabilities at least as good as BepiColombo to answer. This is as true for magnetospheric and exospheric studies as it is for the geological matters upon which the presentations were focused.

Dave Rothery
The Open University, UK

Session: Asteroseismology in the era of the CoRoT and Kepler missions

Asteroseismology is experiencing a major revolution as the result of the CoRoT Mission, which has now been in orbit for more than 2 years, and the Kepler Mission that was launched on 7 March 2009 (GMT). The claim of a scientific revolution is a strong one. With CoRoT we are routinely obtaining amplitude precision of a few micro-mag with over 90% duty cycles. We can see at least 10 times more precisely than the best ground-based observations, and we see 100 times more clearly than more typical ground-based studies. Experience shows that anytime we develop the ability to see 10 to 100 times more clearly, the result is revolutionary. CoRoT has begun this revolution; Kepler will dominate it.

Conny Aerts gave a plenary review of asteroseismology, its goals, techniques and the impact of the revolutionary space data. Because a major international meeting on the CoRoT results was held in Paris in February 2009, only one session was held following the plenary introduction. Helioseismology and asteroseismology allow us to see the interior rotation in stars, which would otherwise be beyond our understanding. Kara Burke from Sheffield University discussed her PhD thesis work on the theory of rotational splitting of pulsation frequencies. For rapidly rotating stars the theory is complex with beautiful predictions of the kinds of modes expected and their rotational frequency splittings. Data from CoRoT and soon from Kepler are expected to test and refine the theory. Ian Roxburgh of Queen Mary discussed the use of frequency spacings of the eigenmodes for detailed inference of the internal structure of stars, showing us as-yet-unpublished new CoRoT results. Graham Verner, also of Queen Mary, presented his PhD work fitting the frequency spectra of several solar-like stars observed by CoRoT. Modes of several degrees can be distinguished in useful echelle diagrams, and there are some fascinating differences to the solar case, including a case of surprisingly short mode lifetimes. Ian Roxbugh gave a second presentation on the use of autocorrelation to extract large spacings for stars where this cannot be seen directly in the amplitude spectra. Finally, Kym Goss of Birmingham University discussed her PhD work that she is just beginning using the Solar Mass Ejection Imager (SMEI) space mission to analyse long runs (~1000 days) with 60-70% duty cycles for beta-Cep stars. She has succeeded in detecting previously unknown pulsation frequencies in 11 bright beta-Cep stars; these will lead to new understanding of the internal structure of these stars when they are modeled.

Don Kurtz,
University of Central Lancashire, UK

Conny Aerts,
Katholieke Univerrsiteit, Leuven Belgium

Session: Binary stars: observation and theory

NAM/JENAM 2009 hosted two sessions dedicated to the observation and understanding of binary star systems, a category of objects of remarkable diversity and also of fundamental importance to stellar physics. Whilst there was a clear slant towards interacting binary systems and their evolution, reflecting the bulk of the abstracts submitted for the sessions, the organisers were encouraged by the diversity and high quality of both the invited and contributed talks.

The first session kicked off with a clear highlight: a presentation by Carla Maceroni (INAF, Rome) on the eclipsing binaries discovered by the French CoRoT satellite. Whilst CoRoT is aimed at studying transiting extrasolar planets and pulsating stars, it has also identified about 360 (and counting) new eclipsing systems. A feature of this catch is the stunningly high quality and quantity of the CoRoT observations, which threaten to overwhelm the traditional analysis procedures for binary stars. The second talk was by Vanessa Stroud (Open University), and discussed two new massive eclipsing binaries which are members of stellar associations (a subject close to the heart of the first organiser).

The meat of the sessions was a wide-ranging look at theoretical studies of binary stars and stellar populations, covering the effects of massive binaries (John Eldridge, Cambridge), rotational mixing (Selma de Mink, Utrecht), binaries in unresolved stellar populations (Peter Anders, Utrecht), halo binaries (Takuma Suda, Keele) and compact and ultracompact binaries (Paul Groot, Nijmegen, and Tom Barclay, Armagh). Tom Marsh (Warwick) outlined the degenerate-object binary star science which will arise from the forthcoming GAIA satellite: we researchers can look forward to a torrent of over 150000 white dwarfs, 50000 white dwarf detached binaries and 2000 cataclysmic variables. Binary star science is not immune from the new era of large-scale surveys: researchers will be overwhelmed in the near future by huge populations of exotic objects, each jostling for attention and further telescope time.

Turning from the large-scale to the single-object studies, we also heard about a rare outburst of GW Lib, the prototype cataclysmic variable with a pulsating white dwarf (Kristiina Byckling, Lecicester), the nova-in-a-planetary-nebula V458 Vul (Roger Wesson, UCL), a jet trail nebula from a low-mass X-ray binary (Klaas Wiersema, Leicester) and the recurrent nova object RS Oph (Valerio Ribeiro, LJMU). Whilst survey astronomy is beginning to dominate, it is clear that we still have much to learn from detailed studies of the best individual objects. The organisers would like to thank everyone who was involved in the sessions, including the speakers, the audience and postre contributors, for making it such an enjoyable and fast-paced experience.

John Southworth,
University of Warwick, UK

Rob Izzard,
University of Utrecht, The Netherlands

Hans Bruntt,
Observatoire de Paris, France

Session: Star formation: from massive stars to brown dwarfs

In recent years, observational data has become available for the most obscured parts of star forming complexes, the Infrared Dark Clouds and dense cores and clumps. This allows us to relate the clump mass function to the stellar initial mass function and constrains the physics of the steps in between. At the same time, much progress has been made in imaging examples of high mass protostars in the near infrared, while at the low mass end, a new field has been unveiled.

In this session, several contributions have focused on the progress that are offered by the suite of new large Galactic survey datasets that are becoming available at wavelengths from the optical to the radio. We are starting to have a complete view of the star formation in our own galaxy, based on comprehensive mappings conducted, for instance, with the MSX satellite, the SCUBA Legacy Catalogue, the Gould Belt JCMT Legacy Survey, or UKIDSS. These databases will be complemented very soon with cartographies conducted with the Herschel mission. The mathematical apparatus to exploit these databases to the fullest is also being developed (see the contributions by Oudmaijer et al., Parsons et al., Ward-Thompson et al, Samuel & Lucas). Very young, massive stars are also revealing a new face suing updated techniques (see Avison & Fuller, Galaway). The low-mass end is also producing some surprises: from some of the first proto-brown dwarf candidates or very low, cool mBD (Lucas et al., Morales-Calderon et al., Burgess et al.) to complete Initial Mass Functions well within the substellar domain in very different environments (Lodieu et al., Oliveira et al.).

One impressive result is the accurate light curves and unbiased rotational distributions provided by Corot (Favata et al.), which shows that the period distribution of Young Stellar Objects is unimodal at a period of a few days, not bimodal. In addition, theory and observations are coming together (Whitworth et al., Duarte Cabrales et al., Rowles & Froebrich, Paulus, Vitti, Walch et al., Rundle et al.) in some cases provoking new questions. As an example, the new discoveries of extrasolar planets in wide orbits, not readily explicable by traditional «bottom up» planet formation models, are providing new impetus to ongoing work on formation mechanisms involving disc fragmentation (Stamatellos et al.).

As a summary, a very interesting session, with a vividly participation and a large number of high quality contribution which unfortunately could not fit within the allocated time for the oral contributions and had to be presented as posters.

David Barrado,
LAEX-CAB, Spain

Philip Lucas,
Univ. of Hertfordshire, UK

Session: The Galaxy and its Satellites

This session opened with Gaia, the space mission that will provide the data for modeling the Galaxy and understand its formation to an unprecedented level of detail. At present, the radial velocity and the atmospheric parameters for several tens of thousands of stars from RAVE (southern hemisphere only) have been used to detect dynamical streams and inves-

tigate the spiral Galaxy pattern. Some stars have a peculiar motion supporting their origin in the Galaxy disk and their subsequent expulsion into the Galaxy halo. Stellar orbits are explored as tracers of the kinematics in the solar neighborhood. The global properties of the Galaxy, including the number and distribution of its Satellites, are results of SDSS. Models of these large-scale data reveal the major Galaxy substructures and their interaction. The spatial distribution of the Galaxy Satellites suggests the existence of many old tidal-dwarf galaxies. Results on the stellar populations of both bright and faint Satellites were presented.

Metal poor stars testify the chemical composition of the Universe in its early stages, in particular the detection of lithium-6. On the other hand, azimuthal abundance variations in super giant stars of the Galaxy could result from the intense but patchy star formation driven by the potential of the central bar. The chemistry of white dwarf star atmospheres allows for distinguishing them from contaminating sources providing a working sample for investigating the structure of the Galaxy, disk and halo. Other tracers, PNe, were identified in a large number from IPHAS and will be further explored in other surveys with the support of model photometry. IPHAS contains also many A-type stars that trace the Galaxy disc. The interaction between the disc and the halo was addressed via the study of HI superbubbles.

Maria-Rosa Cioni
University of Hertfordshire, UK

Session: The Local Volume: Constraints on Galaxy Formation and Evolution

The Splinter Session «The local volume: constraints on galaxy formation and evolution» took place on the 21st of April 2009 and was attended by more than 50 people, filling completely the dedicated room. It was structured in three blocks of 1.5 hours each. We started addressing the topic of supermassive black holes (SMBH) at the centers of galaxies. The global correlations between the mass of SMBHs and the central velocity dispersion, luminosity (or mass) of galaxy bulges were considered in the first two talks. While J. Magorrian summarized the past results, indicating that the scatter in both relations is similar, R. Saglia showed that new measurements from a recent survey suggest a tigher relation wit velocity dispersion. W. Maciejewski discussed the issue of gas inflow in the nuclei of spirals. D. Krajnovic reviewed the first results of the Atlas 3D survey, stressing that there is a continuous distribution of early-type galaxies as a function of their specific angular momentum. H. Ledo closed the session with a report on a search for nuclear disks in early-type galaxies.

The second part was dedicated to the problem of dark matter and dynamics in galaxies. O. Gerhard showed that planetary nebulae are useful probes of the kinematics of the outer parts of galaxies and that only fully general dynamical modelling allows to break the intrinsic degeneracies of stellar dynamical systems. G. Mamon further illustrated the point for the case of the Jeans modelling of radial velocities. J. Thomas presented the constraints on formation epoch and mechanisms derived from the dynamical modelling of early-type galaxies in the Coma cluster. L. Koopmans described the mass estimates obtained for galaxies acting as gravitational lenses, confirming the findings of dynamical modelling. N. Scott concluded the session confirming that the local and global gradients of line strengths and stellar population parameters of early-type galaxies are set by the escape velocity derived from dynamical modelling.

The last part of the Splinter meeting was dedicated to the constraints on galaxy formation. D. Thomas reported on the absence of evidence for young ages in the bulges of later type spirals. I. Ferreras described new methods of analysis of the line strength gradients to reduce the age-metallicity degeneracy. T. Naab presented the differences in the end-products of (major) binary mergers and cosmological sequences of minor mergers. The splinter session finished with a panel discussion on the future prospects of galaxy dynamics research. M. Arnaboldi described the possibilities of studying the resolved stellar populations of early-type galaxies with the E-ELT. T. Oosterloo presented the upgrades to available radio-telescopes and planned future facilities that will allow the study of gas dynamics in distant galaxies. A. Romanovski considered future developments in stellar dynamics. A final general discussion followed and closed the session.

Roberto Saglia
Max-Planck Institut
fuer extraterrestrische Physik, Germany

Session: MHD Seismology of Solar, Space, and Astrophysical Plasmas

The stunning recent progress in observational and theoretical studies of magnetohydrodynamic (MHD) wave phenomena in natural plasmas gave rise to novel and rapidly developing branches of Astrophysics and Space Science: solar coronal seismology, Earth's and Ganymede's magneto-seismologies, and MHD seismology of astrophysical objects. The session aimed to create a joint forum for the specialists working on various aspects of MHD wave diagnostics of space and astrophysical plasmas, and this definitely was achieved. Invited reviews covered four main areas of the applicability of MHD seismology: Earth's magnetosphere, solar corona, flaring energy releases in stellar and solar coronae, and magnetars. Oral and poster contributions presented recent results of the observational detection of MHD waves and oscillations in solar coronal loops and prominences, Earth's and Ganymede's magnetospheres and magnetars; modern data analysis approaches; theoretical modelling of MHD wave interaction with plasma structures, and novel techniques for the diagnostics of plasma parameters.

The session was very well attended, up to 80 people. What was especially important is that more than three quarters of the audience were younger members of the community, PhD

students and PDRAs. Also, the session showed the importance of inter-disciplinary contact, communication between (solar) astrophysicists and (planetary) space physicists, who are working on similar problems in rather contrasting regions of space plasmas.

Valery Nakariakov
University of Warwick, UK

Session: High Energy non-thermal Astrophysics

The two sessions on high-energy non-thermal astrophysics at JENAM were both stimulating and well attended. We had 8 talks and also 10 poster presentations. The talks covered a wide range of topics and wavelengths - from X-ray emission to the ultra-high-energy cosmic rays.

Judith Croston (University of Hertfordshire) present the exciting new discovery non-thermal X-ray emission at a shock bounding the southern radio lobe of the nearby active galaxy Centaurus A. The radio lobe appears to be a giant analogue of a supernova remnant, accelerating particles to 100s of TeV and beyond. Julian Pittard (University of Leeds) discussed ideas for particle acceleration in the colliding winds of massive stellar binaries and Stefan Ohm (Max Planck Institute for Nuclear Physics, Heidelberg) showed the recent results from the HESS telescope system on TeV emission from young and massive stellar clusters, possibly due to collective stellar wind effects.

Stefan Funk (Stanford University) presented the first results from the Fermi gamma-ray space telescope which was launched in May last year. The Fermi LAT detector represents a huge step forward in sensitivity over all previous GeV gamma-ray instruments. 205 very high confidence detections were made in using the first 3 months of data, compared to 31 at the same confidence level from the EGRET instrument in the full 9 year mission of the Compton Gamma-Ray Observatory (CGRO). The new sources include 14 new gamma-ray pulsars which have no X-ray or radio counterparts. Roberto Mignani (Mullard Space Science Laboratory) discussed the challenges of finding counterparts to the many unidentified high-energy sources that Fermi is finding using multi-wavelength follow-up observations.

Moving up to ~TeV energies and ground-based instruments, Daniel Mazin (IFAE, Barcelona) discussed the absorption of gamma-rays in extragalactic space and how this can be used to derive constraining upper limits on the density of the time-integrated radiation of the universe in the UV-FIR band, and hence on the star-formation history of the universe. At the very highest energies the results from the Pierre Auger Observatory (PAO) have created a huge amount of new interest and activity in the area of the ultra-high-energy cosmic rays. Sir Arnold Wolfendale (Durham University) has a very long-standing interest in these particles and presented his ideas on the interpretation of the results on anisotropy and composition from the PAO - with a focus on heavier nuclei and nearby radio galaxies.

Last but not least, Sam Nolan (University of Durham) presented the status of the Cherenkov Telescope Array (CTA), an ambitious European project to build an observatory with an order of magnitude better sensitivity then current ground-based gamma-ray telescopes. CTA is half-way through its design study phase and gathering momentum, with high rankings in the ASTRONET, ASPERA and ESFRI lists. CTA promises to increase the source count at TeV energies to ~1000 objects and to achieve the best energy flux sensitivity and angular resolution at any frequency above the hard X-ray.

Jim Hinton
The University of Leeds, UK

Session: Explosive Transients in Distant Galaxies

This triple session began with an overview of how massive stars die when their cores collapse and presentations of some new transients that are challenging our physical understanding of these explosions. Avishay Gal-Yam (Weizmann Inst.) gave a review talk covering the most recent advances in the field, including evidence that massive luminous blue variables explode to produce type IIn SNe. He also reviewed some ongoing work on the brightest and faintest explosions known, suggesting they are not the canonical Fe-core collapse but there is now observational evidence for the theoretically predicted accretion induced collapse events and pair-instability supernovae. Stefano Valenti (QUB) presented his recent work on the faintest hydrogen poor SN known and his interpretation that it is a core-collapse supernova. The nature of a very peculiar optical transient in an HST supernova search was discussed by Boris Gaensicke (Warwick). He showed the unique light curve and spectra could be matched with a cool carbon-rich atmosphere at redshift around 0.1. The search for SNe in ultra-luminous IR galaxies is being enhanced by the use of 8m telescopes with Adaptive optics images. Seppo Mattila (Turku) outlined his searches with VLT and Gemini, showing the ability to discover significant numbers at extinctions more than 15 magnitudes in the visual, hence allowing the star formation rate to be probed in these systems. Radio SNe have been discovered in the cores of star-bursting galaxies and Zsolt Paragi (JIVE) presented new e-EVN and Global VLBI of possibly the nearest type Ic SN to date (SN2007gr). A detection has been made, and the data are currently being analysed to determine if there was any jet-like expansion of the SN.

The two afternoon sessions were focused on Gamma-ray Bursts (GRBs). Ralph Wijers (Amsterdam) started the second session with a nice summary of the physics of blast waves. GRBs evolve in a similar way to supernova but their relativistic outflows make the emission both brighter and appear to evolve much faster. The localisation of short GRBs were discussed by Andrew Levan (Warwick) who stressed the continuing problem of identifying host galaxies in cases where the burst progenitor may have been «kicked» away from its birthplace. Klaas Wiersema (Leicester) contrasted shorts with long

burst hosts, and discussed the few which are in spirals the nearest of which can be probed using long-slit or IFU spectroscopy to give detailed constraints on the progenitor site. Andrea Melandri (LJMU) discussed the evidence from multi-wavelength studies for prolonged central-engine activity in GRBs. This phenomenon appears to be common and poses a challenge to the collapsar model. Similarly, Rhaana Starling (Leicester) identified a burst, GRB080721, where the beaming-corrected energy poses challenges to current progenitor models. Nicola Lyons (Leicester) identified a group of long GRBs which may be partly powered by the extraction of spin-down energy from a newly-formed magnetar.

The final session began with a review of surveys by Rubina Kotak (QUB). The new PanSTARRS and similar surveys will revolutionise the discovery of transients of all kinds including SN, GRBs and intermediate objects. Nial Tanvir (Leicester) then discussed the optically-brightest object ever seen, GRB080913B. This burst at z~1 was so bright it could have been seen with the naked eye. Nial presented evidence for the supernova which accompanied the burst. Peter Curran (MSSL/UCL) discussed the distribution of physical parameter values inferred from detailed afterglow fits, and in particular the power law indexes of the electron energy distribution and the external density. Franck Genet (UH) described a detailed physically motivated analytic model for the prompt emission and its high-latitude tail, that can be used for combined fits to data and help pin down the prompt GRB emission mechanism. Samantha Oates (MSSL/UCL) summarised the Swift/UVOT observations of GRBs which clearly show that the UV/Optical light curve does not look identical to the X-ray light curve providing evidence for multiple emission components. Paul Kuin (MSSL/UCL) discussed the first UV spectrum of a GRB found using the Swift/UVOT grisms. The technique allows for faster spectroscopy than available with any other facilities. Finally Bob Chapman (Reykjavik) explained how the the observed proportion of low to high redshift GRBs implies a separate population of low-luminosity bursts.

Paul O'Brien,
University of Lecester, UK

Steve Smartt,
Queens University of Belfast, UK

Jonathan Granot,
University of Hertfordshire, UK

Session: Three Decades of Gravitational Lenses

The field of gravitational lenses has diversified into several sub-fields, which are strong lensing by galaxies, weak lensing by clusters of galaxies and large-scale structure, and galactic and extragalactic microlensing. These days, most of the workshops and conferences cover only one of these topics. The main aim of this symposium was to bring all parts of the (European) lensing community together again to discuss previous achievements, recent results and future developments.

In the historical session, the first lens discoveries (Bob Carswell) and the application of light deflection by the Sun as the first test of general relativity (Richard Massey) were reviewed. Prasenjit Saha showed in a theory review that most of the later developments were based on original ideas of Sjur Refsdal. The whole symposium was dedicated to the memory of this main founder of our field, who passed away in January 2009. Supplementing the theory review, a solution to a long-standing paradox related to the magnification theorem was presented (Olaf Wucknitz).

The second session was devoted to both kinds of microlensing, with reviews about galactic microlensing by our US guest Andy Gould, and about extragalactic microlensing by Joachim Wambsganss. The talks by Gould and Jean-Philippe Beaulieu covered microlensing studies of compact objects in the Milky Way, in particular the discovery of extrasolar planets with microlensing (14 so far!), which covers a parameter space that cannot be reached by any other method. Extragalactic microlensing, on the other hand, is used to study mass constituents of other galaxies. In addition, it has the potential to constrain properties of AGN accretion disks. This has been promised for long and is now eventually made possible by spectrophotometric monitoring. Results by Dominique Sluse seem to confirm standard accretion disk models.

Strong lensing by galaxies was reviewed by Leon Koopmans, who showed that very accurate constraints on general mass distributions have resulted so far. Most important, and not fully understood, is the fact that most galaxies have a close to isothermal mass profile. Oliver Czoske contributed more technical details on the observational side of this project. Timo Anguita presented a new lens discovery from the COSMOS survey, and John McKean showed how the magnification provided by a lens was used to find the highest redshifted water in the Universe, a H20 maser at z=2.64. Without lensing, the observing time required for this discovery would have been 1000 times longer. This discovery was published by the BBC already during the session. Future lens surveys were discussed by Neal Jackson.

Dandan Xu and Sarah Bryan discussed the influence of substructure in the matter distribution of galaxies on observed lensed images. Much less substructure than expected from simulations is seen in the light distribution of nearby galaxies, but much more seems to be present in lenses from the CLASS survey. Lensing is sensitive to these mass clumps, because they cause observed flux ratio anomalies in the images.

Andy Taylor gave a review of weak gravitational lensing. Weak lensing is used to study large-scale mass distributions completely unbiased by light. Sarah Bridle discussed intrinsic alignments of galaxies as a contaminating signal in weak lensing, and ways to correct for it.

Clusters of galaxies as lenses were reviewd by Jean-Paul Kneib. In particular the combination of strong and weak lensing provides very accurate results. Graham Smith and Victoria Hamilton-Morris discussed the LoCuSS weak cluster lensing survey. Important results are a higher-than-expected

concentration-mass relation. With stacking techniques, isothermal profiles can be ruled out for clusters, while the universal dark-matter profiles are consistent with the data. Henk Hoekstra gave a more general overview of weak lensing by clusters and presented results of the Canadian Cluster Comparison Project. Joerg Dietrich presented a weak lensing study of X-ray underluminous galaxy clusters.

The posters discussed lens monitoring, the use of lenses as natural telescopes, constraints on accretion disks from lensing observations, the search for new lenses, orbital motion effects in microlenses, weak lensing in the CFHTLS, the comparison of stellar population synthesis results with mass distributions measured by lensing, the theory of moving lenses, effects of lensing time-delays on pulsar timing, and constraints on neutrino masses from cosmic shear measurements.

The symposium was summarized by Shude Mao, co-chair of the SOC.

Olaf Wucknitz
University of Bonn, Germany

Session: Multi-wavelength High Redshift Surveys

The «Multi-wavelength high redshift surveys» symposium consisted of six reviews and multiple contributed talks that covered different recent results on galaxy evolution, including first galaxies, large-scale structure, stellar mass assembly, star formation and black-hole activity. The last session was devoted to present the design and goals of forthcoming large surveys that will be conducted with future facilities of key importance for European astronomy, particularly VISTA and Herschel.

Some of the highlights of the presented scientific results were the spectroscopic confirmation of 70 Lyman-break galaxies at redshifts $z>5$, and an APEX/LABOCA sub-millimetre galaxy at $z=4.76$. Also, the progress made towards the determination of the nature of the sub-mJy radio galaxy population detected with the GMRT and VLA, by identifying most of these sources as dominated by star formation rather than nuclear activity. New constraints on the cosmic far-infrared background obtained with BLAST have as well been presented. Other studies provided important clues to the size growth and star formation activity of early-type galaxies at $z<1$.

On the other hand, several problems and open questions in galaxy evolution have been discussed throughout the symposium. For example, the apparent discrepancy between the assembled stellar-mass and integrated star-formation rate densities over cosmic time, the over-prediction of the luminosity-function faint end by different galaxy formation models, and the existence of a universal initial mass function. Some of the major open questions highlighted included the following: why galaxy formation is so inefficient, i.e. why are only a very small fraction of the baryons locked in galaxies? What are the different mechanisms for galaxy formation and growth? Why are some galaxy morphologies dominated by disks and others by bulges? What is the exact role of black-hole activity in galaxy evolution? And, what is the role of environment?

In the next few years, substantial progress is expected in understanding these issues. The advent of a new generation of multi-wavelength telescopes —including eROSITA, VISTA, JWST, Herschel, SCUBA2, ALMA, LOFAR and eMERLIN— will allow for the deep coverage of large areas of the sky, producing unprecedented statistics for tracing and studying different galaxy populations up to very high redshifts.

Karina Caputi
ETH Zurich, Switzerland

Session: Epoch of Reionisation: First Light to the Earliest Galaxies Currently Known

Understanding first light - the formation of the first stars and galaxies in the early Universe - and the process of reionisation, are among the most fundamental and challenging problems in cosmological research. Observationally, the last two decades have witnessed a revolution in studying very high redshift galaxies through highly successful selection techniques coupled to a dramatic increase in the sensitivity of ground- and space-based telescopes. We can now routinely investigate the denizens of the early Universe as they emerge from the neutral medium, determine their physical properties and place constraints on theoretical models. The future is also bright with first light and reionisation being prominent science cases for upcoming facilities such as the SKA, LOFAR, ALMA, JWST and the E-ELT. This session brought together experts from the European Astronomical Community to discuss our current understanding of the early Universe less than ~1 billion years after the Big Bang, and prospects for the next decade.

The session was roughly divided into two, with theory and simulations of reionisation in the first followed by the properties of the highest redshift galaxies known in the second. The sessions were lead by two excellent review talks by Richard Battye (Manchester) and George Becker (IoA, Cambridge). Richard discussed Phenomology of Reionization and the CMB and described recent constraints on reionisation from CMB polarisation studies. He discussed the prospects for constraining non-Gaussianity with the forthcoming Planck satellite that will measure the CMB temperature using 9 frequency bands at a resolution of 5 arcminutes. Observational signatures to constrain reionisation were described by Ilian Iliev (Sussex) whose simulations of early sturcture formation and the process of reionisation predict observational signatures in the the kinetic S-Z effect, 21cm emission and in Lyman-alpha surveys. One of the key open issues is the origin of ionising photons responsible large-scale reionisation

(QSOs, mini-blackholes, very massive stars, and/or galaxies) that was discussed in both sessions. Predictions for the ionising flux density emerging from early star-forming galaxies were discussed by Milan Raicevic (Durham) and Anne Verhamme (Geneva, Oxford). Milan described his code that couples the semi-analytic galaxy formation and evolution code GALFORM with the radiative transfer scheme SimpleX to produce large volume simulations of reionisation by early galaxies that can be run in a few days on a single work station. Anne's talk focussed on here detailed radiative transfer simulations of the emergent spectrum and Lyman-alpha escape fraction in individual galaxies as a function of viewing angle as well as its evolution with time, feedback from SNe and the effect of the clumpiness of the ISM.

The observational session focused on the properties of the highest redshift galaxies known (z>6) and the nature of the high redshift IGM. By tracing absorption systems along the sight-lines to high-z quasars, the z>5 IGM is known to be enriched with metals. Yet, George Becker discussed his recent results that confirm that the number of CIV absorbers declines with increasing redshift. George suggested that at high redshift metals are mostly found in a neutral state and proposed that z~6 may mark the tail end of reionisation. Finding quasars at even higher redshifts would help to confirm these findings in an increasingly neutral IGM. The search for high-z quasars in the UKIDSS Large Area Survey was described by Mitesh Patel (Imperial College), that should potentially reveal the first z>6.4 quasar. Steve Warren (Imperial College) gave an overview of one of NASA's SMEX missions Joint Astrophysics Nascent Universe Satellite (JANUS) that, as part of its R=14 slitless near-infrared spectroscopic survey to J=19.5 over 20,000 square degrees, will routinely identify quasars at 6<z<10. However, known high-z quasars do not provide sufficient UV photons to have ionised the Universe, and as Andy Bunker (Oxford) found, neither do the known population of high-z star forming galaxies. Therefore, probing to yet higher redshift and to the faint end of the luminosity functions of both populations is necessary. Some progress towards detecting galaxies fainter than normal blank field surveys can be made using amplification by massive lensing clusters and Jean-Paul Kneib described recent results of narrow-band and SINFONI surveys that should reveal the first confirmed z>7 galaxies. Finally, Jim Dunlop spoke about the promise of the next generations of near-infrared facilities, VISTA and WFC3/HST, to find and characterise galaxies at even higher redshifts. With future, sensitive multiwavelength facilities, it seems inevitable that within the next decade we will be able to observationally confirm the sources responsible for the reionisation of the universe.

Aprajita Verma
Oxford University, UK

Session: Plans and Opportunities for European Astronomy

The focus of the session was long-term planning for European astronomy, and the wider opportunities for funding being opened up by the European Research Council. The session was organised by Mike Bode (LJMU) and Frank Molster (NWO) and was chaired by Johannes Andersen (NOTSA, chair of the ASTRONET Board).

Frank Molster (NWO) introduced the session by giving some of the background to ASTRONET, including the Science Vision and Common Call. ASTRONET is an FP6 ERA-NET which combines over 20 (and growing) national research organizations in Europe as well as the European Southern Observatory and the European Space Agency. The aim of ASTRONET is to establish a long term strategy for European astronomy and to help to execute this plan. The first step in this process was the production of «A Science Vision for European Astronomy», a document containing the important astronomical questions of today and a pathway how to solve them in the future. Based on this document the ASTRONET Infrastructure Roadmap was developed (see below) and a subject was chosen for the ASTRONET Joint Call, which turned out to be a very successful exercise.

Mike Bode (Liverpool John Moores University) then went on to describe in more detail the ASTRONET Infrastructure Roadmap. Published in November 2008, the ASTRONET Roadmap provides a prioritised plan regarding the infrastructures required over the next 10-20 years for Europe to deliver the science set out in the ASTRONET Science Vision. In addition, it contains recommendations for the furtherance of public engagement and education, plus the enhancement of links to European Industry. The talk provided an overview of the process and main recommendations of the Roadmap, as well as giving an update on its implementation.

The ASPERA Roadmap process and outcomes to-date was then discussed by Stavros Katsanevas (University of Paris VII & IN2P3/CNRS). The European Strategy for Astroparticle Physics roadmap document, published in October 2008, gives the priorities and timeline of Astroparticle Physics in Europe for the next decade. The talk reviewed the updated information concerning this roadmap, as well as the steps taken or about to be taken for its implementation, including: a common call for the R&D required with respect to design studies of the priority infrastructures; the launch of a worldwide coordination effort in the context of the OECD, and the effort to link a posteriori existing infrastructures as for example the underground labs.

Finally, Teresa Lago (University of Porto & ERC Scientific Council) spoke about the European Research Council (ERC) – seen as a new opportunity for fundamental research in Europe. The talk focussed on the ERC's strategy and operation as set up by its scientific council – to stimulate investigator-initiated frontier research across all fields of research, on the basis of excellence. The ERC grants scheme was presented in terms of:

- ERC Starting Grants - with the objective to provide critical and adequate support to the independent careers of excellent researchers who are at the stage of starting or consolidating their own independent research programme.

- ERC Advanced Grants - with the objective to encourage and support excellent, innovative investigator-initiated research projects by leading advanced investigators across the Member States and Associated countries. The talk included their simple operating procedures, budget and statistics covering the two years of ERC activity so far.

Michael Bode
Liverpool John Moores University, UK