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OF
IAU SYMPOSIA, IAU COLLOQUIA,
AND
REGIONAL IAU MEETINGS
IN 2005

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Karel A. van der Hucht

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SYMPOSIA

- IAU Symposium No. 227 p. 3
Massive Star Birth: A Crossroads of Astrophysics
16-20 May 2005, Catania, Sicily, Italia
Chair: Edward B. Churchwell & Peter S. Conti
- IAU Symposium No. 228 p. 5
From Lithium to Uranium: Elemental Tracers of Early Cosmic Evolution
23-27 May 2005, Paris, France
Chair: Roger Cayrel
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Asteroids, Comets, Meteors - ACM 2005
7-12 August 2005, Rio de Janeiro, Brasil
Chair: Sylvio Ferraz-Mello & Julio A. Fernández
- IAU Symposium No. 230 p. 10
Populations of High-Energy Sources in Galaxies
15-19 August 2005, Dublin, Ireland
Chair: Evert J.A. Meurs & Giuseppina Fabbiano
- IAU Symposium No. 231 p. 13
Astrochemistry throughout the Universe: Recent Successes and Current Challenges
29 August - 2 September 2005, Monterey, CA, USA
Chair: Ewine F. van Dishoeck
- IAU Symposium No. 232 p. 17
Scientific Requirements for Extremely Large Telescopes (ELTs)
14-18 November 2005, Cape Town, South Africa
Chair: Michel Dennefeld & Virginia L. Trimble

COLLOQUIA

- IAU Colloquium No. 198 p. 21
Near-Field Cosmology with Dwarf Elliptical Galaxies
14-18 March 2005, Les Diablerets, Switzerland
Chair: Helmut Jerjen & Bruno Binggeli
- IAU Colloquium No. 199 p. 24
Probing Galaxies through Quasar Absorption Lines
14-18 March 2005, Shanghai, China
Chair: Brice Ménard & David A. Turnshek
- IAU Colloquium No. 200 p. 27
Direct Imaging of Exoplanets: Science and Techniques
3-7 October 2005, Nice, France
Chair: Claude Aime & Jean Schneider

REGIONAL IAU MEETINGS

- 9-th Asian-Pacific Regional IAU Meeting (APRIM-2005) p. 29
26-29 July 2005, Nusa Dua, Bali, Indonesia
Chair: Winardi Sutantyo & Shin Mineshige
- 11-th Latin-American Regional IAU Meeting (LARIM-2005) p. 33
12-16 December 2005, Pucon, Chile
Chair: Monica Rubio & Leopoldo Infante

IAU SYMPOSIUM No. 227, POST MEETING REPORT

1. IAU Symposium No.: 227
2. Title of meeting: Massive Star Birth: A Crossroads of Astrophysics
3. Dedication of meeting: -
4. Location: Acireale (Catania, Sicily), Italia
5. Dates of meeting: 16-20 May 2005
6. Scientific Organizing Committee:
 - Edward B. Churchwell USA (co-Chair)
 - Peter S. Conti USA (co-Chair)
 - Philippe R.J. Eenens Belgium/Mexico
 - Marcello Felli Italy
 - Yasuo Fukui Japan
 - Guido Garay Chile
 - Susana Lizano Mexico
 - C. Malcolm Walmsley Italy
 - Hans Zinnecker Germany
7. Local Organizing Committee:
 - Marcello Felli INAF-Arcetri, Firenze, Italy (Chair)
 - Riccardo Cesaroni INAF-Arcetri, Firenze, Italy
 - Corrado Trigilio IRA-CNR, Noto, Italy
 - Grazia Umana IRA-CNR, Noto, Italy
8. Number of participants: 240
9. Countries represented: 28
 - Argentina Chile Iran Mexico Scotland Taiwan
 - Australia China Ireland Netherlands South Africa UK
 - Belgium France Italia Poland South Korea USA
 - Brazil Germany Japan Portugal Spain
 - Canada India Jordan Russia Switzerland
10. Report submitted by: Marcello Felli
Place and date: Florence, Italia, 7 June 2005

11. Summary of the scientific highlights of IAU Symposium No. 227

The main motivations for IAUS227 were to bring together radio, IR, optical, and X-ray observers as well as theoreticians to discuss our present understanding of massive star birth, to establish what the main outstanding problems are, and to explore what steps are now needed in order to make further progress. The symposium was a resounding success in achieving these goals.

The symposium was divided into five sessions in chronological order of the star formation process.

Session I consisted of four introductory reviews designed to outline our current knowledge about massive star formation and its impact on the evolution and physics of galaxies, the interstellar medium, and local star formation regions. **Robert Kennicutt** gave a general overview entitled 'The role of Massive Stars in Astrophysics', **John Bally** spoke on 'Nearby Regions of Massive Star Formation' emphasizing in particular Orion, **Mark Morris** reviewed 'Massive Star Formation in the Galactic Center', and **Karl Menten** reviewed 'Initial Conditions for Massive Star Birth'.

Session II was entitled 'Star Birth Sequence: The Natal Precursors'. In this session reviews were given on 'Ices as Tracers of Massive Star Birth' by **Elisabetta Palumbo**, 'Hot Molecular Cores' by **Riccardo**

Cesaroni, ‘Chemistry of Molecular Clouds’ by **Floris van der Tak**, and ‘The Role of Magnetic Fields’ by **Richard Crutcher**. Contributed talks were given by **Joao Alves**, **Sheng-Yuan Liu**, **Arjan Bik**, **Clare Dobbs**, **Guido Garay**, and **Igor Zinchenko**. Space does not permit discussion of all the interesting highlights of this session; however, the roles of magnetic fields, turbulence, dust, and chemistry and their possible interdependencies was a main theme of this session and raised numerous questions and new avenues of investigation.

Session III was entitled ‘The Star Birth Sequence: The Stars’. This session emphasized the observational evidence for and physics of massive protostars. Here reviews were given on ‘Hypercompact H II Regions’ by **Stanley Kurtz** and ‘Ultracompact H II Regions’ by **Luis Rodriguez**, ‘Near and Mid-IR Observations of UC H II Regions’ by **Paul Crowther**, ‘*Spitzer* Observations of Massive Star Forming Regions’ by **Remy Indebetouw**, ‘Massive Star Disks: Observations and Theory’ by **Qizhou Zhang**, ‘The Disk Jet Connection’ by **Ralph Pudritz**, ‘Stellar Evolution before the ZAMS’ by **Francesco Palla**, ‘Protostellar SEDs for Massive Stars’ by **Barbara Whitney**, ‘Accretion Signatures in Massive Stellar Objects’ by **Robert Blum**, ‘Massive Star Outflows’ by **Debra Shepherd**, ‘*Chandra* Observations of Massive Star Forming Regions’ by **Ettore Flaccomio**, ‘X-Ray Studies of Massive Star Birth Regions’ by **Katsuji Koyama**, and ‘Massive Star Formation: Accretion and Binary Mergers’ by **Ian Bonnell**. Contributed talks were given by **Rolf Chini**, **Frederique Motte**, **Michael Burton**, **Andrei Sobolev**, **James De Buizer**, **Jose-Maria Torreles**, **Yuefang Wu**, **Mark Krumholz**, **Susana Lizano**, **Morten Andersen**, **Paolo Persi**, **Luca Moscadelli**, and **Leisa Townsley**. The main themes of this session were observational signatures of disks and jets, the physics of both disks and jets, the spectral energy distributions of protostars as a function of viewing angle, luminosity, and evolutionary state. The role of radio masers not only as markers of massive star formation, but also as important tracers of disks and jets was emphasized. Perhaps the most illuminating new results in this session were the new data from *Spitzer* and *Chandra*. **Leisa Townsley** and **Bernhard Brandl** beautifully demonstrated that the bubbles and cavities seen in massive star formation regions by the *Spitzer* mid-IR and far-IR images are filled with several million degree gas, presumably produced by stellar wind interactions.

Session IV was entitled ‘Star Birth in a Cluster Environment’, with emphasis on large scale star formation processes that result in cluster formation both now and in the early universe. Reviews were given on ‘The Formation of Massive Stars at Low Metallicity’ by **Henny Lamers**, ‘Massive Clusters as Seen by *Spitzer*’ by **Bernhard Brandl**, ‘Clustered Massive Star Formation in Molecular Clouds’ by **Jonathan Tan**, ‘Massive Stars from Gravoturbulent Fragmentation’ by **Ralf Klessen**, ‘NIR Studies of Giant H II Region Stellar Clusters’ by **Augusto Daminieli**, ‘Probing the Birth of Super Star Clusters: Implications for Massive Star Formation’ by **Kelsey Johnson**, ‘Evidence for a Fundamental Stellar Upper Mass Limit from Clustered Star Formation’ by **P. Kroupa**, and ‘First Stars and the Cosmic Dawn’ by **Andrea Ferrara**. Contributed talks were given by **Yasuo Fukui**, **Annie Zavagno**, **Lori Allen**, **Massimo Robberto**, **Willem-Jan de Wit**, **Melvin Hoare**, **Margaret Hanson**, **Tom Megeath**, **Christopher McKee**, **Daniel Schaerer**, and **Nino Panagia**. In this session, some of the highlights were the emerging work on super star clusters discussed by **Kelsey Johnson** and **Daniel Schaerer**, the role of metallicity in star formation and the first stars in the universe discussed by **Henny Lamers**, **Nino Panagia**, and **Andrea Ferrara**, and evidence for a fundamental upper mass limit in clustered star formation discussed by **Pavel Kroupa**.

Session V consisted of three 20 minute summary talks by **Neal Evans** on Session II, **Peter Conti** on Session III, and **Hans Zinnecker** on Session IV.

We are aware of numerous new collaborations that are planned as a result of interactions at this symposium. We believe that this is a strong indication of a successful meeting.

Ed Churchwell (SOC co-Chair), Marcello Felli (LOC chair, SOC), Riccardo Cesaroni (LOC), and Malcolm Walmsley (SOC), 7 June 2005

Proceedings published:

R. Cesaroni, M. Felli, E. Churchwell & M. Walmsley (eds.), 2005,
Massive Star Birth: A Crossroads of Astrophysics,
Proc. IAU Symp. No. 227, Catania, Sicily, Italia, 16-20 May 2005,
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e-papers: http://journals.cambridge.org/jid_IAU

IAU SYMPOSIUM No. 228, POST MEETING REPORT

1. IAU Symposium No.: 228
2. Title of meeting: From Lithium to Uranium:
Elemental Tracers of Early Cosmic Evolution
3. Dedicated to: Francois and Monique Spite
4. Location: Paris, France
5. Dates of meeting: 23-27 May 2005
6. Scientific Organizing Committee:

Tom Abel	USA
Nobuo Arimoto	Japan
Beatriz Barbuy	Brazil
Roger Cayrel	France (Chair)
Alessandro Chieffi	Italy
Bengt Gustafsson	Sweden
Amina Helmi	Netherlands
Vanessa Hill	France
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Francesca Primas	Germany
Christopher Sneden	USA
Friedrich-Karl Thielemann	Switzerland
Simon D.M. White	Germany
7. Local Organizing Committee:

Vanessa Hill	Paris-Meudon Observatory (Chair)
Beatriz Barbuy	Brasil
Danielle Briot	Paris-Meudon Observatory
Roger Cayrel	Paris-Meudon Observatory
Francoise Combes	Paris-Meudon Observatory
Eric Depagne	ESO and Paris-Meudon Observatory
Patrick Francois	Paris-Meudon Observatory
Pascale Jablonka	Paris-Meudon Observatory
Gael James	Paris-Meudon Observatory
Elisabeth Vangioni-Flam	IAP
8. Number of participants: 195
9. Countries represented: 24

Australia	China Nanjing	Germany	New Zealand	Switzerland
Belgium	Czech Republic	Italia	Russia	UK
Brazil	Denmark	Japan	South Korea	Ukraine
Canada	Estonia	Latvia	Spain	USA
Chile	France	Netherlands	Sweden	
10. Report submitted by: Vanessah Hill & Roger Cayrel
Place and date: Paris, France, 27 June 2005

11. Summary of the scientific highlights of IAU Symposium No. 228

IAUS228 "*From Lithium to Uranium: Elements Tracers of Early Cosmic Evolution*" was held in Paris, May 23-27, 2005, at the Amphitheatre Henri Poincaré in the Ministère de la Recherche, 1 rue Descartes

Paris 5eme. The symposium was dedicated to **Monique** and **François Spite**, and the scientific program was centred on a subject to which they contributed largely along their careers: chemical abundances of cosmological significance. A total 195 of participants from twenty four countries around the world, among which 25 benefited of IAU Grants, gathered to present and discuss recent results on a variety of topics linked to elemental abundances and the early stages of cosmic evolution, in the form of 61 talks and 105 posters.

The symposium was divided into eight sessions: Primordial Nucleosynthesis, First Stars, Extremely Metal-Poor Stars, Nucleosynthesis and Yields, The Globular Cluster - Field Relation, Heavy Elements, Linking the Halo with its Surroundings, and The High Redshift Connection.

The first day was mostly devoted to tentative explanations for the discrepancy between the observed lithium abundance on the Spite plateau (2.3 in the usual log scale where $\log(H) = 12.0$), and the value predicted from primordial nucleosynthesis and the baryon/photon ratio deduced from WMAP observations, i.e., 2.6. Another problem debated at the conference is the observation of ${}^6\text{Li}$, indicating also a plateau-like behaviour at low metallicity, unexpected from standard primordial nucleosynthesis.

In **Session II**, the current theoretical views for the characteristics of the first stellar generation were presented, with particular emphasis on their role in the re-ionisation of the Universe, the impact of rotation on the evolution (and yields) of these primitive objects. Such objects could explain the very high C, N, O content (1/10 to 1/30th of solar) of the two most metal-poor stars detected to date (1/200000 of the solar iron).

In **Session III**, the current state of the art of metal-poor stars searches was reported, leading to ~ 300 stars with $[\text{Fe}/\text{H}]$ below -3 . In the near future, a stellar extension of SDSS will substantially increase this number. High precision abundance ratios in very metal-poor stars were presented, results of large observational efforts on the three large telescope with high-resolution spectrograph facilities, VLT (**Monique Spite**), Keck (**Judith Cohen**) and Subaru (**Wako Aoki**). One of the most surprising result from these observations is the very low dispersion in most abundance ratios, even at the lowest metallicities when the galactic medium would not have been expected to be well mixed. The discovery of the new most iron-poor star known to date was also reported in this session (**Anna Frebel**).

The speakers of **Session IV** showed the expected chemical yields of the various types of first stars; super-massive stars exploding as pair-instability supernovae (PISN), Type II supernovae with no metals exploding with low or high energies. Current models do not manage to reproduce perfectly all abundance ratios observed in metal-poor stars. But clearly primordial SNe of masses in the range 25-100 M_{\odot} perform much better than PISN in reproducing the observed ratios.

Session V was devoted to the old problem of light element abundance anomalies detected among globular cluster stars, whereas field stars of similar metallicities do not show any anomaly. A key step was achieved with the ESO large programme led by **Raffaele Gratton** which showed that the abundance anomalies were not only detected in evolved giants, but also in unevolved turnoff and subgiant stars. If other anomalies exist in giants, resulting from stellar evolution and associated ‘dredge-up’, those are well understood and exist also in the field stars. But the famous O-Na anticorrelation is clearly specific to globular clusters and is already there at the birth of the star. There is little doubt that these anomalies are linked to the nucleosynthesis after that of C,N,O, involving the next synthesised elements O, F, Ne, Na, Mg, Al. The O-Na and Mg-Al anomalies had been known already for a many years, but new results have been presented for the first time in this session for fluorine. Another new result is a lithium scatter in globular clusters, anti-correlated with Na. Although AGB ejecta are the most obvious possible candidates for the GCs anomalies, it is annoying that one component of these ejecta, the neutron-capture *s*-elements seem to ignore completely the abundance variations of the anomalies. Still many open questions.

Session VI was devoted to heavy neutron capture elements nucleosynthesis. The HERES survey searched successfully for neutron-capture enhancements among metal-poor stars. Eight stars were found to date with strong *r*-process enhancements (enhanced by more than a factor 10 with respect to iron). The record-holder are still CS 22892–052 and CS 31082–001 with overabundances of a factor 50, and even 100 for the actinides in the latter, which enables the first uranium detection in a metal-poor star. The uranium detection in a second metal-poor star was presented at the conference (**Norbert Christlieb**). The *s*-process production in very metal-poor AGB stars is still badly known and new observations of *s*-process enhanced metal-poor stars is a precious tool to constrain this process, in particular new observations of lead (Pb), and even, presented for the first time at the conference bismuth (**Inese Ivans**).

According to hierarchical galaxy formation scenarios, the Milky-Way halo is built up from smaller galaxies, the survivors of which would be the dwarf galaxies of the local group. Abundance analysis of large samples of individual stars in the most nearby galaxies are now becoming available thanks in particular to the multi-object spectrograph FLAMES at the VLT. **Session VII** gathered talks showing that the chemical evolution within dwarf spheroidal galaxies as well as larger systems such as the Magellanic Clouds are distinct from any of the Milky Way's populations, leading to the conclusion that, if the galactic halo was indeed assembled from such galaxies, it must have happened very early on, before any chemical evolution took place within the sub-systems.

Session VIII linked the chemical composition of the oldest galactic stars with that of the extragalactic matter observed at high redshift. In star forming galaxies at redshift 3, about 11 Gyr ago, the abundances, with respect to the primordial element hydrogen, are already about half the abundances in the Sun which is only 4.6 Gyr old. Older matter can be observed along the line of sight connecting us to quasars at redshifts of 5 or 6 (look back time of 12.5 or 12.75 Gyr). Absorption lines believed to cross the interstellar matter of forming galaxies, reveal larger deficiencies, scattered between a half to 1/10th of the solar value. But what is newer is the observation of matter in the intergalactic medium (IGM) itself, by the 'pixel optical depth statistics' method. Lines as Lyman- α , and lines like the C IV 1549 line, are seen in absorption along the line of sight of some high redshift quasars, due to overdensity fluctuations of the IGM by a moderate factor of three, or so. There, extremely low abundances are seen, reaching the 10^{-4} of the solar level, as in the most deficient galactic stars. However, higher abundances are seen when the line of sight passes not far from a damped Lyman α system, observation demonstrating the existence of galactic winds.

We would like to end this report on the IAUS228 by a short citation from an email that **Bengt Gustafsson** who was in charge of summarising the conference on the last afternoon of the meeting, sent to us:

"I would like to thank you with great enthusiasm for the very successful IAUS228 symposium. It was very useful, with very good and interesting contributions, fruitful and intensive discussions and excellent and smooth arrangements. I note after having talked to many young participants, from my department and from elsewhere, that it has all possibilities to be regarded to be one of those meetings that became very significant in the scientific development of individuals, and of our field as a whole."

Proceedings published:

V. Hill, P. François & F. Primas (eds.), 2005,
From Lithium to Uranium: Elemental Tracers of Early Cosmic Evolution,
Proc. IAU Symp. No. 228, Paris, France, 23-27 May 2005,
(Cambridge: CUP) ISBN: 0-521-85199-8, December 2005.
e-papers: http://journals.cambridge.org/jid_IAU

IAU SYMPOSIUM No. 229, POST MEETING REPORT

1. IAU Symposium No.: 229
2. Title of meeting: Asteroids, Comets, Meteors - ACM 2005
3. Dedication of meeting: -
4. Location: Buzios, Rio de Janeiro, Brasil
5. Dates of meeting: 7-12 August 2005
6. Scientific Organizing Committee:
 - Richard P. Binzel MIT, USA
 - Angioletta Coradini Istituto di Astrofisica Spaziale, Italy
 - Julio A. Fernandez Universidad de la Republica, Uruguay (co-Chair)
 - Sylvio Ferraz-Mello Universidade de Sao Paulo, Brazil (co-Chair)
 - Gerhard Hahn DLR, Germany
 - Dimitrij Lupishko Kharkiv National University, Ukraine
 - Alessandro Morbidelli Observatoire de la Cote d'Azur, France
 - Jana Ticha Klet Observatory, Czech Republic
 - Jun-ichi Watanabe National Astronomical Observatory, Japan
 - Iwan P. Williams Queen Mary University of London, UK
7. Local Organizing Committee:
 - Cristian Beauge Universidad Nacional de Cordoba, Argentina
 - Marcos Florczak CEFET Parana, Brazil
 - Ricardo Gil-Hutton Universidad Nacional de San Juan, Argentina
 - Daniela Lazzaro Observatorio Nacional, Brazil (Chair)
 - Tatiana Michtchenko Universidade de Sao Paulo, Brazil
 - Fernando Roig Observatorio Nacional, Brazil
 - Rosa Scorzelli Centro Brasileiro de Pesquisas Fisicas, Brazil
 - Gonzalo Tancredi Facultad de Ciencias, Montevideo, Uruguay
 - Williams Vilas-Boas Instituto Nacional de Pesquisas Espaciais, Brazil
 - Tadashi Yokoyama Universidade Estadual Paulista, Brazil
8. Number of participants: 263
9. Countries represented: 31

Argentina	China	India	Norway	Spain
Azerbaijan	Czech Republic	Israel	Poland	Sweden
Belgium	Finland	Italy	Portugal	UK
Brazil	France	Japan	Russia	Ukraine
Bulgary	Germany	Mexico	Serbia & Montenegro	Uruguay
Canada	Hungary	Netherlands	Slovak Republic	USA
Chile				
10. Report submitted by: Julio A. Fernandez (SOC) & Daniela Lazzaro (LOC)
Place and date: Montevideo, Uruguay, 8 September 2005

11. Summary of the scientific highlights of the IAU Symposium No. 229

This was the ninth meeting of the ACM series that started in 1983. The meeting had a good attendance, only slightly below that of previous ACM meetings, which in itself can be considered a very good result bearing in mind that Brazil is regarded as a distant destination, away from the main routes in Europe and USA. There was an important representation of scientists from South American countries (more than 50), which confirms the appropriateness of having chosen Brazil as the host country of this important meeting, in

line with the IAU endeavor to foster astronomy all around the world. The meeting was held in a hotel that enjoyed excellent facilities, and Búzios provided a beautiful and quiet environment to make the stay very charm and enjoyable.

The meeting consisted of 15 sessions, each one of them had invited talks and oral contributions. Only plenary sessions were programmed following a recommendation by the SOC and Advisory Board based on the incompatibility of parallel sessions with the interdisciplinary spirit of the Symposium. In addition to the oral sessions, there were two poster sessions and two round tables. There were in total 28 invited talks, 63 oral contributions, and 279 poster contributions. Note that the elevated number of poster contributions were a direct consequence of the decision to have only plenary oral sessions. On the other hand, all the posters were exposed during all the week and the poster room open daily from 8:30 to 23:00 hour. This favorably contributed to turn the poster room as the center of the discussions during the meeting.

Among the topics that arose most expectations, we can highlight the presentation of the first reports on the successful Deep Impact mission to comet Tempel 1. There were several presentations as invited talks, oral and poster contributions, on the impact itself, close-up imaging of the nucleus of Tempel 1, visual and infrared data, as well as ground-based observations as part of an international campaign to observe the comet before, during and after the impact.

There were also reports on new space missions to minor bodies, in particular the European Dawn to the asteroids Ceres and Vesta, the European Rosetta to comet Churyumov-Gerasimenko, and the Japanese mission Hayabusa to asteroid Itokawa.

Several sessions were devoted to the study of the different populations of minor bodies, stressing the relationship among them. This was particularly the case of comets that might go through stages of dormancy or volatile depletion, thus looking as inactive objects, disguised as asteroids. Several presentations dealt with spectroscopy and photometry in the visible and near-infrared of asteroids, Centaurs, and trans-Neptunian objects to study the mineralogy of their surfaces, in particular the presence of water ice through the 2-micron absorption feature.

The different populations of minor bodies were put into a cosmogonic perspective through several presentations dealing with accretion processes in the early solar system. In particular, the origin of the ocean water was reviewed, challenging the view that comets may have been the major suppliers.

As mentioned before, two round tables were held on Tuesday and Thursday evening. The first one was devoted to the discussion of the size distribution of the different populations of minor bodies, a topic that has raised some controversy, especially in relation to comets. The second round table was devoted to the analysis of how to handle the huge amount of data on minor bodies expected from the new surveys planned for the near future. Both round tables enjoyed a good attendance.

Beyond the strict scientific aspects, as has become traditional in the ACM meetings several colleagues were distinguished by naming asteroids after them. The announcement was done during the banquet and it constituted a very pleasant and friendly social event. The name of Búzios itself was given to an asteroid and a plaque commemorating this decision was given to the Búzios major.

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Proceedings to be published:

D. Lazzaro, S. Ferraz-Mello & J.A. Fernández (eds.), 2006,
Asteroids, Comets, Meteors - ACM 2005,
Proc. IAU Symp. No. 229, Búzios, Rio de Janeiro, Brasil, 7-12 August 2005,
(Cambridge:CUP) ISBN: 0-521-85200-5, in press (due February 2006).

IAU SYMPOSIUM No. 230, POST MEETING REPORT

1. IAU Symposium No.: 230
2. Title of meeting: Populations of High-Energy Sources in Galaxies
3. Dedication of meeting: -
4. Location: Dublin, Ireland
5. Dates of meeting: 15-19 August 2005
6. Scientific Organizing Committee:

Loredana Bassani	Italy
You-Hua Chu	USA
Chris Done	UK
Guiseppina Fabbiano	USA (co-Chair)
Guenther Hasinger	Germany
Gloria Koenigsberger	Mexico
Katsuji Koyama	Japan
Vladimir M. Lipunov	Russia
Brian P. Mc Breen	Ireland
J. Miguel Mas-Hesse	Spain
Evert J.A. Meurs	Ireland (Chair)
Thierry Montmerle	France
Gustavo E. Romero	Argentina
Zhenru Wang	China
7. Local Organizing Committee:

Brian P. Mc Breen (Chair)	University College Dublin
Catherine Handley	University College Dublin
Coilin O'Maoileidigh	Dunsink Observatory
Evert J.A. Meurs	Dunsink Observatory
Laura Norci	Dunsink Observatory
Carol Woods	Dunsink Observatory
8. Number of participants: 126
9. Countries represented: 19

Belgium	France	Italy	Russia	UK
Chile	Germany	Japan	Slovenia	Ukraine
China	India	Netherlands	Spain	USA
Czech Republic	Ireland	Portugal	Switzerland	
10. Report submitted by: Evert J.A. Meurs
Place and date: Dublin, Ireland, 19 September 2005

11. Summary of the scientific highlights of IAU Symposium No. 230

IAUS230 on **Populations of high energy sources in galaxies** was held in Dublin, Ireland. The venue, the Conference Centre of Dublin Castle, provided an attractive central city location for the symposium. On Monday morning 15 August the symposium was officially opened by the Minister for Education and Science, **Mrs M. Hanafin**, TD. It is noted that attendance at this symposium had evidently been affected by the general European X-ray astronomy meeting that has been scheduled for one month later.

The symposium featured a well-focussed scientific programme, which was organized in seven sessions. Altogether the programme included 25 invited talks, 42 contributed talks and a dedicated poster session with

60 entries. One afternoon (on Wednesday) was kept free for participants to sample some Dublin culture or simply to explore the Irish environment.

The two main approaches underlying the scientific programme are that with present-day X-ray satellites (*Chandra*, *XMM-Newton*) it has become possible to conduct detailed studies of individual X-ray sources in other galaxies and that instrumentation developments at still higher energies now allow to examine comprehensively populations of sources in our own Galaxy at γ -rays (*INTEGRAL*) and also at TeV (notably the HESS array). These developments constitute emerging, very topical areas, that were noticeable as such throughout the presentations.

Session 1 started on “*Key source categories in our Galaxy*”, with overviews of reference X-ray sources as well as the new developments at γ -rays and at TeV energies. Two recent results provided, interesting enough, important links with the generally very distant Gamma Ray Bursts (GRBs): the detection of short GRB afterglows in the work with the high-energy Swift satellite, and the likely additional jet expulsion component signature in an otherwise fairly spherical SNR.

Session 2 complemented the first session by focussing on “*High energy processes in the ISM*”, including recent INTEGRAL results on several nucleosynthesis γ -ray lines. The coverage in this session was subsequently extended to the diffuse X-ray emission seen in other galaxies, due to starbursts and/or merger events.

Detailed studies of sources in relatively nearby galaxies were discussed in **Session 3**, entitled “*Detailed population studies in the nearer galaxies*”. The targets here range from spirals and dwarfs in the Local Group to spirals and ellipticals somewhat further out. The progress in instrumentation of X-ray satellites has notably led to the recognition of extensive LMXB populations in elliptical galaxies.

In **Session 4**, “*Source classes that emerge from sampling over galaxies*”, several categories of high energy sources were considered that can be studied as a class only by examining many galaxies: nuclei of galaxies, GRBs, young supernovae and Ultra-Luminous X-ray sources (ULXs). The ULXs still give rise to several interpretations, although in many presentations gravitate towards BHs of around $10 M_{\odot}$, and attracted the greatest number of talks and posters in the symposium. A special treat proved to be two talks on exploiting historical records on supernovae, showing that in this case sampling over time allows to derive important information on the class of young supernovae.

Session 5 on “*Overall population characteristics*” concentrated on global descriptions of source populations. This both for the new γ -ray inventories in our own Galaxy and for the X-ray inventories of other galaxies. The latter often in the form of X-ray Luminosity Functions, which can be linked to the recent and past starformation activity in these stellar systems.

The interpretation of observational population studies was developed in **Session 6**: “*High energy population synthesis*”. This, of course, involves interesting links with stellar evolution and binary evolution in particular. The implications of starformation activity having been different in the past prepared naturally for the next and last session of the symposium.

To round off the theme, **Session 7** provided “*The high-redshift context*”. In deep X-ray surveys, the integrated X-ray emission of galaxies is necessarily studied, the distribution of which for non-active galaxies peaks for $z \lesssim 1$. If not due to the stellar population, X-rays are also emitted by nuclear cores and towards the end of the programme the Supermassive BHs featured prominently. Notable aspects of the SMBHs included gravitational broadening of Fe X-ray line emission and inferences on the BH growth histories.

The Conference Dinner took place on the Wednesday evening in the plush State Apartments of Dunsink Castle, which was possible thanks to the Minister for Education and Science kindly hosting the event. The dinner guests were also treated on a demonstration of contemporary Irish dancing.

On the Tuesday evening a lecture for the general public was presented by original astrophysicist **Geoffrey Burbidge**. This attracted a full auditorium of around 300 attendees. Notwithstanding a date in the middle of the summer holidays, the tickets for the event were given out within one day. This public lecture was organized in collaboration with the Academy and with an Irish newspaper.

Proceedings to be published:

E.J.A. Meurs & G. Fabbiano (eds.), 2006

Populations of High-Energy Sources in Galaxies,

Proc. IAU Symp. No. 230, Dublin, Ireland, 15-19 August 2005,

(Cambridge:CUP) ISBN: 0-521-85201-3, in press (due February 2006).

IAU SYMPOSIUM No. 231, POST MEETING REPORT

1. IAU Symposium No.: 231
2. Title of meeting: Astrochemistry throughout the Universe:
Recent Successes and Current Challenges
3. Dedication of meeting: --
4. Location: Pacific Grove, CA, USA
5. Dates of meeting: 29 August - 2 September 2005
6. Scientific Organizing Committee:
 - Louis J. Allamandola NASA Ames Research Center, USA
 - John H. Black Onsala Space Observatory, Sweden
 - Geoffrey A. Blake Caltech, USA
 - Paola Caselli Observatorio Astrofisico di Arcetri, Italy
 - Ewine F. van Dishoeck University of Leiden, The Netherlands (Chair)
 - Pascal Ehrenfreund University of Leiden, The Netherlands
 - Guido Garay Universidad de Chile, Chile
 - Michel Guelin IRAM (Grenoble), France
 - Chris Henkel Max-Planck-Institut fuer Radioastronomie, Germany
 - Eric Herbst Ohio State University, USA
 - U... G. Jorgensen Niels Bohr Institute, Denmark
 - John P. Maier University of Basel, Switzerland
 - Karl M. Menten Max-Planck-Institut fuer Radioastronomie, Germany
 - Tom J. Millar UMIST, United Kingdom
 - Young Chul Minh Korea Astronomy Observatory, South Korea
 - Masatoshi Ohishi National Astronomical Observatory, Japan
 - Alejandro C. Raga Institute Astronomia, IA-UNAM, Mexico
 - Bertrand Rowe Universite de Rennes I, France
 - Jongmann Yang Purple Mountain Observatory, China
7. Local Organizing Committee:
 - Mary Ellen Barba IPAC
 - Geoffrey A. Blake Caltech
 - Dariusz (Darek) C. Lis Caltech
 - Jake S. Llamas IPAC
 - Andrew Markwick-Kemper University of Virginia
 - Susan McCurdy Caltech
 - Thomas G. Phillips Caltech (Chair)
 - Susanna L. Widicus Weaver Caltech
8. Number of participants: 304
9. Countries represented: 26

Australia	China	Germany	Mexico	Spain	USA
Austria	Denmark	India	Netherlands	Sweden	
Brazil	Egypt	Israel	Poland	Switzerland	
Canada	Finland	Italy	Russia	Taiwan	
Chile	France	Japan	South Korea	UK	
10. Report submitted by: Ewine F. van Dishoeck
Place and date: Leiden, 12 October 2005

11. Summary of the scientific highlights of IAU Symposium No. 231

The latest in a series of IAU-sponsored symposia on astrochemistry, IAU Symposium No. 231, *Astrochemistry Throughout the Universe: Recent Successes and Current Challenges*, was held from 29 August to 2 September 2005 at the lovely and tranquil setting provided by the Asilomar Conference Grounds, located in Pacific Grove, California within a short distance of the Pacific Ocean. Over three hundred participants from 26 countries managed to discuss and learn many new and exciting aspects of their scientific fields without ignoring the attractions of the nearby beach. An evening alfresco banquet with a barbeque and bonfire and an excursion to the Monterey Bay Aquarium provided times to relax. The Local Organizing Committee, chaired by **Tom Phillips**, who was aided by **Darek Lis**, **Mary-Ellen Barba**, **Geoffrey Blake**, **Andrew Markwick-Kemper**, **Susanna Widicus Weaver**, and others, provided an efficient and smooth operation that left all participants pleased. By the end of the week it had become clear that, true to the title of the Symposium, both recent successes and current challenges exist in abundance.

The Symposium was organized by the IAU Working Group on Astrochemistry, under the sponsorship of IAU Commission 34 (IAU Division VI), with co-sponsorship provided by Commissions 14, 15, 16, 28, and 40. The Symposium was financed in large part through the support of the International Astronomical Union, the California Institute of Technology, the Jet Propulsion Laboratory, the National Radio Astronomy Observatory, the *Spitzer* Science Center, and the Infrared Processing and Analysis Center. This support ensured that the registration costs could be kept very low, only US\$ 120, for a meeting this size. The meeting followed a path provided by earlier conferences, including India in 1985 (IAU Symposium No. 120), Brazil in 1991 (IAU Symposium No. 150), the Netherlands in 1996 (IAU Symposium No. 178), and South Korea in 1999 (IAU Symposium No. 197). Each meeting has been larger than its predecessor, testifying to the growth of astrochemistry. This particular meeting was both similar to and different from its predecessors. The major similarity was the diversity of scientific disciplines, with astronomy, chemistry, physics, and even geology represented, while the major difference was the accent on youthful speakers, who provided a much needed sense of vigor.

The scientific program of the Symposium consisted of 58 oral presentations and 217 posters. The talks were divided into reviews, normal invited talks, and special hot-topic presentations chosen mainly by the SOC from poster submissions. The posters were presented in three separate, very lively sessions of at least two hours each, and indicated the strong diversity and many recent successes of the field.

The oral program started with an introduction to the topic of molecules in space by the Nobel Laureate **Charles H. Townes**, whose team was the first to detect a polyatomic molecule (ammonia) in space. The **first session** was devoted to the topic of star formation, a field of intense current interest in which the role played by molecules as probes is pivotal. The field of single star formation of low-mass stars was emphasized with two newly discovered evolutionary stages – the pre-stellar core and the hot corino – explained. Pre-stellar cores undergo a nearly isothermal collapse and form a dense and cold condensation at their centers. Most species heavier than hydrogen and helium are depleted from the gas in this central condensation, and this depletion produces a very strong deuterium isotopic fractionation leading to the formation of relatively high abundances of multiply deuterated species. Following the pre-stellar stage, the collapse becomes adiabatic and the central condensation heats up and collapses to form a star. In addition to winds and shocks, the protostellar stage in low-mass star formation is now known to contain hot corinos, which are the equivalent of the hot cores surrounding young stellar objects of high mass, although the corinos are smaller, are not as warm, and may not contain as many hydrogen-rich organic molecules. These species arise in part from a warm gas-phase chemistry that starts with evaporated mantles of interstellar dust particles produced by increasing temperatures. This warm-up period is not as simple as previously assumed, since desorption of dirty ices is a rather complex affair. Although much of the discussion was on low-mass star formation, the high-mass case was also considered by speakers. Detailed models including chemistry and a variety of physical processes such as radiative transfer and hydrodynamic collapse were discussed.

Once low-mass and possibly high-mass stars are formed, they are often surrounded by circumstellar disks, which are of unique importance because they can be precursors to systems of planets. Both observations and chemical models of these objects were highlighted. Needless to say, astrochemistry is concerned with more than stellar and planetary formation. Indeed, some of the most interesting chemistry occurs in the envelopes of late-type stars and in evolved objects such as the Red Rectangle, especially under carbon-rich conditions. These topics were also presented.

Star formation cannot be comprehended without an understanding of energetic interfaces, and this topic was

explored in the context of shocks, photon-dominated regions (PDR's), and X-ray-dominated regions (XDR's). The Horsehead Nebula, a particularly well-studied PDR, contains large abundances of hydrocarbons fairly close to its edge, and an explanation of these abundances still represents a challenge to modellers. The discovery of a new interstellar molecule – CF^+ – at a perfectly explainable abundance showed that simple chemical reactions can explain the abundance of this species.

Progress in astrochemistry relies to a great extent on our knowledge of basic chemical and physical processes, so the symposium continued a tradition of sessions on basic processes consisting of presentations on both experimental and theoretical methods. The first of the two general sessions started with a review on what is known and what is needed to be known and continued with talks on molecular spectroscopy, inelastic collisions, low temperature reactive collisions, deuterium fractionation, and dissociative recombination. It was brought out that laboratory evidence indicates strongly that methanol cannot be synthesized in the gas phase and must be produced on grain surfaces and then ejected into the gas in even the coldest regions. But if methanol is so ejected, what about other mantle species? And if all mantle species are desorbed at small but noticeable amounts into the gas, can the use of purely gas-phase models, hitherto rather successful, be continued? Clearly, the challenge of including surface chemistry and gas-surface interactions is a major one.

The **second session** consisted of experimental talks on surface chemistry and desorption, followed by a talk by an ab initio quantum chemist - on the topic of photochemistry on ice surfaces. The session was concluded with talks on PAH identification and spectroscopy and on silicate phases in dust grains. A **third session** – on the details of molecular hydrogen formation on grain surfaces – showed that powerful experimental methods are now being brought to bare on a process that is probably the most basic and important chemical reaction in the universe. Unfortunately, the data and its interpretation by various investigators are not yet in harmonious agreement.

Presenting a major challenge, diffuse interstellar clouds seem to become more complex each year, and their complexity was fully exposed if not fully understood. Not only are these regions the sites of the still unexplained diffuse interstellar bands and the still mysterious ion CH^+ , they are now known to contain polyatomic molecules at hard-to-imagine abundances, including amounts of the simplest polyatomic species - H_3^+ - explainable only in terms of a high ionization rate possibly caused by low-energy cosmic rays. The only model presented of a classical diffuse cloud contains three phases: a cool low-density region with high-density nuggets and a shock.

Part of the appeal of astrochemistry lies in the probing of the extent of molecular complexity in assorted sources, and the subject of complex molecules warranted a **session** of talks on the difficulties of their unambiguous detection despite some past and recent successes using the GBT, and on their possible formation in the gas, via thermal reactions on grain surfaces, and via high-energy surface processes initiated by ionic bombardment.

To balance the accent on youth throughout the oral program, a panel discussion on challenges to the field involving some illustrious but mature astrochemists was organized and proved to be quite entertaining. Two issues seemed to dominate the discussion: the continuing challenge posed by our lack of knowledge of surface processes and the issue of complexity in chemical models. This latter issue appeared to excite the most controversy, with the mature scientists split between coming to grips with if not exactly welcoming complexity in chemical models and preferring back-of-the-envelope estimations.

A special **session** on results obtained with space-based and airborne telescopes was held. We learned about a possible discovery of interstellar molecular oxygen with the *Odin* satellite, and heard a summary of the many exciting discoveries of *SWAS*. New astrochemical results from the *Spitzer* c2d project, and a teasing presentation of the future glories of *SOFIA* ended the session.

Although much of astrochemistry deals with interstellar clouds in our own Galaxy, the field is rapidly expanding its region of interest to include nearby galaxies, objects at high redshift, and even the formation of early structures. Talks on each of these subjects were given showing that successes, although less detailed than in the Milky Way, exist.

The links among astrochemistry, the solar system, and extra-solar planets were explored in a pivotal session. The chemistry of extra-solar planets is a field still in its infancy, but with immense potential to overcome current challenges. Objects much closer to home still retain some mysteries: as we learned, comets are chemical factories not fully understood even if pristine by solar system standards, meteorites show complex

organic chemistry but much processing, and interstellar dust particles are amazingly complex given their small sizes.

The oral program was concluded with a fine summary by **Alex Dalgarno**, whose soft-spoken but incisive commentary never fails to hold the listener's attention. All of the attendees look forward to the next symposium in this fine series, currently planned in approximately five-years' time at a venue in southern Europe. By then or shortly thereafter, a new generation of telescopes, including the *Herschel Space Observatory* and ALMA, will begin to bring new and unimagined advances providing both excitement and difficulty to those of us who must understand them.

Eric Herbst and Ewine van Dishoeck

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Proceedings to be published:

D.C. Lis, G.A. Blake & E. Herbst (eds.), 2006,
Astrochemistry throughout the Universe: Recent Successes and Current Challenges,
Proc. IAU Symp. No. 231, Monterey, CA, USA, 29 August - 2 September 2005,
(Cambridge:CUP) ISBN: 0-521-85202-1, in press (due March 2006).

IAU SYMPOSIUM No. 232, POST MEETING REPORT

1. IAU Symposium No.: 232
2. Title of meeting: Scientific Requirements for Extremely Large Telescopes (ELTs)
3. Dedication of meeting: -
4. Location: Cape Town, South Africa
5. Dates of meeting: 14-18 November 2005
6. Scientific Organizing Committee:
 - Arne L. Ardeberg Lund Observatory, Sweden
 - Youri Yu. Balega SAO, Russian Federation
 - Beatriz Barbuy IAG, Brazil
 - David A.H. Buckley SAAO, South Africa
 - Mathew Colless AAO, Australia
 - Xiang-Qun Cui Nanjing Inst Astronomical Optics & Techno, China PR
 - Michel Dennefeld IAP, France (Chair)
 - Isobel M. Hook Oxford Astrophysics, UK
 - Masanori Iye NAOJ, Japan
 - Rolf-Peter Kudritzki Inst for Astronomy, Hawaii, USA
 - Bruno Leibundgut ESO, Germany
 - Jeremy R. Mould NOAO, USA
 - Andreas Quirrenbach Leiden Observatory, Netherlands
 - Virginia L. Trimble Dept Physics-Astronomy, UC Irvine, USA (Co-Chair)
 - Patricia A. Whitelock SAAO, South Africa
7. Local Organizing Committee:
 - John W. Menzies SAAO (Chair)
 - Phil A. Charles SAAO
 - Ian S. Glass SAAO
 - Isobel Bassett SAAO
 - Glenda Snowball SAAO
8. Number of participants: 135
9. Countries represented: 20

Armenia	China	Italia	Poland	South Africa
Australia	France	Japan	Spain	UK
Belgium	Germany	Ireland	Sweden	USA
Canada	India	Netherlands	Russia	Nigeria
10. Report submitted by: M. Dennefeld
Place and date: Paris, December 22, 2005

11. Summary of the scientific highlights of IAU Symposium No. 232

This symposium, proposed by IAU Commission 9 (and supported by the relevant Division IX), was organised at a moment where the various ELT projects come to the end of their phase A studies, so that a confrontation of the scientific requirements with the technical possibilities seemed appropriate before entering a more advanced phase. At the same time, it gave an opportunity to spread the information to the astronomical community at large, opening doors to further collaborations with the various projects.

At the occasion of the International Year of Physics (2005), the International Union of Pure and Applied Physics (IUPAP) planned its General Assembly in South Africa, the country which also inaugurated shortly afterwards its new giant telescope, the Southern African Large Telescope, SALT. Holding our IAU Symposium in South Africa, jointly with those events, was therefore an excellent opportunity to gather a wide

community in a country which has demonstrated its dynamism in astronomical research and its constant will to participate in large international projects.

Recent examples are given by South Africa's preparation to bid to host the SKA, its development of the Karoo Array Telescope and its Astronomy Geographical Advantage Programme, as stressed in the opening address given by the honourable Minister of Science and Technology, **Mr Mosibudi Mangena**, which will be reproduced in the Proceedings.

This symposium was, therefore, sponsored jointly by IAU and IUPAP, a new and most welcome initiative. As the topics of interest for ELT's cover almost all of Astrophysics, it would have been difficult to accommodate it all linearly in a program not to exceed one week. It was, therefore, decided by the SOC to start by "setting the scene" with review papers only, and then have the detailed discussion and analysis within four parallel sessions which dealt, respectively, with:

- A) Galaxy Formation/Evolution and Cosmology
- B) Stellar Populations
- C) Intergalactic Medium and Large Scale Structure
- D) Exoplanets and Star Formation

The last day was devoted to the presentation of the conclusions of the various groups, which, together with the presentation of the main characteristics foreseen by the major projects, gave rise to a lively final discussion.

After a presentation by **D. Buckley** on the SALT telescope, the latest Large Telescope (LT) to enter into service, by our South African hosts, **M. Longair** reviewed the achievements of current LT's and showed why obviously larger telescopes were necessary. An overview of existing ELT projects by **R. Carlberg** demonstrated the diversity of concepts, with well advanced preliminary studies, and possibly their complementarity. Exploration and detailed studies of the possible best sites over the world are progressing collaboratively (**M. Sarazin**). **K. Hodapp**, in a dynamic review of present (and future) performances of detectors, convinced us that they will certainly meet the requirements of the most demanding instruments. On the other hand, the performances requested from adaptive optics, presented in a two-voiced show by **B. Ellerbroek** and **N. Hubin**, and the complexity of planned instrumentation (**G. Monnet**), represent larger challenges to fully exploit the possibilities of ELT's, but have registered major progresses in recent years.

Other large projects are in the planning (SKA, presented by **S. Rawlings**), are decided but will fly in some time only (*JWST*, discussed by **J. Gardner**), or will enter operations soon (*Herschel* and ALMA, both presented by **T. Wiklind**). Their impact on science to do with the ELT's can only partly be foreseen, but certainly calls for a fast track in erecting ELT's, to make best use of their complementarity. In some specific cases like the search for earth-like exoplanets, still other techniques (like interferometry on ground or in space) might be more efficient than direct imaging by an ELT (**A. Quirrenbach**), but the latter will be indispensable for a detailed study of their physical parameters.

Each of the four groups studied a few scientific key-issues which defined specific requirements for the design of the ELT's.

In the first splinter group (Group A, chaired by **I. Hook**, on galaxy formation and evolution), extending for instance the relation between blackhole masses and the bulge mass of their host galaxy to higher redshifts, would shed light on the formation of blackholes, but require a high spatial resolution and sensitivity to low surface brightness, *and* spatial coverage to probe the dynamical structure. Probing the dark matter in ellipticals, via the dynamics of test particles like Planetary Nebulae or Globular Clusters, requires a wide field of view and moderate spectral resolution ($R \simeq 5000$). Similar requirements come from the need to study the physics of galaxies in the redshift range from 1 to 5, but with the additional need of multiple Integral Field Units (IFU's) to spatially resolve the objects on the kpc scale. Studying the "First Galaxies" (at $z > 6$) requires both high-sensitivity (28th mag objects in *B*, or 24th in *K*) and high spatial resolution to allow sampling of objects which presumably have only a few tens of milli-arc-sec in radius, thus calling for Multi-Object-Adaptive-Optics (MOAO). However finding such galaxies will require specific programs either with *JWST* or with dedicated LT's, or perhaps ELT's themselves if wide field cameras are available/possible.

An interesting possibility to directly measure the cosmic expansion (by measuring the shift with time of absorption lines in QSO's) requires extreme accuracy (a few cm/s/yr) and stability in velocity measurements with high signal to noise, therefore also a high spectral resolution. The latter is also required to constrain possible variation in fundamental constants like the fine structure one, present measurements with LT's being

inconclusive at the moment.

In the “Stellar Populations” group (Group B, chaired by **J. Mould**), the interest in ELT’s comes from the fact that ELT’s bring galaxies within 5 Mpc “as close as the Magellanic Clouds”, allowing to resolve galaxies into stars and learning their history from “fossil records” of old stars and increased look-back time. Topics which were more directly discussed concerned:

Colour Magnitude Diagrams and star formation history; Galactic Archaeology and chemical evolution; Starbursts and super star clusters; and Neutron stars and pulsars.

Speakers in the stellar populations session offered six messages to the ELT projects:

- 1) Plan for periods when adaptive optics is not operable.
- 2) Provide full wavelength coverage from the UV through the thermal IR.
- 3) Support high resolution spectroscopy.
- 4) Include polarization performance in the science requirements for the project.
- 5) Stellar populations / galaxy evolution science is strongly dependent on aperture.
- 6) Study the trade-off with interferometers.

The group C, addressing the intergalactic medium, under chair of **R. Srianand**, divided the science in three broad topics and redshifts ranges.

At high redshift ($z > 7$), addressing re-ionisation, metals lines and Lyman-alpha emitters requires observations at intermediate resolution of $R = 2000$ in the NIR with Signal to Noise (S/N) up to 100. An OH-line suppressor with multiple IFUs with field-of-view of several arcmins square is ideal. Targets are moderately faint QSOs and Lyman-break galaxies of AB magnitudes about 27, but require an ELT larger than 30m. NIR observations at higher resolution ($R = 10000$) and S/N up to 100 would be possible with brighter, transient objects like average-luminosity Gamma-Ray Bursts and Pop. III Supernovae.

At intermediate redshifts, to study the distribution of metals in the IGM and their evolution with cosmic time, observation of brighter QSO’s in single target mode are required, but with high spectral resolution ($R = 40000$) and high S/N (10 000). To cover a large range of transitions and constrain the ionisation corrections, the spectrograph should be blue sensitive and cover a large range in wavelength (303-930 nm).

Finally, at low redshift ($z < 5$), the main gain of an ELT in studying the galaxies-IGM connexion is the possibility of observing fainter targets and thus sampling the metal distribution, and its correlation with galaxies, with a finer grid of lines along which the IGM can be probed. The QSOs and bright LBGs (background sources for the ISM lines observations) can be observed with optical, high-resolution ($R = 50000$) spectroscopy (and $S/N = 100$) to probe the distribution of metals. But a detailed correlation of these metals with galaxies requires the redshift determination of the fainter LBGs (down to $0.01 L_*$) using optical/NIR MOS with $R = 2000-5000$, with multiple IFUs and a total FoV of several arcmin-square, centered on the bright LBGs and QSOs.

In group D (chaired by **M. McCaughrean**), Exoplanets and Star Formation were discussed, with a larger concentration on the former, revealing the intense interest in this rapidly growing field. The power of an ELT at thermal-IR wavelengths to penetrate the extreme extinction associated with massive star formation and to resolve very young high mass stars was however stressed by **Zinnecker**. **Lenzen** presented various science cases driven by thermal-IR imaging with an ELT, including solar system, star formation, exoplanets, and even extragalactic science. Some novel instrumental concepts were presented, including a high-precision polarimeter measuring fractional polarisation down to one in a million (**J. Hough**) usable for the detection of exoplanets, or a high-resolution IR spectrometer ($R = 10^6$) to detect terrestrial planets via their OH airglow separated in velocity space from our own terrestrial airglow. It was stressed (**K. Stapelfeldt**) that, based on considerable extrapolation of current AO technologies, star-planet contrast ratios of greater than 10^8 were unlikely to be achieved by ground-based ELTs, thus making it difficult to see true terrestrial analogues around nearby stars. Nevertheless, considerable and important scientific results can be expected for gas and ice giant exoplanets, as well as so-called super-terrestrials with masses roughly $10 \times$ the Earth. In summary, strong cases were made that considerable progress can be achieved with ELT’s, with only ‘modest’ AO systems being required for the Star Formation part, but dedicated, extremely optimised, very high Strehl-ratio, very high contrast systems for exoplanets studies, with a set of general purpose IR instrumentation for both topics.

A presentation of the actual level of preparation and advancement in ELT studies by various countries and projects prepared the final discussion and comparison between scientific requirements and technical capabilities. Representatives of China (**X. Cui**), Japan (**M. Iye**), Russia (**Y. Balega**) presented the situation in their respective countries. It was shown that virtual observatories and archival data were preparing for the

ELT era also (**N. Walton**), while **J. Urama** underlined the need of cooperation and support for astronomers in less developed countries, to avoid too big a gap developing among various communities.

The major projects, *Thirty Meter Telescope* (by **D. Crampton**), *Giant Magellan Telescope* (by **P. McCarthy**) in the US, and *OWL* in Europe (by **G. Monnet**), were presented in details, as well as the European Design Study (presented by **A. Ardeberg**) joining forces between teams from OWL, Euro 50 and numerous European laboratories under the auspices of the European Commission.

Another two-voices presentation (US-EU, **B. Ellerbroeck** and **C. Cunningham**) outlined the technical developments under way in the fields of smart focal plane units, or adaptive optics, while **J. Mould** addressed the needs for complementary surveys, and the various possible operation modes in ELT's.

The final, lively, discussion addressed both technical questions like diameter or field of view, and more general questions like time scales, synergies with other projects or organisational matters. It was the occasion for the various projects to openly discuss some of their motivations, and it appeared quite clearly that the large variety of scientific projects, and corresponding requirements should end up in a large number of instruments which could probably not be built all at the same time nor on a single telescope. While it is too early to talk about specialised ELT's, the consensus was that an important point is to constantly close the loop in interactions between scientific requirements, telescope designers and instrument makers.

This symposium contributed to that goal, in assembling a majority of specialists of the field, yet in a not-too-large number (135), to allow fruitful exchanges. It was considered by many as a sign that the various projects had really "got off the ground", even if the financial aspects were left aside.

Another encouraging aspect was the participation of many enthusiastic African students in astronomy, most of them having participated also, the week before, in an international school of astronomy, specially organised in Cape Town by **Patricia Whitelock** at the occasion of this symposium.

It was agreed that other events of that kind were needed in the future, the projects developing, and the support of IAU and IUPAP, and the IAU's role in general, were gratefully acknowledged.

Last, but not least, the conference was a success thanks also to a very fine local organisation under the chair of **John Menzies**, which the delegates thanked warmly.

Proceedings to be published:

M. Dennefeld, B. Leibundgut & P.A. Whitelock (eds.),
Scientific Requirements for Extremely Large Telescopes (ELTs),
Proc. IAU Symp. No. 232, Cape Town, South Africa, 14-18 November 2005,
(Cambridge:CUP) ISBN: 0-521-85608-6, in preparation (due May 2006).

IAU COLLOQUIUM No. 198, POST MEETING REPORT

1. IAU Colloquium No.: 198
2. Title of the meeting: Near-Field Cosmology with Dwarf Elliptical Galaxies
3. Dedication of meeting: -
4. Location: Les Diablerets, Switzerland
5. Dates of the meeting: 14-18 March 2005
6. Scientific Organizing Committee:
Bruno Binggeli Astronomical Institute Basel, Switzerland (co-Chair)
Nelson Caldwell Smithsonian Astrophysical Observatory, USA
Jonathan I. Davies University of Cardiff, UK
Enrico V. Held Osservatorio Astronomico di Padova, Italy
Helmut Jerjen Research School of Astronomy and Astrophysics, Australia (Chair)
Igor D. Karachentsev Special Astrophysical Observatory, Russia
Mario Mateo University of Michigan, USA
Ben Moore University of Zuerich, Switzerland
Joseph Silk University of Oxford, UK
Eline Tolstoy Kapteyn Instituut Groningen, the Netherlands
R. Brent Tully University of Hawaii, USA
7. Local Organizing Committee:
Bruno Binggeli Astronomical Institute Basel, Switzerland (Chair)
Eva Grebel Astronomical Institute Basel, Switzerland
Helmut Jerjen Research School of Astronomy and Astrophysics, Australia (co-Chair)
Andrea Kayser Astronomical Institute Basel, Switzerland
Andreas Koch Astronomical Institute Basel, Switzerland
Stefan Kautsch Astronomical Institute Basel, Switzerland
Thorsten Liesker Astronomical Institute Basel, Switzerland
8. Number of participants: 93
9. Countries represented: 23
Argentina Chile Israel Russia Ukraine
Australia Croatia Italy Serbia & Montenegro UK
Austria Finland Japan South Korea USA
Belgium France Netherlands Spain
Canada Germany Romania Switzerland
10. Report submitted by: Helmut Jerjen and Bruno Binggeli
Place and date: Canberra/Basel, 9 August 2005

11. Summary of the scientific highlights of IAU Colloquium No. 198

The main purpose of the IAU Colloquium No. 198 on *Near-Field Cosmology with Dwarf Elliptical Galaxies* was to provide a forum for the presentation and discussion of the most recent results on dwarf elliptical (dE) galaxies (subsuming dwarf spheroidals, dSphs) and to highlight the importance of this research field as provider of local benchmarks for cosmological studies, in particular of theories of structure formation. Nearly all research groups working on dwarf galaxies worldwide were well represented at the meeting and were joint by various international cosmology groups. As a result there was a good balance between observers and theoreticians, giving this IAU Colloquium the right mixture and density of scientists to mark and initiate current and future progress in the field.

At the meeting we have taken a huge step forward towards a unified view of the phenomenon “dwarf

elliptical galaxy” and the theory of galaxy evolution with a number of distinct key issues identified, on which the conference naturally focussed, as briefly described in the following.

Deep colour-magnitude diagrams are now available for an impressive number of nearby dEs (dSphs) and these show a surprisingly large variety of stellar populations. The challenge is to reconstruct reliable star formation and abundance histories for these dwarfs and to model them accurately by means of complex chemodynamical processes that include feedback of star formation to the ISM. Tremendous progress was reported, on both the observational and the theoretical side, but clearly we are still some way away from a full tracking and understanding of dSph evolution.

Local Group dwarf analogs are now routinely observed in the nearby galaxy groups and clusters, allowing us to address the question of how the environment is shaping dwarf galaxy evolution. But even for the bright cluster dEs there is no consensus on the most important environmentally driven process that produced the bulk of cluster dEs. Various scenarios of dE origin were discussed, most notably “galaxy harassment” and “gas stripping”, but none is able to explain all properties of the dwarfs. A major breakthrough in recent years is the detailed kinematical knowledge for a growing number of cluster dEs. In contrast to previous assumptions it turned out, there are many dEs that are rotationally supported stellar systems and new deep images with *HST* and large ground-based telescopes find clear signs of disk structure. These observations together with the discovery of significant amounts of neutral hydrogen in these seemingly gas-free galaxies provide strong evidence that dEs are less homogeneous as a class than we thought and/or that there are distinct subclasses of dEs with different evolutionary paths.

The most pressing issue in the two dwarf galaxy/cosmology research areas is the “missing-satellite problem”: the discrepancy between the low number of observed and the very high number of theoretically expected dwarf galaxies in the context of CDM structure formation. This was highnoon for participants doing LCDM simulations and those trying to connect mass to light. No unique solution could be presented, but various plausible mechanisms that could explain why DM mini-halos, below a critical mass, stay without baryons were offered. Meanwhile the state-of-the art to determine the mass of local dwarf spheroidals has reached a level where detailed models for the mass distribution can be applied to the data. The MODified Newtonian Dynamics alternative, which is now more attractive by its relativistic version, was also discussed (and dismissed). Even ways to detect those DM particles (if present) that make up the dark halos of the nearby dwarfs - which turn out to be ideal objects for that purpose - were presented.

Other topical highlights of the conference include *the build-up of large galaxies like the Milky Way from accretion of dwarf satellites* like Sagittarius, *the physical nature of morphological substructure in dEs* such as the *central nuclei and globular cluster systems*, *the connection between dwarf Es and giant Es*, as well as *the fundamental problem of reliable distance determination*.

Overall, it was a highly successful, scientifically fruitful meeting, as testified by many participants to the organizers during and after the meeting (see below). Throughout the conference, in the lecture hall as well as in the conference hotel in the free time, an atmosphere of intense and vivid discussion prevailed that surely must have been the starting point of many new projects and collaborations. This is probably the greatest payoff of the IAUC198 conference for our community.

Feedback from conference participants:

... first of all, I would like to thank you again for the excellent work in organizing the IAUC198: I think it has been an exciting meeting! (Sergio Colafrancesco, Observatory of Rome, Italy).

... I wanted to thank you again for your superb job on the meeting. It was a most enjoyable and educational trip for me. (Mario Mateo, University of Michigan, USA).

... It was very good to see you in Switzerland and thanks again for putting together an interesting meeting. (Jay Gallagher, Editor of The Astronomical Journal, USA).

... What a great conference! Well done. I really enjoyed it. And a friendly group of participants. (Alister Graham, RSAA, Australia).

... First of all I wish to thank and congratulate you both on organizing a most interesting and successful conference. (Rami Rekola, Tuorla Observatory, Finland).

... I am only now back at work after a most enjoyable week at Les Diablerets. I wanted to tell you once more how much I appreciated the opportunity to take part – I learnt a great deal at the meeting on subjects which are relevant to my work. I also enjoyed the many opportunities to interact with colleagues: all in all it was one of the best meetings I have been to in recent years. Thank you both for all the work which you put into making this IAU Colloquium a resounding success. (Max Pettini, Institute of Astronomy, Cambridge, UK).

... da ich Euch nicht gleich oder zuwenig auf der Tagung danken konnte, moechte ich dies hiermit noch tun. Die Tagung war wirklich exzellent, nicht nur organsiert, sondern auch inhaltlich. Der Impakt an neuen Ergebnissen war wohl für alle enorm und fruchtbringend für die weitere eigene Arbeit. Vielen herzlichen Dank also nochmals. (Gerhard Hensler, Astronomical Institute Vienna, Austria).

Proceedings published:

H. Jerjen & B. Binggeli (eds.), 2005,
Near-Field Cosmology with Dwarf Elliptical Galaxies,
Proc. IAU Coll. No. 198, Les Diablerets, Switzerland, 14-18 March 2005,
(Cambridge:CUP) ISBN: 0-521-85204-8, November 2005.
e-papers: http://journals.cambridge.org/jid_IAU

IAU COLLOQUIUM No. 199, POST MEETING REPORT

1. IAU Colloquium No.: 199
2. Title of the meeting: Probing Galaxies through Quasar Absorption Lines
3. Dedication of meeting: -
4. Location: Shanghai, China
5. Dates of the meeting: 14-18 March 2005
6. Scientific Organizing Committee:

Jacqueline Bergeron	Paris, France
Jiansheng Chen	Beijing, China
Stefano Cristiani	Trieste, Italia
Brice Menard	Princeton, NJ, USA (Chair)
Houjun Mo	Amherst, MA, USA
Max Pettini	Cambridge, UK
Huib Roettgering	Leiden, the Netherlands
David A. Turnshek	Pittsburgh, PA, USA (co-Chair)
Simon D.M. White	Garching, Germany
7. Local Organizing Committee:

Guoxuan Dong	National Science Foundation of China
Xiaoyu Hong	SHAO
Jinliang Hou	SHAO
Chenggang Shu	SHAO and ShNU (Chair)
Jueming Sun	ShNU
Peter Williams	ShNU
Jiaxiang Xiang	ShNU
Junliang Zhao	SHAO
8. Number of participants: 110
9. Countries represented: 15

Canada	China	Taiwan	India	Mexico	Switzerland
Chile	France		Italia	Netherlands	UK
China Nanjing	Germany		Japan	Russia	USA
10. Report submitted by: Brice Menard and Chenggang Shu
Place and date: Princeton, NJ, USA, 7 July 2005

11. Summary of the scientific highlights of IAU Colloquium No. 199

IAU Colloquium No. 199 *Probing Galaxies through Quasar absorption lines* was attended by 110 registered participants. Approximately two thirds of the participants were students and postdocs, emphasizing the fact that this field is very active and has a bright future.

The objective of the meeting was to present new results in quasar absorption line spectroscopy and see what constraints they can give on galaxy formation and evolution. The last previous workshop on this subject was held in 1997 in Paris. In the meantime, several new instruments came online and large surveys have become public. It was therefore very timely to gather all the people from the community.

The Scientific Organizing Committee proposed to focus the meeting on the following topics:

- new observational results on the connection between galaxies and absorbers
- results from large surveys (SDSS, 2dF, CORALs, etc.)
- recent progress in theoretical models for absorber systems

- results from numerical simulations
- the IGM
- abundances
- very high redshifts and re-ionization

Todd Tripp started the scientific presentations by giving a very interesting review on what is known and not known regarding the connection between absorbers and galaxies. Several speakers then presented new observational results on metal absorbers (**John Stocke / Brian Keeney, Chris Churchill, Bastien Aracil, Patrick Petitjean**). Another observational session was devoted to Damped Lyman- α systems (DLAs). **Sandhya Rao** presented what has been done so far in order to identify DLA galaxies. Several talks completed her review by presenting recent progress: detecting DLAs in γ -ray burst (**Paul Vreeswijk**), observing DLAs in 21 cm (**Nissim Kanekar**), and investigating the environment of DLAs (**Jessica Rosenberg**). In addition there were two talks presenting surveys of the Lyman- α line in emission (**Fuzhen Chen, Martin Zwaan**).

The morning of the **second day** was devoted to theoretical models of absorbers. **Houjun Mo** presented a very powerful formalism that allows to relate the dark matter distribution to that of the hydrogen gas seen with the Ly- α transition. Two talks then presented analytic models of metal absorbers (**Jinliang Hou, Weipeng Lin**). We then enjoyed several talks presenting some physical properties of the absorbing galaxies seen with absorption lines (**Arthur Wolfe, Glenn Kacprzak, Raghunathan Srianand**).

The afternoon was focused on new results obtained from large surveys: **Daniel Nestor** presented a new sample of more than 1500 Mg II absorbers found in the Sloan Digital Sky Survey (SDSS) which was followed by several statistical studies using this data (**Brice Ménard, David Turnshek**). **Donald York** introduced the new SDSS absorber database which contains several thousand detected absorber systems and will soon be publicly available. Finally, integral field spectroscopy surveys and radio surveys were presented (**Lise Christensen, Sara Ellison**).

The morning of the **Wednesday** was devoted to numerical simulations. **Tom Theuns** gave a brilliant review of simulations of absorbers. Five talks followed: **Yipeng Jing, Serena Bertone, Alistair Nelson** and **James Bolton** presented several aspects of absorber systems studied with simulations, and **Matteo Viel** showed how simulations can be used in order to extract cosmological parameters from observations of the Lyman- α forest.

The afternoon was free and a trip to Shanghai Museum was organized.

The **fourth day** was devoted to the IGM and abundances. **Jason Prochaska** gave a review talk to introduce the subject and presented at the end some new results on DLAs obtained with the SDSS. New results on the metallicities, isotopic ratios, chemical abundances, star formation histories were then shown and discussed (**Tae-Sun Kim, Miroslava Dessauges-Zavadsky, Sebastien Muller, Regina Schulte-Ladbeck, Varsha Kulkarni / Donald York**). **Jacqueline Bergeron** showed what can be learnt using highly-ionized absorbers, **Michael Rauch** presented results on the environmental impact of galaxies on the IGM, **Anthony Aguirre** confronted numerical simulations to observations of metallicities, and **Ariyeh Maller** presented some remarks about the multi-phase gas that fuels galaxy formation.

The problem of dust obscuration was discussed from a theoretical point of view by **Giovanni Vladilo** and observational results were presented by **Michael Murphy** and **Junfeng Wang**.

The **last day** was focused on the very high-redshift Universe. **Kurt Adelberger** presented some exciting observational results from the Keck telescope and showed that not only quasars but also galaxies can be used as sources for absorption line studies. Several talks then presented recent progress in our understanding of the baryon distribution (**Nicolas Lehner, Celine Peroux, Martin Haenelt**). **Xiaoyang Xia** presented some results about infrared quasars, and **Esther Hu** showed some spectroscopic studies of very high redshift galaxies and their implication for the re-ionization. **Xiaohui Fan** and **George Becker** presented some constraints on the re-ionization history using the highest redshift quasars from SDSS. **XiangPing Wu** and **Huub Röttgering** showed the current status of the two upcoming high- z 21 cm telescopes: PAST and LOFAR. **Anfrea Ferrara, Steven Furlanetto** and **Ilian Iliev** then presented some theoretical results on the re-ionization epoch.

The conclusion of the meeting was given by **Simon White**. He gave an overview of the highlights of the conference, and from these forwarded a series of questions arising. His talk was followed by a discussion on

these current issues and future prospects.

This Colloquium was very lively and many discussions followed the talks and continued during the breaks. In addition, a number of collaborations started during that week. Many people came to China for the first time and really enjoyed discovering this country and its culture. We thank the IAU for its generous financial support that allowed a number of young researchers to have attended this exciting Colloquium.

Brice Ménard and Chenggang Shu
chairs of the SOC and LOC

Proceedings published:

P.R. Williams, Chenggang Shu & B. Ménard (eds.), 2005,
Probing Galaxies through Quasar Absorption Lines,
Proc. IAU Coll. No. 199, Shanghai, China, 14-18 March 2005,
(Cambridge: CUP) ISBN: 0-521-85205-6, October 2005.
e-papers: http://journals.cambridge.org/jid_IAU

IAU COLLOQUIUM No. 200, POST MEETING REPORT

1. IAU Colloquium No.: 200
2. Meeting Title: Direct Imaging of Exoplanets: Science and Techniques
3. Dedication of meeting: --
4. Location: Villefrance-sur-mer (Nice), France
5. Dates of the meeting: 3-7 October 2005
6. Scientific Organizing Committee:

Claude Aime	France (Chair)
Malcolm Fridlund	Sweden
Thomas Henning	Germany
Anne-Marie Lagrange	France
Andreas Quirrenbach	the Netherlands
Roberto Ragazzoni	Italy
Daniel Rouan	France
Jean Schneider	France
Sara Seager	USA
Mike Shao	USA
Motohide Tamura	Japan
Wesley A. Traub	USA
7. Local Organizing Committee:

Farrokh Vakili (Chair)
Valerie Cheron (Executive Secretary)
Claude Aime
Yves Rabbia
Marcel Carbillet
Andre Ferrari
8. Number of participants: 182
9. Countries represented : 14

Australia	Germany	Morocco	Spain	UK
Belgium	Italy	Netherlands	Switzerland	USA
France	Japan	Poland	Ukraine	
10. Report submitted by: Claude Aime
Place and date: Nice, 2 November 2005

11. Summary of the scientific highlights of IAU Colloquium No. 200

The topic of the IAU Colloquium No. 200 on *Direct Imaging of exoplanets: Science and Techniques* was the detection and analysis of photons from terrestrial and giant exoplanets.

The Colloquium was held in the citadel of Villefranche-sur-Mer, a 16th century castle located at sea level in the beautiful bay of Villefranche, near Nice. The duration of the Colloquium was of five days, with a break on Wednesday afternoon.

The two first days of the Colloquium were devoted to science goals of exoplanets detection: interest of their direct observation, physics of terrestrial and giant planets, instrumental requirements in the visible and the infrared and reports of the first observations of very massive exoplanets. The three last days of the Colloquium were on ground and space instrumentation to achieve these goals. There was half a day for interferometric nulling techniques, one day for coronagraphy and the rest of the communications were on

innovative techniques and data processing.

We had 66 oral presentations, including 7 invited talks:

Willy Benz on *Overview of science goals and detection methods*,

Victoria Meadows on *Physics of terrestrial planets*,

France Allard on *Physics of giant planets*,

Robert Brown on *Expectations in the visible domains*,

Neville Woolf on *Expectations in the infrared domain*,

Antoine Labeyrie on *ELTs versus Interferometers*, and

Roger Angel on *Ground-based telescopes versus space missions*.

We have deliberately avoided having SOC members as invited speakers. The oral presentations were completed by about 70 poster presentations split in two sessions of 2 hours each. Contributed talks and posters described some of the latest theoretical developments in understanding the formation and evolution of planetary systems. The state of the art for both the instrumental concepts and data analysis methods were largely presented and debated. All world-wide top experts were present. We favored also the participation of a large number of students, post-docs and very young scientists developing themselves observing science, concepts and instruments which witnessed of the attraction of the colloquium and the selected topics.

The context of the Colloquium was the preparation of both ground-based and space-borne ambitious projects for the detection of exoplanets by imaging, especially terrestrial planets. Key-projects of the major world agencies such as ESA, ESO, NASA, NASDA were outlined. The impact of the Colloquium can also be measured by the participation of scientists in charge of the major European, Japanese and US projects in exoplanet imaging.

The Colloquium was not only useful for delivering new information on several instrumental topics and scientific perspectives. It has also underlined several conclusions for the present status and future directions for the actions of the exoplanet community and agencies scientific policy. First, there is a remarkable agreement among the exoplanets community on the goal of characterizing them by imaging. Some important questions remain, that are guidelines for future actions:

- Should we consider different definitions of “*a planet*”? We should prepare ourselves scientifically about unexpected characteristics of planets. Do Earth-like planets exist nearby? How do we prepare for the public response to their discovery? What if the result is “*No Earth-like planet out there*”?

- The relative merits of ground-based ELT and space missions should be strongly investigated further. Are precursor ground and space missions needed? How can we stimulate international cooperation, necessary for large projects? What could be the benefits for other branches of astrophysics?

In addition to the usual scientific debates and discussions between participants, semi-formal contacts were initiated in view of establishing future international cooperation on the most ambitious ground and space projects for the coming decade and the long term of research in exoplanetary astrophysics.

The major part of the presentations given during the Colloquium is available in PDF Format at the web site (<http://www-luan.unice.fr/colloqueUAI/planning.html> - links are with the titles of the communications).

Claude.Aime@unice.fr

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Proceedings to be published:

C. Aime & F. Vakili (eds.),

Direct Imaging of Exoplanets: Science and Techniques,

Proc. IAU Coll. No. 200, Nice, France, 3-7 October 2005,

(Cambridge:CUP) ISBN: 0-521-85607-8, in press (due April 2006).

9-th ASIAN-PACIFIC REGIONAL IAU MEETING (APRIM-2005), POST MEETING REPORT

1. REGIONAL IAU MEETING: 9th Asian-Pacific Regional IAU Meeting
2. Meeting Title: APRIM-2005
3. Dedication of meeting: -
4. Location: Nusa Dua, Bali, Indonesia
5. Dates of the meeting: 26-29 July 2005
6. Scientific Organizing Committee:

Brian J. Boyle	Australia
Russell A. Taylor	Canada
Leonardo Bronfman	Chile
Cheng Fang	China Nanjing
Ding-Qiang Su	China Nanjing
Gang Zhao	China Nanjing
Sun Kwok	China Taipei
Jayant Vishnu Narlikar	India
Bambang Hidayat	Indonesia
Iratius Radiman	Indonesia
Winardi Sutantyo	Indonesia (Chair)
Satoru Ikeuchi	Japan
Norio Kaifu	Japan
Shin Mineshige	Japan (co-Chair)
Hyung Mok Lee	South Korea
John B. Hearnshaw	New Zealand
Iraida S. Kim	Russia
John P. Huchra	USA
7. Local Organizing Committee:

Premana W. Premadi	Institut Teknologi Bandung (Chair)
Djoni N. Dawanas	ITB
Dhani Herdiwijaya	ITB
Thomas Djamaluddin	LAPAN
Taufiq Hidayat	ITB
Chatief Kunjaya	ITB
Hakim L. Malasan	ITB
Mahasena Putra	ITB
Moedji Raharto	ITB
Mezak A. Ratag	BMG
Suhardja D. Wiramihardja	ITB
8. Number of participants: 269
9. Represented countries: 24

Argentina (1)	China Taipei (4)	Iraq (1)	Netherlands (1)	South Korea (20)
Australia (4)	Germany (3)	Italy (1)	New Zealand (3)	Thailand (1)
Canada (4)	India (5)	Japan (118)	Philippines (1)	UK (1)
Chile (1)	Indonesia (63)	Malaysia (3)	Peru (1)	USA (7)
China Nanjing (21)	Iran (2)	Mexico (1)	Russia (5)	
10. Report submitted by: SOC and LOC of APRIM 2005
Place and date: Bandung, Indonesia, 26 August 2005

11. Summary of the scientific highlights of APRIM-2005

The topics covered in APRIM 2005 varied from Sun-Earth Interactions, Solar Physics, Planetary Systems, Compact Objects, Stellar Evolution, The Milky Way, up to the Large Scale Structure of the Universe and Cosmology. The topics also covered large astronomical projects which involve international cooperation like the Square Kilometer Array, the New Generation Ground-Based telescope, ALMA and large projects in China. We heard not only the advancement of astronomy in countries in which astronomy is firmly established, but we also learned the development of astronomy in less advanced countries and even the situation of astronomy in Iraq which we know still in turbulent situation.

The program was arranged such that all invited talks were presented in plenary sessions to ensure that all participants could take a grasp of the newest developments in the topics, not only in their fields of interest but also in other fields as well.

The meeting put special emphasize on education and popularization of astronomy. This session was held as a special session which could be attended not only by the registered astronomers, but also by teachers, students and amateurs. In this session we heard some presentations from professional astronomers who are active in this area. A session of discussions in which amateurs could share their experiences and work in collaboration was also arranged. A program to visit many high schools in this area to socialize astronomy among high school teachers and students in Bali area was also organized. A star party program was also arranged in the evening of the last day of the meeting.

The various papers presented in the meeting were: 1 Special Lecture, 25 Invited Papers, 81 Oral Contributions, 106 Poster Papers, and a number of exposition papers. A list of the special lecture and invited talks follows here:

Special Lecture

The State of the Universe Report by **John P. Huchra**

Session 1. SOLAR PHYSICS, PLANETARY SYSTEMS AND SUN-EARTH INTERACTION

The search of extrasolar planets by **Ian A. Bond**

Recent progress in multi-wavelength investigations of solar and stellar activity by **Aleksander V. Stepanov**

Recent progress of solar high-energy phenomena by **Weiqun Gan**

Long term variations in solar magnetic field, geomagnetic field and climate by **Silvia Duhau**

Session 2. STELLAR EVOLUTION, ACTIVITIES AND BINARIES

Evolution of Binaries with Compact Components by **X-D. Li**

Population synthesis by **Zhanwen Han**

Session 3. COMPACT OBJECTS, AGNs AND HIGH ENERGY/COSMIC RAY ASTROPHYSICS

Origin and mechanism of gamma-ray bursts with HETE-2 by **Nobuyuki Kawai**

Session 4. THE MILKY WAY, INTERSTELLAR MATTER, STAR FORMATION

Cold hydrogen clouds in the Milky Way: an evolutionary missing link? by **Russell A. Taylor & Gibson**

Star formation in molecular clouds; a sub-mm perspective by **Yasuo Fukui**

Origin and Early Evolution of Brown Dwarfs by **R. Jayawardhana**

Session 5. GALAXIES, LARGE SCALE STRUCTURE AND COSMOLOGY

First results from the 6dF Galaxy survey by **Matthew Colless**

A case for alternative cosmology by **Jayant V. Narlikar**

The evolution of supermassive black Holes: the evidence from QSO surveys by **Brian J. Boyle**

On the early stage of galaxy formation by **Yoshiaki Taniguchi**

Large scale structure traced by different species of galaxies by **Changbom Park**

Extragalactic stellar astronomy by **Rolf-Peter Kudritzki**

Session 6. NUMERICAL ASTROPHYSICS

Posters only.

Session 7. ASTRONOMICAL INSTRUMENTATION

On the Square Kilometer Array (SKA) by **Ronald D. Ekers**

Next generation ground-based telescopes by **Rolf-Peter Kudritzki**

Atacama Large Millimeter/submillimeter Array (ALMA) by **Masato Ishiguro**

Progress on the development of large astronomical facilities in China by **Guoxiang Ai**

Session 8. ASTRONOMY WITH SMALL TELESCOPES

2m telescope at around 4500 m height in the Himalayas by **Tushar P. Prabhu**

Session 9. EDUCATION AND POPULARIZATION OF ASTRONOMY

The present state of Iraqi astronomy by **Athem Alsabti**

Participation in the International Astronomy Olympiad (IAO) as means to attract highschool students to astronomy by **Soehardja Wiramihardja**

IUCAA's activities on astronomy education in schools by **Naresh K. Dadhich**

The future astronomical education and popularization in Japan by **Hidehiko Agata**

Scientific highlights as reported by SOC members:

Special Lecture Session (reported by Satoru Ikeuchi):

John Huchra gave a fascinating lecture on the present status of cosmology including the historical episodes with humor. Many attendants were satisfied and had deep insights of the evolution of the Universe.

Session 1-A (reported by John B. Hearnshaw):

On Tuesday I chaired Session 1-A with a variety of oral contributed papers on the solar system and planetary systems. Of the eight papers scheduled, six were presented (two speakers did not turn up).

Ing-Guey and **Li-Chin Yeh** from Taiwan presented two papers on numerical simulations of planetary system bodies, one paper on the Kuiper Belt objects, and another on the role of discs in extrasolar planetary systems.

Budi Dermawan from ITB gave a very interesting account of his Subaru (SuprimeCam) observations of the spin rates and shapes of asteroids. It was impressive that he was able to obtain spin periods for as many as 73 faint asteroids down to R -magnitude 24.6. This paper was one of the highlights of this session.

Mochamad Irfan, also from ITB, analysed photographic images of Mars from Bosscha Observatory taken at the 2003 opposition, to measure the limb darkening and hence atmospheric height of the Martian atmosphere. Another paper, by **Dhani Herdiwijaya** (ITB) analysed the proper motion of sunspots observed between 1989 and 2002, and found a longitudinal separation drift of about 70 m/s for pairs of different polarity.

Finally **Subhash Chandra Kaushik** from Datia, India, discussed the role of the interplanetary magnetic field on magnetic cloud events which initiate large geomagnetic storms in coronal mass ejections.

Session 2 (reported by Zhao Gang):

The session was about stellar evolution, activities and binaries. The schedule included 2 invited talks, 13 oral presentations and 6 posters. However, the actual number for the oral presentations was 7 instead of 13. In order to test stellar evolution theory, **Liu & Zhao Gang** obtained the abundances of α -elements of 75 red clump stars with high-resolution, high signal-to-noise ratio spectra. The result would be a good constraint to the theory on the evolution of the first giant branch stars. The mass-loss effect on the evolution of BD +60 2522 was investigated theoretically by **Aprilia Wardana & Djoni Dawanas**. **Peng Qui-he** proposed a new explosion mechanism for core collapse supernova, and the key points are a new criterion for the onset of fast collapse and the idea that the inner core collapses faster. However, the new mechanism needs to be tested numerically. **Chen Yang**, on the other hand, discovered metal-rich thermal emission of supernova remnant N157B with *Chandra* observations, and the emission is relevant to radiative transfer model of supernova remnant. We also saw a book by **Tomokazu Kogure & Kam-Ching Leung** from the poster session on the physics of emission-line stars. There has been good progress in the observations of solar-like oscillations, and the measurement of natural resonant frequencies of stars can be used to infer internal information of stars. **Tim Bedding** gave a nice review on the recent results obtained with the AAT and VLT on stars such as α Centauri A and B.

Binaries are an active subject. **Han Zhanwen** discussed the binary model for the formation of subdwarf B stars, while **Li** reviewed the studies on the evolution of X-ray binaries and in particular the evolutionary channels leading of the formation of ultraluminous X-ray binaries. **Hakim Malasan, Winardi Sutantyo & Mahasena Putra** constrained common envelope evolution with PSR B2303+46, a binary pulsar with a relatively long (12.34d) orbital period and a white dwarf companion. The result shows that the common envelope ejection efficiency could be over 1.

Sean M. Dougherty & Julian M. Pittard investigated colliding-wind binary WR 140 with multi-epoch high-resolution radio observations from VLBA. The observations well determined the binary motion parameters of the system, and are used to constrain radiative transfer model of colliding-wind binaries, which are used as particle acceleration laboratories. Orbits of some close binaries are determined observationally by

Komonjinda & al. and **Jatmiko & al.**, so that orbital evolution or the possible existence of a third component can be studied. Three-dimensional hydrodynamic simulations of wind-generated accretion disc are performed by **Matsuda & al.** to investigate the gas flow in the symbiotic binary star Z Andromedae. **Hasan** observed young star clusters NGC 1960, NGC 2453 and NGC 2384 in the near infrared bands and obtained the *JHK* data, while **Kim** calculated theoretical isochrones with extinction in the *K*-band. **Han** seems to have solved the UV-upturn problem of elliptical galaxies by adopting the binary model of subdwarf B stars.

Session OP3 (reported by Shin Mineshige):

Highlights of the session included a discussion by **Kei Kotake** of magneto-rotational core-collapse of massive stars based on his MHD simulations, a discussion by **Bian Weihao** of the nature of blue outliers, blue-shifted [O III] emission-line narrow-line Seyfert 1 galaxies (NLS1s) found by SDSS, a discussion by **Atsunori Yonehara** of the useful method for constraining the size of narrow line region at high-*z* quasars, a discussion by **Anant Eungwanichayapant** of a new method for probing extragalactic background light, and a discussion by **Makoto Inoue** of possible detection of thermal plasma surrounding AGN jets.

Session OP5 (reported by John P. Huchra):

Highlights of the session included a discussion by **Hesti Wulandari** of the latest experimental results from the CRESST Dark Matter search which has not yet achieved sufficient sensitivity to detect CDM, a discussion of the modeling of galaxy cluster cores by both **Massimo Meneghetti & Motokazu Takizawa**, and the use of gravitational lensing to measure their inner profiles by **Massimo Meneghetti**, incredible deep imaging of galaxies with the SUPRIME camera on Subaru by **Sadanori Okamura** and a delightful talk by **Louise Riofrio** on how a non-standard cosmology with a varying speed-of-light might reproduce the high-redshift supernova Hubble diagram.

Session OP9 (reported by Shin Mineshige):

Highlights of the session included a discussion by **Julieta Fierro** of archaeoastronomy for outreach projects on astronomy in Mexico, a report by **Jose Kaname Ishitsuka** on their precious efforts for re-constructing astronomical facilities in Peru after a nightmare caused by terrorism, a report by **Norio Okamura** and his high-school students at Mito, Japan, of the reproduction of William Hershel's metallic mirror telescope, a discussion by **Cynthia Celebre** of a renewed astronomy program in the Philippines, a report by **John B. Hearnshaw & Julieta Fierro** of their work of the IAU Commission 46 Program Group for the World-Wide Development of Astronomy (PGWWDA), and on astronomy in Mongolia and Cuba.

Proceedings to be published:

W. Sutantyo, S. Mineshige, P.W. Premadi & Mahasenaputra (eds.),
Proc. *9th Asian-Pacific Regional IAU Meeting (APRIM-2005)*,
Nusa Dua, Bali, Indonesia, 26-29 July 2005,
(Bandung: Penerbit) ISBN: 979-3507-63-2, in press (due mid February 2006).

11-th LATIN-AMERICAN REGIONAL IAU MEETING (LARIM-2005), POST MEETING REPORT

1. REGIONAL IAU MEETING: 11th Latin-American Regional IAU Meeting
2. Meeting Title: LARIM-2005
3. Dedication of meeting: -
4. Location: Pucon, Chile
5. Dates of the meeting: 12-16 December 2005
6. Scientific Organizing Committee:

Beatriz Barbuy	Brasil
Gustavo Bruzual	Venezuela
Gloria Dubner	Argentina
Mario Hamuy	Chile
Julio Fernandez	Uruguay
Wolfgang Gieren	Chile
Leopoldo Infante	Chile (co-Chair)
Rene Mendez	Chile
Dante Minniti	Chile
Monica Rubio	Chile (Chair)
Maria Teresa Ruiz	Chile
Silvia Torres-Peimbert	Mexico
7. Local Organizing Committee:

Felipe Barrientos	Pontificia Universidad Catolica de Chile
Edgardo Costa	Universidad de Chile
Gaspar Galaz	Pontificia Universidad Catolica de Chile (co-Chair)
Douglas P. Geisler	Universidad de Concepcion
Roberto Gilmozzi	ESO
Eduardo Hardy	NRAO
Paulina Lira	Universidad de Chile (co-Chair)
Sebastian Lopez	Universidad de Chile
Mark M. Phillips	Las Campanas Observatory
Amelia Ramirez	Universidad de la Serena
Malcolm G. Smith	CTIO/NOAO
8. Number of participants: 290
9. Countries represented: 20

Argentina (56)	Canada (4)	Germany (5)	Mexico (28)	UK (1)
Australia (2)	Chile (113)	Greece (1)	Netherlands (1)	Uruguay (5)
Belgium (1)	Colombia (10)	Honduras (1)	Peru (2)	USA (13)
Brasil (35)	France (2)	Japan (1)	Spain (4)	Venezuela (5)
10. Report submitted by: Monica Rubio
Place and date: Santiago de Chile, 1 February 2006

11. Summary of the scientific highlights of LARIM-2005

Introduction

LARIM-2005 was a very successful meeting. Almost 300 participants from 20 different countries attended. Twenty four Invited Lectures and 60 Oral Presentations were presented during the five days of the meeting.

Over 300 posters were set up during four days of the meeting. Two public lectures were given. One in Santiago by **Prof. Riccardo Giacconi** and the other in Pucón by **Dr. Luis Aguilar** from Mexico.

Half of the participants were astronomy students from Latin-American countries. Funding from IAU and other agencies in Chile, plus important companies in Chile that sponsored LARIM-2005 allowed us to grant all students and invited speakers. A total of US\$50,000 was used in financial support to students.

The scientific highlights of the meeting are summarized below. These have been grouped in three main topics well represented at LARIM-2005: Extragalactic Astronomy, Stars and Stellar Clusters, and Star Formation.

Extragalactic Astronomy

The program of the 11th Latin-American Regional IAU Meeting included two sessions on Topic 5, Galaxies, Large Scale Structure and Cosmology, and two sessions on Topic 6, Compact Objects, AGNs and High Energy/Cosmic Ray Astrophysics. In all, there were seven Invited Reviews and 20 Contributed Talks. Talks ranged from Nearby Galaxies to the Cosmic Microwave Background. Most of the talks described current research at the cutting edge of their field.

It is worth mentioning a few interesting results. In cosmology are the latest results from *WMAP* and the new measurements of the acceleration rate of the universe using Supernovae type I. Regarding clusters of galaxies and galaxy evolution at high redshifts, there were reports on how well massive clusters and groups of galaxies are now understood and on the steps taken towards understanding the physical nature (star formation, metallicities, etc.) of intermediate redshift galaxies. Also, we heard about the new techniques that are being developed to probe the large-scale structure through Dumped Ly systems.

In our opinion, two novel and very interesting pieces of work were presented in the conference. On the one hand, the use of echoes from distant supernovae in the LMC to study SN physical properties and evolution, and on the other, a simple AGN model based on AGN unification to explain both X-ray properties of sources and the X-ray background spectral shape.

We should also highlight a number of remarkable talks telling the story of how some research field developed. For example **Giacconi's** talk on X-ray astronomy and its connection with massive clusters of galaxies, or **Freeman's** talk about galaxy formation histories, or **Genzel's** description of the Galactic Centre black hole, or **Longair's** discussion on the most luminous radio galaxies, or **Osmer's** description of the data that have been built up to determine the physical evolution of quasars.

Stars and Galactic Structure

An excellent review talk on the use of HB stars to investigate a number of important Galactic and Extragalactic issues was given by **M. Catelan** (PUC, Chile). These halo traces tell us much about the formation of our own Galaxy. For example, by studying the Oosterhoff-dichotomy we can put very stringent upper limits on the likelihood of the formation of the halo from fragments like the current-day dwarf spheroidal galaxies which are at odds with the favorite Lambda CDM hierarchical formation scenarios.

Revised results for the proper motion of the LMC were discussed by **M. Pedreros** (Universidad de Tarapaca, Chile). Their new analysis now agrees much better with the bulk of previous values. They find that the LMC does not appear to be a member of the proposed Draco - Ursa Minor stream.

Very deep CMDs for a variety of fields in the SMC have been derived by **N. Noel** (Spain) and collaborators. They have investigated their star formation histories and mean metallicities. They find that both of these properties vary strongly with position in the galaxy. For example, very strong MS stars are found in their eastern fields, but not in their western fields. They find almost no evidence for a globular-cluster aged population in any of their fields, even out to a radial distance of 4 degrees. Intermediate-aged stars dominate in all of their fields. No metallicity gradient is found.

S. Duffau (PUC, Chile) reported on the results of a large-scale survey for distant halo RR Lyrae stars, conducted with the QUEST telescope in Venezuela. They find evidence for a stellar stream in the direction of Virgo at a distance of ~ 20 kpc. The preliminary radial velocity dispersion is ~ 17 km/s, and the preliminary metallicity spread is large, indicating that the purported progenitor was likely a dwarf galaxy and not a globular cluster.

Star Formation

Star formation is an area of long tradition in Latin America and this was reflected in a strong participation in the topic during LARIM-2005. Invited reviews in this area were presented by **Garay, Rodriguez, Larson,** and **Boulanger**. **Guido Garay** presented the recent discovery of the pre-stellar massive cores, believed to be the future sites of massive star formation. **Luis F. Rodriguez** discussed regions of on-going massive star formation and pointed that while accretion seems to be the preferred phenomenon by which massive stars form (as is the case in low-mass stars), the possibility of merging of intermediate stars to form massive ones should also be investigated. **Richard Larson** talked about the physical processes beyond star formation from a theoretical point of view, emphasizing the problems in understanding the initial mass function and the origin of binaries. **Françoise Boulanger** showed spectacular images and data from the *Spitzer* satellite, of galactic and extragalactic regions of star formation.

At the level of oral presentations we counted with several contributors of which we highlight the following results. **Bronfmann** and collaborators discussed their new and sensitive CS survey of galactic regions of star formation. This survey should be of great value for the workers. **Barba** and collaborators presented evidence of the presence of remarkable jets emanating from star-forming regions in the Large Magellanic Cloud. This is the first solid report of stellar jets in extragalactic objects. **Doppmann** and collaborators presented a high spectral resolution study of young stars in several nearby molecular clouds, finding that the objects studied exhibit a broad range of mass accretion activity. Finally, there were 44 excellent posters on the area of star formation. As in the oral contributions, massive star formation seems to be a main concern of the researchers, with about half of them dealing with this problem.

Proceedings to be published:

M. Rubio, L. Infante & S. Torres-Peimbert (eds.), 2006,
Proc. 11th Latin-American Regional IAU Meeting (LARIM-2005),
Pucon, Chile, 12-16 December 2005,
Revista Mexicana de Astronomía y Astrofísica - Serie de Conferencias, in preparation (due June 2006).

Table 1: 2005 IAU MEETING STATISTICS

IAU meeting	number of participants	from countries	total grant awarded (CHF)	number of recipients	from countries
S227	240	28	24 924.-	40	18
S228	195	24	23 389.-	27	11
S229	263	31	25 000.-	30	20
S230	126	19	21 517.-	28	15
S231	304	26	25 000.-	44	14
S232	135	20	17 905.-	13	10
C198	93	23	16 000.-	30	13
C199	110	15	15 776.-	26	11
C200	182	14	14 400.-	15	6
total	1648		183 911.-	253	39
9th APRIM	269	24	24 860.-	22	12
11th LARIM	290	20	24 913.-	43	11
grand total	2207		233 684.-	318	43

Table 2: GRANT STATISTICS OF 2005 IAU MEETINGS (CHF)

IAU	S227	S228	S229	S230	S231	S232	C198	C199	C200	APRIM	LARIM	TOTAL
Host	Italy	France	Brazil	Ireland	USA	S.Afr.	Suisse	China	France	Indonesia	Chile	
Argentina	187		1100				1000			1500	326 326 261 261 261 392 261 261	6 136
Australia	855 187	755					550 800					3 147
Austria							450					450
Azerbaijan			2300									2 300
Brasil	855 311	1002 1002 247 1002 1002 247			1200 800						392 392 392 392 392 392 914 914	12 240
Bulgaria			1550									1 550
Canada	855	1002						655		930 2490	522	6 454
Chile	855 855		750									2 460
China Nanjing	855 855 855	1002	230	1112	1200	1279		175 175 175 175		930 930 900 600		11 448
China Taipei								655		900 900		2 455
Czech Rep.		1002	500 800	818 818								3 938
Egypt					1000							1 000
Finland							350					350
France	311		710 230 770	803	500 500	1279			1000 800		914 914	8 731
Germany	855 855 855 187	1002	710	740 772 772 700	500 500 500 500	1279	350 450 300 350 350 450	655		1260 1200	914 522	17 528
India	855		710	1500		1918		877 877 877		800 930 300		9 644
Indonesia										300 300 300 300		1 200
Iran	855 187									1020		2 062
Ireland				340 340 401 401								1 482
Israel							450					450
Italy	855 855 187	902 902 902 247 247 902	230 480	772	800		400 300 500 400	655 655				11 191
Japan	855 855 187 187 187	1002			800	1279		655	1200			7 207

Table 2: (cont'd)

IAU	S227	S228	S229	S230	S231	S232	C198	C199	C200	APRIM	LARIM	TOTAL
Host	Italy	France	Brazil	Ireland	USA	S.Afr.	Suisse	China	France	Indonesia	Chile	
Jordan	187											187
Mexico	311							655			914 914 914 392 392 392 300	5 184
Morocco									800			800
Netherlands	311				950 325 325 325 325	1279	700					4 540
New Zealand										1260 660		1 920
Philippines										750		750
Poland			710 230 230		900 900				800			3 770
Portugal	311		710	280								1 301
Russia	855 855	1002 1002 1002 1002	710 2030	1500 850 741 803 1500 741	1000 1000 900	1279 1918	800 900 1000	655		1200 1200 2370		28 815
Serbia & M.			600									600
Slovakia			230 710									940
Slovenia				741								741
South Korea							700 750			630		2 080
Spain			480	280	500 500		400				522	2 682
Sweden		1002			500 500 500 500	1279						4 281
Switzerland				770					1000			1 770
UK			710	500	500 600 500 500 500 500 500 500 500	1279 1279 1279	450 250	655 655			914	12 571
Ukraine		1002 1002 1002 1002	2200 1800	1081								9 089
Uruguay			1000 580								261	1 841
USA	855 855 855 855 855 855 311		1000	700 741	250 250 250 200 250 200 250	1279	600 300 500 650 550	655 655 655 655 655 655 655 655 655	1600 800 1600 800 800 800 800 800 800 800		261 914 914 914 914 914 522 261	33 720
Venezuela Venezuela Venezuela											914 849 914	2 677
TOTAL	24 924	23 389	25 000	21 517	25 000	17 905	16 000	15 776	14 400	24 860	24 913	233 684