



**INTERNATIONAL ASTRONOMICAL UNION  
UNION ASTRONOMIQUE INTERNATIONALE**

**POST MEETING REPORTS  
OF  
IAU SYMPOSIA  
IN 2008**

compiled by

**Ian F. Corbett, IAU AGS**

Contents	Page
List of Meetings	2
Post Meeting Reports	4
Meeting statistics	94
Grant statistics	95
Publication Dates	97

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Symposium		Page
IAUS 251	Organic Matter in Space 18-22 February, Hong Kong, China Nanjing SOC Chair: Sun Kwok	3
IAUS 252	The Art of Modelling Stars in the 21st Century 6-11 April, Sanya, China Nanjing SOC Chair: Licai Deng	15
IAUS 253	<i>Report missing!!!</i> Transiting Planets 19-23 April, Boston, USA SOC Chair: : Didier Queloz	24
IAUS 254	The Galaxy Disk in Cosmological Context 9-13 June , Copenhagen, Denmark SOC Chair: Birgitta Nordström	28
IAUS 255	Low-metallicity star formation: From the first stars to dwarf galaxies 15-19 June, Rapallo, Italy SOC Chair: Leslie Hunt	31
IAUS 256	The Magellanic System: Stars, Gas, and Galaxies 28 July-1 August, Keele University, UK SOC Chair: Jacco van Loon	46
IAUS 257	Universal Heliophysical Processes 15-19 September, University of Ioannina, Ioannina, Greece SOC Chair: Nat Gopalswamy	52
IAUS 258	The Ages of Stars 13-17 October, Baltimore, Maryland, USA SOC Chair: David Soderblom	68
IAUS 259	Complex Magnetic Fields: from Planets to Stars and Galaxies 3-7 November, Puerto Santiago, Tenerife, Spain SOC Chair: Karl Strassmeier	78
MEARIM 2008	<i>First Middle-East Africa Regional IAU Meeting</i> 5 – 10 April, Cairo, Egypt. SOC Chair: Ahmed Abdel Hady	85
APRIM 2008	<i>10<sup>th</sup> Asian-Pacific Regional IAU Meeting</i> 1 – 4 August, Kunming, China Nanjing SOC Chair: Gang Zhao	89



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# POST MEETING REPORT FORM

for meetings other than Joint Discussions and Special Sessions

Deadline for Submission: within 1 month after the meeting

***the following information should be sent to the IAU Assistant General Secretary***

The following documents should be attached:

- i Final Scientific Program
- ii List of participants
- iii List of recipients of IAU Grants, including amount and country
- iv Receipts signed by the recipients of IAU Grants (This does not apply to Scientific Meetings held during General Assemblies)
- v Brief report (text.txt file or word.doc) to the Executive Committee on the scientific highlights of the meeting (1-2 pages)

1. Meeting Number: 251
2. Meeting Title: Organic Matter in Space
3. Dedication of meeting (if any):
4. Location (city, country): Hong Kong, China
5. Dates of meeting: Feb. 18 - 22, 2008
6. Number of participants: 162
7. List of represented countries: USA, Canada, Mexico, Brazil, Colombia, UK, France, Germany, Italy, Spain, Switzerland, Austria, Egypt, Czech Republic, Sweden, Poland, Slovak, Australia, Japan, Korea, India, China including Mainland, Hong Kong and Taiwan
8. Report submitted by: Sun Kwok
9. Date and place: Mar. 3, 2008 Hong Kong, China
10. Signature of SOC Chairperson:



FACULTY OF SCIENCE  
THE UNIVERSITY OF HONG KONG  
香港大學 理學院

DEAN  
Professor S Kwok  
院長 郭新教授

FACULTY SECRETARY  
Mrs. A O M Tsang  
院務主任 曾謝靄文女士

February 29, 2008

Executive Committee  
International Astronomical Union  
Paris

Re: Report on IAU Symposium 215: Organic Matter in Space

Dear Dr. Corbett:

IAU Symposium 251: Organic Matter in Space was successfully held on February 18-22, 2008 in Hong Kong. The meeting was attended by 162 participants from 22 countries and 2 regions. The symposium brought together researchers in three separate disciplines: astronomy, solar system, and laboratory spectroscopy to tackle the current issues of the detection and identification of organic matter in space. A total of 58 oral talks and 79 posters were presented.

The meeting was held in the historical Loke Yew Hall of the University of Hong Kong. In addition to travel grants from the IAU, the Local Organizing Committee received financial assistance from the Lee Hysan Foundation, National Natural Science Foundation of China, The Croucher Foundation, Fong Shu Fook Tong Foundation, K.C. Wong Education Foundation, and the University of Hong Kong.

A welcome reception was held in the Renaissance Harbour View Hotel in the evening of February 17. The conference itself was opened by the President of the IAU, Dr. Catherine Cesarsky. After the opening review by Ewine van Dishoeck, the first day of the meeting was devoted to astronomical observations of gas-phase organic molecules in the interstellar medium, including emissions from molecules in star formation regions and absorptions in the diffuse interstellar medium. Also discussed was the role played by organic molecules on the formation of the diffuse interstellar bands. During the lunch break, the participants were welcomed with a traditional lion dance and a cutting of a roasted pig ceremony.

The second day of the meeting was devoted to the observations of organic molecules and solids in circumstellar environments, spectral line surveys, and the observation of organic species in external galaxies. On the third day, the analysis of organic materials in interplanetary dust particles, meteoroids, planetary surfaces, asteroids, and comets were discussed. Analysis of the organic content of the comet Wild 2 based on results from the Stardust sample return were also presented. The afternoon was free and many participants joined our tour of Hong Kong.

On the fourth day, discussions on the solar system continued, with emphasis on the planetary satellites Europa and Titan. Issues relating to presolar grains and their relations with AGB stars were also addressed. In the evening, the conference banquet was held in the historical Repulse Bay Hotel, where the participants enjoyed a fascinating "face-change" show. Our after-dinner speaker was Prof. Clifford Matthews, who was a student of the University of Hong Kong and prisoner of war in Japan after his capture by the Japanese after the surrender of Hong Kong in 1941. Prof. Matthews is well-known for his theory on the role played by

HCN polymers in the origin of life on Earth, and the recitation of his war-time experience has brought him a standing ovation after his speech at the banquet. The sessions on Friday was devoted to laboratory studies, including the simulations of molecular synthesis and the spectroscopic properties of possible laboratory analogs of interstellar organic compounds such as PAH, QCC, and HAC.


After the conference, some participants joined the tour of the Lantau Island and the Po Lin Monastery. Additional details of the meeting and associated activities can be found in our web site [www.hku.hk/science/iau251](http://www.hku.hk/science/iau251)

Significant local press coverage was given to the conference in Hong Kong, including two major stories in the South China Morning Post, a leading newspaper in Southeast Asia.

Overall the comments from the participants have been highly positive. Many expressed appreciation to the fact that they met new colleagues in other fields, and that the talks and posters in the meeting have been stimulating to them for the exploration of new ideas and interdisciplinary studies.

We wish to thank the IAU for providing us with the opportunity to hold what we feel was a very successful and stimulating scientific symposium.

Sincerely yours,

The image shows two handwritten signatures in blue ink. The signature on the left is stylized and appears to be 'Sun Kwok'. The signature on the right is more legible and reads 'Scott Sandford'.

Sun Kwok and Scott Sandford  
Co-chairs of the Scientific Organizing Committee

# Scientific Programme

## February 18, 2008 (Monday)

- 8:00 am - 9:00 am    Registration  
9:00 am – 9:30 am    Opening Remarks – Catherine Cesarsky, President of the IAU

### **Session I Observations of organic compounds beyond the solar system**

Session Chair: William Irvine (University of Massachusetts)

- 9:30 am - 10:00 am    Introductory review  
                              Ewine van Dishoeck (Leiden Observatory)
- 10:00 am - 10:30 am    Molecular spectral line surveys and the organic molecules in the  
                              interstellar molecular clouds  
                              Masatoshi Ohishi (National Astronomical Observatory of Japan)
- 10:30 am - 11:30 am    COFFEE BREAK AND POSTER SESSION
- 11:30 am - 12:00 pm    The origin and evolution of interstellar organics  
                              Yvonne Pendleton (NASA headquarters)
- 12:00 pm - 12:30 pm    Organic molecules in protostellar environments  
                              Cecilia Ceccarelli (Observatoire de Grenoble)
- 12:30 pm - 2:00 pm    LUNCH

Session Chair: Ewine van Dishoeck (Leiden Observatory)

- 2:00 pm - 2:30 pm    The birth and death of organic species in planet-forming disks  
                              Thomas Henning (MPI für Astronomie)
- 2:30 pm - 3:00 pm    Organic compounds as carriers of the diffuse interstellar bands  
                              Peter Sarre (U. of Nottingham)
- 3:00 pm - 3:15 pm    Fullerenes as carriers of extinction, diffuse interstellar bands and  
                              anomalous microwave emission  
                              Susana Iglesias-Groth (Instituto de Astrofísica de Canarias)
- 3:15 pm – 3:30 pm    Models and observations of deuterated molecules in protostellar  
                              cores  
                              Helen Roberts (The Queen's University of Belfast)

- 3:30 pm - 5:00 pm COFFEE BREAK AND POSTER SESSION
- 5:00 pm - 5:30 pm Molecular evolution in star-forming cores: From prestellar cores to protostellar cores  
Yuri Aikawa (Kobe University)
- 5:30 pm - 5:45 pm Precursors of complex organic molecules: NH<sub>3</sub> and CH<sub>3</sub>OH in the ices of low-mass protostars  
Sandrine Bottinelli (Leiden Observatory)
- 5:45 pm – 6:00 pm Chemical changes during transport from cloud to disk  
Ruud Visser (Leiden Observatory)

## **February 19 (Tuesday)**

### **Session I Observations of organic compounds beyond the solar system - continued**

**Session Chair: Yvonne Pendleton (NASA headquarters)**

- 9:00 am - 9:30 am    Organic chemistry in circumstellar envelopes: Setting the stage for prebiotic synthesis  
Lucy Ziurys (U. of Arizona)
- 9:30 am - 10:00 am    Synthesis of organic compounds in the circumstellar environment  
Sun Kwok (HKU)
- 10:00 am - 10:15 am    A Spitzer Space Telescope study of dust features in planetary nebula and HII regions  
Jeronimo Bernard-Salas (Cornell U.)
- 10:15 am - 10:30 am    Spitzer spectroscopy of unusual hydrocarbons in cool radiative environments  
Gregory C. Sloan (Cornell U.)
- 10:30 am - 11:15 am    COFFEE BREAK AND POSTER SESSION
- 11:15 am - 11:45 am    Unidentified infrared bands and the formation of PAHs around carbon stars  
Angela Speck (University of Missouri)
- 11:45 am – 12:00 pm    Carbon-rich AGB stars in our galaxy and nearby galaxies as a possible source of PAHs  
Mikako Matsuura (National Astronomical Observatory of Japan)
- 12:00 am - 12:15 pm    Organic and inorganic molecules as dust precursors in nearby and primordial Type II Supernovae  
Isabelle Cherchneff (ETH Zürich)
- 12:15 pm - 12:30 pm    Organic molecular anions in interstellar and circumstellar environments  
Martin Cordiner (Queens University Belfast)

12:30 pm - 2:00 pm    LUNCH

**Session Chair: Hans Olofsson (Onsala Space Observatory)**

- 2:00 pm - 2:15 pm    Probing the chemical processes in AGB stars  
Fredrik Schöier (Onsala Space Observatory)
- 2:15 pm - 2:45 pm    Organic compounds in galaxies  
Takashi Onaka (University of Tokyo)



- 2:45 pm - 3:00 pm    Interstellar gas, dust and diffuse bands in the Local Group: From the Milky Way, the Magellanic Clouds to the Andromeda Galaxy  
Nick Cox (European Space Agency)
- 3:00 pm - 3:15 pm    Properties of polycyclic aromatic hydrocarbons in the star forming environment in nearby galaxies  
Itsuki Sakon (The University of Tokyo)
- 3:15 pm - 3:30 pm    Spectra of nearby galaxies measured with a new very broadband receiver  
William Irvine (U. of Massachusetts)
- 3:30 pm - 5:00 pm    COFFEE BREAK AND POSTER SESSION
- 5:00 pm - 5:15 pm    Observing ultraviolet signatures of interstellar organics with the Hubble Space Telescope  
Theodore Snow (U. of Colorado)
- 5:15 pm - 5:30 pm    A 3-mm molecular line study of the Central Molecular Zone of the Galaxy  
Paul Jones (The University of New South Wales)
- 5:30 pm - 5:45 pm    Very small carbonaceous dust particles in the envelopes of evolved stars and in the interstellar medium: from the Milky Way to LMC and to further galaxies  
Rygzard Szczerba (N. Copernicus Astronomical Center)

**February 20 (Wednesday)**

**Session II Organic compounds within the solar system**

Session Chair: Scott Sandford (NASA/Ames Research Center)

- 9:00 am - 9:30 am    Organic matter in interplanetary dust particles  
George Flynn (SUNY, Plattsburgh)
- 9:30 am - 10:00 am    Unraveling the chemical history of the solar system as recorded  
in extraterrestrial organic matter  
George Cody (Carnegie Institution of Washington)
- 10:00 am - 10:30 am    Organic materials on planetary surfaces: From colors to spectral  
bands  
Dale Cruikshank (NASA Ames)
- 10:30 am - 11:45 am    COFFEE BREAK AND POSTER SESSION
- 11:45 am - 12:00 pm    The organic matter in meteorites: Interstellar or solar?  
Conel Alexander (Carnegie Institution of Washington)
- 12:00 pm - 12:30 pm    Organics in the samples returned from Comet 81P/Wild 2 by the  
Stardust Spacecraft  
Scott Sandford (NASA/Ames Research Center)
- 12:30 pm - 1:30 pm    LUNCH
- 1:30 pm                TOUR

## February 21 (Thursday)

### **Session II Organic compounds within the solar system - continued**

Session Chair: Ernst Zinner (Washington U)

- 9:00 am - 9:30 am    Chemical diversity of organic volatiles among comets: An emerging taxonomy and implications for processes in the proto-planetary disk  
Michael Mumma (NASA Goddard Space Flight Center)
- 9:30 am - 9:45 am    Organics in cometary and interplanetary dust  
Anny-Chantal Levasseur-Regourd (Université Pierre et Marie Curie, Paris)
- 9:45 am - 10:00 am    Organic molecules in Saturnian E-ring particles. Probing subsurface oceans of Enceladus?  
Frank Postberg (MPI für Kernphysik)
- 10:00 am - 10:30 am    Laboratory experiments as support to the built up of Titan's theoretical models and interpretation of Cassini-Huygens data  
Marie-Claire Gazeau (Université Paris XII-Val de Marne)
- 10:30 am - 11:30 am    COFFEE BREAK AND POSTER SESSION
- 11:30 am - 11:45 am    Complex organic formation in Titan's upper atmosphere  
Jack Waite (Southwest Research Institute)
- 11:45 am - 12:00 pm    The Composition of Europa's Near-Surface Atmosphere  
Mau Wong (JPL)
- 12:00 pm - 12:15 pm    Titan's surface inventory of organic materials estimated from Cassini RADAR observations  
Ralph Lorenz (Johns Hopkins University)
- 12:15 pm - 2:00 pm    LUNCH

Session Chair: Dale Cruikshank (NASA Ames)

- 2:00 pm - 2:15 pm    Structural, chemical and isotopic examinations of interstellar organic matter extracted from meteorites and interstellar dust particles  
Henner Busemann (The Open University)
- 2:15 pm - 2:30 pm    Micro-Raman study of nanodiamonds from the Allende meteorite  
Arnold Gucsik (MPI for Chemistry)

- 2:30 pm - 3:00 pm Stardust in meteorites: A link between stars and the solar system  
Ernst Zinner (Washington U)
- 3:00 pm - 3:30 pm Presolar grains in the solar system: Connections to stellar and  
interstellar organics  
Larry Nittler (Carnegie Institution of Washington)
- 3:30 pm - 5:00 pm COFFEE BREAK AND POSTER SESSION
- 5:00 pm - 5:15 pm Formation of biomolecule precursors in space?  
Wolf D. Geppert (Stockholm University, Sweden)
- 5:15 pm - 5:30 pm Optical and Chemical Properties of Tholins  
Bishun Khare (Carl Sagan Center)
- 7:00 pm BANQUET  
(Shuttle bus to banquet restaurant departs symposium hotels at  
6:30 pm.)

## **February 22 (Friday)**

### **Session III Laboratory analogs of organic compounds in space**

**Session Chair: Setsuko Wada (The University of Electro-Communications, Japan)**

- 9:00 am - 9:30 am    Laboratory spectroscopy of neutral and ionized PAHs: From molecules to grains - astronomical implications  
Farid Salama (NASA/Ames Research Center)
- 9:30 am - 9:45 am    Survival of amino acids and nucleobases in interstellar and interplanetary radiation conditions  
Sergio Pilling (Brazilian Synchrotron Light Laboratory)
- 9:45 am - 10:00 am    Formation of alcohols on ice surfaces  
Herma Cuppen (Leiden Observatory)
- 10:00 am - 10:30 am    Simulation of organic interstellar dust in the laboratory  
Walt Duley (U. of Waterloo)
- 10:30 am - 11:15 am    COFFEE BREAK AND POSTER SESSION
- 11:15 am - 11:45 am    Electronic spectra of carbon chains and rings: Astrophysical relevance?  
John Paul Maier (University of Basel)
- 11:45 am - 12:00 pm    A self-perpetuating "catalyst" for the production of complex organic molecules in protostellar nebulae  
Joseph Nuth (NASA Goddard Space Flight Center)
- 12:00 pm - 12:30 pm    Tholins and their relevance for astrophysical issues  
Eric Quirico (Université Joseph Fourier - CNRS)
- 12:30 pm - 2:00 pm    LUNCH

**Session Chair: Thomas Henning (MPI für Astronomie)**

- 2:00 pm - 2:30 pm    Quenched carbonaceous composite as a carrier candidate of the extended red emission and blue luminescence in the red rectangle  
Setsuko Wada (The University of Electro-Communications, Japan)
- 2:30 pm - 3:00 pm    Laboratory analogs of carbonaceous matter - Soot, its precursors and by-products  
Cornelia Jäger (MPI für Astronomie, Heidelberg)
- 3:00 pm - 3:30 pm    Reactions of aromatics in space and connections to the carbon chemistry of solar system materials  
Max Bernstein (NASA Ames Research Center)

- 3:30 pm - 4:30 pm COFFEE BREAK AND POSTER SESSION
- 4:30 pm - 4:45 pm Hydrogen cyanide polymers connect cosmochemistry and  
biochemistry  
Clifford Matthews (University of Illinois, Chicago)
- 4:45 pm - 5:00 pm Laboratory simulation of the evolution of organic matter in dense  
interstellar regions  
Vito Mennella (INAF Osservatorio Astronomico di  
Capodimonte)
- 5:00 pm - 5:30 pm Formation of amino acid precursors with large molecular weight  
in dense clouds and their relevance to origins of  
bio-homochirality  
Kensei Kobayashi (Yokohama National University)
- 5:30 pm The end



# POST MEETING REPORT FORM


for meetings other than Joint Discussions and Special Sessions

Deadline for Submission: within 1 month after the meeting

**the following information should be sent  
to the IAU Assistant General Secretary**

The following documents should be attached:

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- ii List of participants
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- v Brief report (text.txt file or word.doc) to the Executive Committee on the scientific highlights of the meeting (1-2 pages)

1. Meeting Number: Symposium 252
2. Meeting Title: The Art of Modelling Stars in the 21st Century
3. Dedication of meeting (if any):  
Professor Da-Run Xiong 70 birth anniversary, for his contributions to stellar convection theory.
4. Location (city, country): Sanya, China
5. Dates of meeting: April 6-11, 2008
6. Number of participants: 110
7. List of represented countries:  
Austria(1),Belgium(1),China(53),Czech Republic(1),Denmark(1),Estonia(1),France(12),Germany(4),Hongkong/China(3),  
Israel(5),Korea(3),Northern Ireland/UK(1),Poland(2),Portugal(1),Scotland/UK(1),Switzerland(2),Taiwan/China(1),  
Turkey(1),UK(3),USA(7)
8. Report submitted by: Licai Deng
9. Date and place: May 7, 2008
10. Signature of SOC Chairperson: 

## **A brief report on the IAU Symposium 252 “The art of modelling stars in the 21<sup>st</sup> Century”**

Exactly as previously scheduled, the symposium has been successfully held in April 6-11, 2008 in Sanya, China,. The total number of participants finally turned up at the conference was 110, representing 21 countries (districts) from all continents except Africa.

We have distributed all the IAU travel grants to participants from outside China, inclined to ones from developing countries, students, invited speakers. This is planned so due to the fact that we also had some funding from Chinese co-sponsors to support participants from China, the host country. For those who come from outside China and did not meet the deadline of IAU grant application, we also provided financial supports using the local grants. This category includes some of our invited speakers, contributed speakers and students and general participants (mostly from developing areas) who needed help in order to come to this conference.

Due to health and other emergency reasons, 2 invited speakers and a few solicited talk contributors canceled their trip right before the meeting opening. We managed to fill up the gap in both science and time by turning some of the contributed talks by our SOC members to review talks. To better highlight the most recent developments in fields covered by the conference, and to widen the representation to as many as possible active working groups from all over the world, SOC members (active figures in the scientific fields) are avoided in invited talk selection during planning stage. However, the adjustments of our science program on site actually retained the meeting the same interesting and enjoyable in terms of science.

The selection of the conference site was also a wise decision for following reasons: the city Sanya has rather a resort-like environment, therefore there is not very much (historical, cultural attractions) to look at. The only attraction to people is the tropical beach that is the best in late afternoon when meeting finishes every day. As such, there was almost no shrinking of the audience volume towards the end of the meeting.

A number of social events were arranged to make our participants communicating with each other and refreshed from tight science program, including a reception cocktail and conference opening paid by LOC, a relaxing free style poolside conference dinner, and a half-day excursion to the village of the native local minority people to get a sight on their life style and culture.

Before going into scientific highlights, there is one more thing worth mentioning: we arranged a public outreach activity during the meeting, a talk presented by one of our SOC member, , at Sanya No.1 high school. The talk was really excellent in both the topic (the final fate of our Sun and of the earth) and the very active interactions with the audience. It will not be a surprise if one day in a future, a young colleague will tell me that he/she was brought to Astronomy because of that talk.



As defined by the scientific rationale of the meeting and our final program, the scope in science of the symposium is very wide. There are quite some advances on observational constraints and computational techniques that may have opened new windows in stellar modelling in the recent decade. The talks or posters have addressed all topics we proposed at the beginning during the symposium. The actual statistics of contributions are: 17 invited talks, 40 contributed (including solicited) talks, and 60 posters.

The scientific highlights can be summarized in the following:

1. Micro Physics: the most recent developments in micro physics, new data sets and formalisms of opacity and equation of state for stellar models (both internal and atmospheric), initial chemical composition of stars etc. are presented by various speakers, covering molecules, ions and dust etc in a very wide range of parameters;
2. Mixing in stars: this is one of the long lasting tough problems in stellar models, with quite a number of physical processes involved. Among others, we were able to cover convective, rotational, diffusive and convective overshooting situations. Multi-dimensional diagnostics of mixing problem was a focus during the meeting;
3. Pulsation (Helio- and Astero-Seismology): this is a classical assessment to the internal structure of stars and a strong constraint for stellar models. Nicer and higher temporal resolutions than ever observational data base due to new advances in technology proved to be a challenge to stellar structure and evolution. This is one of the points where observers and theorists highly interacted during the symposium, which was really fruitful and enjoyable for all participants.
4. Atmospheres of stars: a wide range of studies has been covered for this actually visible part of stars. This is also linked to the important issue on where a star actually ends. Both observational and theoretical developments were addressed: abundance, mass loss by winds, models beyond 1D, opacities, questions for all type of stars going from hot ones to late stage AGBs.
5. Finally the evolution of single and binary stars: we raised more than actually solved problems for stellar evolution in general, from main sequence to SN/white dwarf, from single to interacting binary. As this is actually the real meaning of “modelling stars”, a lot of discussions have been connected to all the above 4 entries in this list. The physical picture of interactive binaries and its consequences to applications of stellar models in general astrophysics was highlighted probably for the first time in the community of stellar modelling.

A round table discussion session of 40 minutes was arranged in the middle of the meeting for general discussion. Thanks to the session chairs (G. Meynet and F. Kupka) and, more importantly, all participants, we really made good use of the time.

Just as Norbert Langer concluded in his summary talk, we started the meeting with a very ambitious planning, we did a very good job in this meeting already, but we

did not cover any of the topics thoroughly, and left out many more of them completely. One of the apparent highlights of this symposium is that a rather big fraction of people is from “Observation” even this meeting was designed as a “theory”, and so is case for the progress made in the topics. Our participants enjoy this pattern, which also made very much sense in terms of science.

# IAU Symposium 252

## Scientific Program

**April 7 (Monday), 2008**

### Session I: Updates of physical ingredients of stellar models

**Chair: Norbert Langer**

1. 9:00- 9:40 (Invited Review) J. Ferguson:  
Changing Abundances, Changing Opacities
2. 9:40-10:20 (Invited Review) M. Asplund:  
Is the Sun's chemical composition unusual?
3. 10:20-10:40 E. Caffau  
3D model atmospheres and the solar photosphere oxygen abundance

Coffee break and poster view 10:40-11:30

### Session II: Physical processes in stars

**Chair: Kwing-Lam Chan**

4. 11:30-12:10 (Invited Review) J.-P. Zahn:  
Instabilities and mixing in stellar radiation zones
5. 12:10-12:30 D.R. Xiong:  
Lithium depletion in late-type dwarfs as probe of stellar convection

Lunch break 12:20-14:30

6. 14:30- 15:10 (Invited Review) V. Canuto:  
Convection in stars
7. 15:10 -15:30 H. Ludwig:  
Radiation-hydrodynamics simulation of surface convection  
in low-mass stars: connections to stellar structure and asteroseismology
8. 15:30-15:50 L. Deng:  
How extended is convective overshooting

Coffee break and poster view 15:50-16:30

9. 16:30-16:50 A. Stoekl :  
A new two columns description for convective transport in stars
10. 16:50-17:10 S. Vauclair:  
Thermohaline Convection in Main Sequence stars
11. 17:10-17:30 M. Cantiello:  
Thermohaline mixing in low mass giants

## **April 8 (Tuesday), 2008**

### Session III: From physics to stars, the progenitors of white dwarfs

#### **Chair: Vittorio Canuto**

12. 9:00-9:40 (Invited Review) J. Christensen-Dalsgaard:  
Helio- and asteroseismology
13. 9:40-10:00 Günter Houdek:  
On the seismic solar age using low-degree p modes
14. 10:00-10:20 G. Vauclair:  
Rate of Change of the pulsation periods in the PG 1159 star PG 0122+200

Coffee break and poster view 10:20-11:00

15. 11:00-11:40 (Invited Review) C. Charbonnel:  
Deep inside low-mass stars
16. 11:40-12:00 A. Palacios:  
Hydrodynamical simulations of the turbulent convection in a rotating red giant star
17. 12:00-12:20 M. Yildiz:  
Mixing Length Parameter from binaries and clusters

Lunch break 12:20-14:50

#### **Chair: Jorgen Christensen-Dalsgaard**

18. 14:50-15:20 L. A. Willson:  
Deathzones and exponents: A different approach to incorporating mass loss in stellar evolution calculations
19. 15:20-15:50 Sun Kwok:  
Stellar evolution from AGB to PNs

Coffee break and poster view 15:50-16:30

20. 16:30-17:10 (invited review) F. Herwig:  
AGB star models
21. 17:10-17:30 M. Mocak:  
Multidimensional hydrodynamic simulations of the core He-flash
22. 17:30-17:50 T. Rauch:  
Spectral analysis of extremely hot post-AGB Stars
23. 17:50-18:10 Peter Woitke:  
Dust-driven Winds Beyond Spherical Symmetry
24. 18:10-18:30 S. Campbell:  
Low-mass Extremely Metal-Poor Stellar Models: Yields, Uncertainties and the Galactic Halo Stars

## **April 9 (Wednesday), 2008**

### Session IV: From physics to stars, the progenitors of neutron stars and black holes

**Chair: Lee Anne Willson**

25. 09:00-09:40 (Invited Review) J.S. Vink:  
Mass loss from hot massive stars
  26. 09:40-10:00 J. Krticka:  
The influence of inhomogeneities on hot star wind model predictions
  27. 10:00-10:20 M. Vick:  
Self consistent models of A and F Stars with turbulence and mass loss
- Coffee break and poster view 10:20-11:00
28. 11:00-11:40 (Invited Review) L. Siess:  
The most massive AGB stars
  29. 11:40-12:00 G. Hensler:  
Interaction of massive stars with their surroundings
  30. 12:00-12:20 W. Dappen:  
Rigorous and phenomenological equations of state

12:30-13:00 Conference photo taking

13:00- Tour

## **April 10 (Thursday), 2008**

**Chair: Martin Asplund**

31. 09:00-09:40 (Invited Review) G. Meynet:  
Rotating Massive stellar models

32. 09:40-10:00 N. Langer:  
Evolution of massive stars towards gamma-ray bursts and pair instability supernovae
33. 10:00-10:20 R. Waldman:  
Around the Pair Instability Valley - Massive SN Progenitors
34. 10:20-10:40 Wei Wang:  
 $^{60}\text{Fe}$  and massive stars

Coffee break and poster view 10:40-11:20

**35. 11:20-12:00**

**Organizer: Friedrich Kupka & Georges Meynet**

**Round table discussions:**

**Stellar models and observational assessments**

Lunch break 11:40-14:30

36. 14:30-15:50 Poster viewing session  
*All the authors are requested to stand by beside their posters.*

## Session V: Physics of stars in close binaries

Coffee break and poster view 15:10-15:50

**Chair: Ph. Podsiadlowski**

37. 15:50-16:30 (invited talk) Z. Han:  
Binary evolutionary models
38. 16:30-16:50 Z. Li:  
The role of binary stars in stellar population synthesis
39. 16:50-17:10 S. de Mink:  
Rotational Mixing in Massive Binaries
40. 17:10-17:30 P. Lu:  
Close binary evolution and blue stragglers formation
41. 17:30-17:50 C. Belczynski:  
The lowest stellar BH, catastrophic death of NS in GRB

## **April 11 (Friday), 2008**

**Chair: Licai Deng**

42. 9:00-9:40 (invited review) Ph. Podsiadlowski:  
The end point of binary star evolution
43. 9:40-10:00 X. Meng:  
The single degenerate channel for the progenitor of type Ia SN
44. 10:00-10:20 O. Pols:  
Modelling the evolution and nucleosynthesis of C-enhanced metal poor stars

Coffee break 10:20-11:00

- 45. 11:00-11:20 G. Liu:  
A spectroscopic study of blue stragglers in M67
- 46. 11:20-11:40 J. Ziolkowski:  
The binary evolution leading to the formation of...
- 47. 11:40-12:00 P. Kervella:  
Stellar radii from long-baseline interferometry
- 48. 12:00-12:20 S. Yi:  
The  $Y^2$  Isochrones getting a new dimension

## Session VI: New tools and future perspective

Lunch break 12:20-14:30

### **Chair: Werner Dappen**

- 49. 14:30-15:10 (invited talk) C. Meakin:  
Hydrodynamic processes in the advanced stages of massive star evolution
- 50. 15:10-15:40: (invited talk) F. Kupka:  
New numerical simulations and the role of coherent structures

Coffee break and poster view 15:40-16:10

- 51. 16:10-16:40 Norbert Langer:  
Conference summary



# POST MEETING REPORT FORM

for meetings other than Joint Discussions and Special Sessions

Deadline for Submission: within 1 month after the meeting

**the following information should be sent  
to the IAU Assistant General Secretary**

The following documents should be attached:

- i Final Scientific Program
- ii List of participants
- iii List of recipients of IAU Grants, including amount and country
- iv Receipts signed by the recipients of IAU Grants (This does not apply to Scientific Meetings held during General Assemblies)
- v Brief report (text.txt file or word.doc) to the Executive Committee on the scientific highlights of the meeting (1-2 pages)

1. Meeting Number: 253
2. Meeting Title: Transiting Planets
3. Dedication of meeting (if any): -
4. Location (city, country): Boston, Mass., USA
5. Dates of meeting: 19 – 23 May 2008
6. Number of participants: 218
7. List of represented countries: Argentina (1), Australia (2), Belgium (1), Brazil (3), Canada (5), Czech Republic (2), Denmark (2), France (16), Germany (17), Israel (3), Italy (2), Japan (3), Netherlands (3), New Zealand (1), Poland (1), Portugal (1), Spain (5), Sweden (1), Switzerland (9), UK (10), USA (130).
8. Report submitted by: No report submitted. Data taken from web site and grants letters.
9. Date and place:
10. Signature of SOC Chairperson:



start time

## Monday

- 900 **Introductions & Welcome**  
910 **Introductory review on transiting planets (D. Charbonneau)**  
1000 **Comparative assessment of transit surveys (T. Mazeh)**  
1040 **BREAK**  
1110 Transiting planets with HATNet (G. Bakos)  
1130 The WASP transit surveys (A. Cameron)  
1150 The MEarth project: searching for transiting habitable super-Earths around nearby M-dwarfs (J. Irwin)  
1210 **LUNCH & POSTER**  
1400 Transiting Planets in the Galactic Bulge - Implications (K. Sahu)  
1420 Transits against Fainter Stars: The Power of Image Deconvolution (P. Sackett)  
1440 Variability characterization of stellar fields with BEST and BEST II (P. Kabath)  
1500 Predicting the Yields of Photometric Surveys for Transiting Extrasolar Planets (T. Beatty)  
  
1520 **BREAK**  
1550 **The Corot mission (A. Baglin)**  
1630 CoRoT-Exo-1b: The first planet discovered from space (P. Barge)  
1650 A quest for the secondary eclipse of CoRoT-Exo-2b, and a study of its transit timing variations (R. Alonso)  
1710 Properties of starspots on CoRoT-Exo-2 (A. Silva-Valio)  
1730 Statistical analysis of transit surveys and application to CoRoT (F. Fressin)  
1750 End of the day sessions
- 

## Tuesday

- 900 **Measuring accurate transit parameters (J. Winn)**  
940 Characterizing the Eccentricities of Transiting Extrasolar Planets with Kepler and CoRoT (E. Ford)  
1000 Pushing the precision limit of ground-based transit photometry (M. Gillon)  
1020 **BREAK**  
1050 **Radial velocity follow-up observations (F. Bouchy)**  
1140 Recent results for follow-up observations of transiting planets with the Euler Swiss telescope (D. Queloz)  
1200 The Rossiter-McLaughlin Effect and a Possible Spin-Orbit Misalignment in HD17156b (N. Narita) (TB confirmed)  
1220 **LUNCH & POSTER**  
1400 Precision radial velocities of double-lined binary stars and the spectroscopic follow-up of circumbinary transiting planet candidates (M. Konacki)  
1420 The Keck eta\_Earth project (A. Howard)  
1440 Towards the characterization of the Hot-Neptune/Super-Earth population around nearby bright stars (C. Lovis)  
1500 A ~5 M\_earth Super-Earth Orbiting GJ 436 (I. Ribas)  
1520 The puzzling eccentricity of GJ 436b : a case of multi-techniques follow-up observations (X. Bonfils)  
1540 **BREAK**  
1610 The HARPS/Laser-Comb spectrometer: Understanding super-Earth geochemistry (D. Sasselov)  
1630 Precision Radial Velocities in the Near Infrared with TEDI (J. Loyd)  
1650 **Summary of MOST observations of transiting planets (J. Matthews)**  
1730 Observations of bright transiting exoplanets with the MOST satellite (J. Rowe)  
1750 End of the day sessions
- 

## Wednesday

IAU253  
Final program (May 6th 2008)

- 900 **Interior and structure of giant planets (T. Guillot)**  
940 Probing the Interiors of Very Hot Jupiters Through Transit Timing (A. Wolf)  
1000 **Interiors of solid planets and Super Earths (R. O'Connell)**  
1040 **BREAK**  
1110 Effects of oxidation on building rocky planets: from Mercury to a coreless terrestrial exoplanet (L. Elkins-Tanton)  
1130 The range of atmospheric mass and composition for super Earths (S. Seager)  
1150 **Understanding the formation of close-in planets (W. Benz)**  
1230 **LUNCH & POSTER**  
1400 What to Expect from Transiting Multiplanet Systems (D. Fabrycky)  
1420 Planetary dynamics in multi-star systems (G. Takeda)  
1440 Tides and hot Jupiters (Y. Wu)  
1500 On The Origins Of Eccentric Close-in Planets (S. Matsumura)  
1520 **BREAK**  
1550 **Detecting planet emerging flux: overview of Spitzer results (D. Deming)**  
1630 Transits and secondary eclipses of HD 189733 with Spitzer (E. Agol)  
1650 Exoplanet spectroscopy at the tipping point (M. Swain)  
1710 The Effects of Tides on Planetary Transits (B. Jackson)  
1730 Eccentric Transiting Planets (G Laughlin)  
1750 end of the day session
- 

**Thursday**

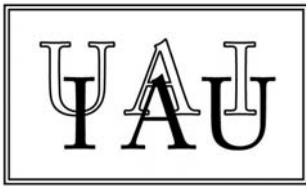
- 900 **The planet atmosphere and exosphere: Emission and transmission spectroscopy (G. Tinetti)**  
940 Spectrum and atmosphere models of irradiated transiting extrasolar giant planets (I. Hubeny)  
1000 Two Classes of Irradiated Atmospheres: A Unified Theory for the Atmospheres of the Hot and Very Hot Jupiters (J. Fortney)  
1020 Characterizing the Atmospheres of Hot Jupiters: From Spectra to Multi-Color Maps (H. Knutson)  
1040 **BREAK**  
1110 The Atmospheres of Extrasolar Super-Earths (E. Miller-Ricci)  
1130 **Dynamics of heavy irradiated atmospheres (A. Showman)**  
1210 3D Coupled Radiative Hydrodynamical Simulations of Irradiated Planetary Atmospheres (I. Dobbs-Dixon)  
1230 **LUNCH & POSTER**  
*free afternoon*  
1800 **Symposium dinner**
- 

**Friday**

- 900 **Thermosphere, exosphere and planet evaporation (A, Lecavelier)**  
940 Energetic neutral atoms as the explanation for the high velocity hydrogen around HD 209458b (M. Holmstrom)  
1000 **The Kepler mission (B. Borucki)**  
1040 **BREAK**  
1110 The NASA EPOXI Mission of Opportunity to Gather Ultraprecise Photometry of Known Transiting Exoplanets (J. Christiansen)  
1130 **Asteroseismology, a tool for transit studies (H. Kjeldsen)**  
1210 **LUNCH & POSTER**  
1400 Serendipitous Detection of Transiting Planets in Future Synoptic Surveys (S. Gaudi)  
1420 The Pan-Planets Project - A massive Search for Hot Jupiters (C. Afonso)

IAU253  
Final program (May 6th 2008)

- 1440 **Prospects for Transits From Space: Detailed Characterization and Future Surveys (C. Beichmann)**
- 1520 Transiting Exoplanet Survey Satellite [TESS] (G. Ricker)
- 1540 **Summary and end of the symposium**



## POST MEETING REPORT FORM

(Except Joint Discussions and Special Sessions)

To be submitted to the IAU Assistant General Secretary within one month after the meeting

1. Type and number of meeting: Symposium No. 254
2. Title of meeting: The Galaxy Disk in Cosmological Context
3. Dedication of meeting (if any): Dedicated to Prof. Bengt Strömgrén (1908 – 1987)
4. Location (city, country): Copenhagen, Denmark
5. Dates of meeting: June 9 – 13, 2008
6. Number of participants: 236 (incl. 80 women; many PhD students and postdocs).
7. List of countries of origin of the participants: 35 countries: Argentina (1), Austria (3), Australia (4), Belgium (1), Brazil (3), Bulgaria (1), Canada (6), Chile (1), China (3), Czech Republic (1), Denmark (36), Estonia (1), Finland (4), France (9), Germany (37), Hungary (1), India (5), Israel (1), Italy (5), Japan (2), Korea Rep. (2), Latvia (1), Lithuania (2), Mexico (1), Netherlands (7), Norway (1), Romania (1), Russia (2), Slovenia (2), Spain (11), Sweden (17), Switzerland (7), United Kingdom (20), USA (36), Venezuela (1).
8. Report submitted by: Birgitta Nordström, SOC Chair
9. Date and place: Copenhagen, June 13, 2008
10. Signature of SOC Chair

The following documents should be sent to the IAU Secretariat in Paris with the original signed report:

- i Final Scientific Programme
- ii List of Participants
- iii List of IAU grant recipients, with nationality and amount
- iv Receipts signed by grant recipients (not for meetings at a GA)
- v Brief report to the Executive Committee on the scientific and other highlights of the meeting (in text.txt or Word.doc format; max. two pages)

**Short Report on IAU Symposium 254:**  
**“The Galaxy Disk in Cosmological Context”**  
Dedicated to Professor Bengt Strömberg (1908-1987)

The impetus to organise the meeting in Copenhagen, in 2008, was the 100th anniversary of the birth of Danish astrophysicist Bengt Strömberg, who was a leading figure in the development of modern astrophysics. His comprehensive drive towards a physical understanding of the constituents of our Galaxy – stars and gas – and their interplay laid the foundation for the concept of galactic evolution as we know it today. Bengt Gustafsson reviewed Bengt Strömberg’s role in this development at the start of the meeting; the rest of it focused on current and future scientific progress in the field, as he would have wished.

The underlying theme of the Symposium was essentially the following set of questions:

*“Given the success of cosmological simulations in reproducing the large-scale structure of the Universe and the formation of bulge galaxies, why is it so difficult to match the properties – and not least the variety of properties – of real disk galaxies? What new have we learned recently, and what are the key areas where our physical understanding still needs to be improved? And where and how do we invest our efforts most profitably over the next 5-10 years?”*

These issues were discussed in the following six sessions over the five days of the meeting:

**Disk galaxies throughout space and time**  
**Origin, structure, and chemical evolution of disks**  
**Accretion and the interstellar medium**  
**Stars as drivers and tracers of chemical evolution**  
**Disk galaxy meets LambdaCDM cosmology**  
**Surveys, challenges, and prospects for the future**

Each session was introduced by 1-2 reviews by the most prominent experts in each field, followed by shorter invited and contributed papers for a total of 70 oral presentations (23 by women). Many more contributions were proposed than could be accommodated as oral presentations, and a total of ~120 posters provided much supplementary material and new results and ideas in most subfields. They were on display at the meeting venue throughout the meeting, with time reserved for poster viewing.

By design, the programme emphasised overall understanding rather than spectacular recent results, but certainly the high-resolution observations of young disk galaxies at high redshift; the discovery of tidal streams in the Galaxy and M31; the detailed stellar abundance data for the distant halo and nearby galaxies; the evidence for vigorous exchange of gas between galaxies and their environment; and the increasing resolution and realism of hydrodynamical computations of star and disk formation, starting from the boundary conditions provided by cosmological simulations, must count as scientific highlights.

The large attendance (236, including 80 women and many PhD students and postdocs) of scientists from different observational and theoretical backgrounds made for a very varied scientific programme, and the discussions showed how fruitful it is to bring together people with different backgrounds and specialities. A persistent comment by many participants after the meeting was the new insights obtained by having the topic illuminated from so many different angles, yet with a persistent focus.

The lessons of the Symposium were aptly summarised by Rosemary Wyse in her concluding review in terms of the two *Strömgren Legacies* that could be discerned at the meeting:

- *Advances are made by seeing **connections** among apparently unrelated fields; and*
- *Using **complementary** approaches, tools, and techniques is important and fruitful.*

In these terms, the topics of the Symposium can be classified as follows:

***Complementary approaches:***

- Integrated light at high redshift vs local, individual stars
- Numerical simulations vs analytic theory
- Theory vs observations
- Stars vs gas
- Spectroscopy vs photometry and astrometry

***Connections between various subfields:***

- High redshift – low redshift
- Local star formation – global star formation efficiency
- Bulge formation – (thick) disk formation
- First stars – present day star formation
- Substructure – galactic scale structure
- Dark matter – light matter
- Gas – stars
- Chemical evolution – dynamical evolution

The Proceedings will record the oral presentations, while the posters will be available on-line at CUP.

To mark the occasion of Bengt Strömgren's centenary, a rich social programme had been organised, including a welcome reception at the Convocation Hall of the University of Copenhagen, a reception at the City Hall offered by the Lord Mayor and City Council of Copenhagen, a celebration at the former Strömgren (and Bohr) residence of honour at the Carlsberg brewery with special invited guests (including former IAU President A. Blaauw, a friend of Bengt Strömgren since 1938 and organiser of IAU Symposium No. 1 in 1953, Co-ordination of Galactic Research", and the sons of Bengt Strömgren and Niels Bohr). The conference dinner, with live dance music, was held at the impressive headquarters of the Danish Order of Freemasons, adjacent to the Niels Bohr Institute, and a Saturday excursion to the island of Hven, the site of Tycho Brahe's observatories, was enjoyed by 40 of the participants.

Public outreach events featured three public evening talks in downtown Copenhagen by meeting participants (A.C. Andersen, V. Bromm and J. Silk), as well as several newspaper articles.

The organisers thank the IAU for its indispensable moral and financial sponsorship for the meeting. In addition, we were very fortunate in raising local funding for the meeting, enabling us to offer a total of 60,000 Euro in financial support for 125 participants in addition to the 14 grants provided by the IAU. For this, we thank the Niels Bohr Institute and the Royal Danish Academy of Sciences and Letters (our two host institutions); the Danish Natural Science Research Council; the Carlsberg Foundation; the Foundation of December 29, 1967; the Niels Bohr International Academy; the Instrument Center for Danish Astrophysics; the Dark Cosmology Centre; and the Danish Astrophysics Research School.

## IAU Symposium No. 255: Post-Meeting Report

- 1. IAU Symposium Number:** 255
- 2. Title of meeting:** Low-Metallicity Star Formation:  
From the First Stars to Dwarf Galaxies
- 3. Dedicated to:**
- 4. Location:** Rapallo (Genova), Italy
- 5. Date of meeting:** 16-20 June 2008
- 6. Scientific Organizing Committee:** Roger Chevalier (USA)  
Eli Dwek (USA)  
Andrea Ferrara (Italy)  
Leslie Hunt (Co-Chair, Italy)  
Deidre Hunter (USA)  
Yuri Izotov (Ukraine)  
Suzanne Madden (Co-Chair, France)  
Andre Maeder (Switzerland)  
Francesca Matteucci (Italy)  
Sandra Savaglio (Germany)  
Daniel Schaerer (Switzerland)  
Raffaella Schneider (Italy)  
Evan Skillman (USA)  
Eduardo Telles (Brazil)
- 7. Local Organizing Committee:** Roberto Baglioni  
Viviana Casasola  
Marco Grossi  
Leslie Hunt  
Emanuela Masini (Chair)  
Raffaella Schneider  
(all INAF-Firenze)
- 8. Number of participants:** 164 (23 IAU grant recipients)
- 9. Countries represented:** 24  
Australia, Belgium, Brazil, Canada, China, Czech Republic, Denmark, France,  
Germany, India, Italy, Japan, South Korea, Latvia, Mexico, The Netherlands,  
Russia, Spain, Sweden, Switzerland, Taiwan, Ukraine, United Kingdom, United States
- 10. Report submitted by:** Leslie Hunt  
INAF-Istituto di Radioastronomia/Sezione Firenze
- Place & Date:** Firenze, Italy, 4 July 2008

**Scientific program summary:**

5 Invited Reviews, 18 Invited talks, 46 oral contributions, 84 poster presentations.

### General Summary

IAU Symposium 255 began with a Welcome Cocktail on Sunday, 15 June 2008, amidst torrential rains at the Clarisse Auditorium in the seaside town of Rapallo in the province of Genoa, Italy. The

Scientific Program commenced the next morning, 16 June at 09:00, with a Welcome by the Mayor of the City of Rapallo and the Cultural Attaché from the Province of Genoa, both of whom had sponsored the Symposium.

IAUS 255 was marked by two special events, in addition to the scientific program. On the evening of 17 June, in the Clarisse Auditorium, the Province of Genoa offered the Symposium participants a private concert (by Dario Bonuccelli, pianist) and poetry reading (by Rachele Gherzi, actress, in Italian with written English translation). The program, entitled “Starry Nights” (Notte delle Stelle), was compiled by Dr. Giorgio Devoto, the Cultural Attaché from the Province of Genoa, and dedicated to poetry and music with astronomical themes. An extraordinary musical piece for piano entitled “Big Bang – Low Metallicity” was composed by Bonuccelli for the occasion of IAUS 255, and performed by him that night as a world premiere. Incredibly, it captured musically the essence of the primordial universe, and was received with a standing ovation. The next evening, 18 June, Prof. Franco Pacini, former IAU President, gave a free public lecture which attracted almost 100 guests from the City of Rapallo.

By Wednesday, 18 June, the weather had improved, and the conference banquet could take place on Thursday on a terrace overlooking the Mediterranean. The Symposium ended on 20 June with the bright sunshine typical of early summer at the seaside.

## Travel grants and sponsorships

We received 42 grant applications from 13 countries, with more than a factor of two oversubscription relative to the available IAU grant funding of 25000 CHF. In the end, the SOC collectively decided to give grants only to PhD students and research scientists from economically disadvantaged countries. There were 23 such requests (from 9 countries), and although 23 is a low percentage (14%) of the total number of participants, we apportioned the travel grants based on the amount of the requests, and lowered each request in the same proportion. The idea was that people tend to ask for what they need, and we wanted to facilitate attendance from economically disadvantaged areas. At the last minute, two grantees were forced to cancel their participation, leaving us with a total of 1391 CHF unaccounted for.

Because we obtained additional funding from INAF (Italy) and CEA (France), we were able to waive the registration fees for a total of 69 participants [including the invited speakers (23), INAF participants (19), IAU grant recipients (23), and additional PhD students (4)].

We also received “Patrocinio”, or sponsorship, by the City of Rapallo and the Province of Genoa. This was very important both from the financial point of view (the rental of the auditorium was discounted) and the cultural point of view (a musical piece was composed in honor of the Symposium, in the context of a brilliant concert and poetry reading in an astronomical theme). One of our aims was to expose an international community to the charm of a seaside village in a beautiful part of the Italian Mediterranean coastline, and thanks to the City of Rapallo and the Province of Genoa, we hope we succeeded.

## Scientific highlights

We wanted a Symposium which considers low-metallicity star formation both from a local perspective, and at high redshifts, when the first galaxies are predicted to form. Although low-mass metal-poor galaxies in the local universe have often been proposed as the “primordial building blocks” in the hierarchical scenario of structure formation, several lines of evidence suggest that this may not be true. Moreover, it is not clear to what extent dwarf galaxies, because they are metal poor and because of their kinematics and structure, can tell us about how star formation proceeded in the early universe.

To this end, the meeting was focused on six topics:



1. *Population III and metal-free star formation*
2. *Metal-poor IMFs, stellar evolution, and star-formation histories*
3. *Low-metallicity star formation in local dwarf galaxies*
4. *Dust and gas as seeds for metal-poor star formation*
5. *Explosive events in low-metallicity environments: SNe and GRBs*
6. *Metal enrichment, chemical evolution, and feedback*

The underlying theme pervading the conference was the question of whether or not low-metallicity dwarf galaxies in the Local Universe can serve as proxies for primordial star formation. Each topic was opened with an Invited Review, and at least two Invited presentations. The many oral and poster contributions were distributed roughly equally among each topic, according to the subjects proposed for the presentations. There were two dedicated Poster Sessions, and Coffee Breaks were held in the same area as the poster exhibition. The logistics of one of the Invited Review speakers dictated the order of the scientific topics in the oral program; the Symposium opened with the interstellar medium as *Dust and gas as seeds for metal-poor star formation* and ended with *Population III and metal-free star formation*. One Invited and one oral presenter were forced to cancel at the last minute; the attached Final Scientific Program considers this, but the tallies above do not.

*Dust and gas as seeds for metal-poor star formation*

The chemistry of low-metallicity gas clouds is quite different from that of metal-enriched ones, since cooling relies only on H<sub>2</sub> and HD. It is still not clear to what extent local dwarf galaxies exemplify star formation in the early universe, since the boundary conditions are very different (e.g., the background radiation field, CMB, stars); moreover metallicities in local star-forming galaxies are  $\sim 2\%$  in the “best case”, but significantly below 0.01% solar for first-epoch star formation (Spaans). Since large-scale spontaneous gravitational instabilities are not dominant, other—local—processes must be important in dwarf galaxies; this is seen observationally since star formation is occurring in HI clouds or complexes even where the *average* gas density is “too low” (Hunter). A wealth of atomic hydrogen observations were presented in the context of the THINGS collaboration (Brinks, Leroy), and FUSE observations suggest that the neutral gas surrounding low-metallicity local dwarfs has been previously enriched (Lebouteiller). The morphology of the interstellar medium (ISM) is shaped by massive stars, both in the form of energy input and mechanical input from stellar winds and supernova (SN) explosions (Hunter). Unlike atomic gas, the molecular component is apparently underabundant and only nearby metal-poor galaxies (LMC, SMC) can be studied in any detail (Bolatto, Ott). One emphasis of the meeting was that dust is ubiquitous even at low metallicity (Galliano, Lisenfeld, Verhamme), but an outstanding question is how the gas-to-dust mass ratio changes as a function of metal abundance.

*Metal-poor IMFs, stellar evolution, and star-formation histories*

It was suggested that the galaxian integrated Initial Mass Function (IGIMF) should depend on star formation rate (SFR). Hence, low-metallicity dwarf galaxies with low SFR would have different IMFs than larger high-SFR systems, and the SFR in such dwarfs could be substantially underestimated (Kroupa). However, variable IMFs are still controversial (Skillman), and there was no consensus at the meeting. Recent work points to the enhanced importance of stellar rotation at low metallicities (Hirschi). This, too, would affect inferred SFRs since high-mass stars tend to be more luminous and bluer once rotation effects are taken into account (Leitherer). The SMC is the nearest low-metallicity “prototype”, and detailed color-magnitude diagrams (CMDs) are shedding light on its star-formation history (SFH) (Tosi). Deep HST observations of other nearby dwarfs (the LCID project) are also enabling a new understanding of the wide variety of SFHs (Skillman, Monelli). Indeed, the power of *stellar archaeology*, namely tracing SFHs through constraints provided by CMDs, was brilliantly illustrated (Tolstoy). Searches for extremely metal-poor stars in our Galaxy with dedicated surveys such as the Sloan Digital Sky Survey SDSS/SEGUE are also proving to be a powerful tools

for understanding how the first stars formed (Beers, Frebel, Komiya). Scaling relations for dwarf spheroidals (De Rijcke) and schemes for modelling them (Salvadori) are pointing toward a balance between gravity and feedback during their formation epoch. At the other end of the age regime, the existence of truly young galaxies in the Local Universe (e.g., I Zw 18) is still highly debated, although new evidence suggests that youth is rare if not impossible (Aloisi).

*Explosive events in low-metallicity environments: SNe and GRBs*

Reduced stellar winds at low metallicity can alter the SN outcome for a given initial mass. The reduced winds also lower the angular-momentum loss from a star, which may be a critical ingredient for producing the rapidly rotating core thought to be associated with a gamma-ray burst (GRB) (Chevalier). Indeed, low-metallicity SN events may drive the powerful explosions behind GRBs (Ekstrom). Part of the reason may be the strongly anisotropic winds expected to be dominant in fast rotating (low-metallicity) hot stars, which would favor the formation of collapsars and thus long soft GRBs (Georgy). An important effect of SN explosions is the metal enrichment of the surrounding ISM; the signature of this enrichment at early epochs can be found in extremely-metal-poor stars in the Galaxy (Tominaga), and can be used to constrain typical masses of first stars (Nomoto). Another potentially important ingredient of chemical abundances and enrichment in the early universe is dust production and mechanical feedback from the first SNe (Nozawa). GRB host galaxies were shown to be powerful relatively unbiased probes of the early universe; surprisingly GRB hosts are the least massive systems observed at high redshift (Savaglio). They are also very probably metal poor galaxies (Calura, Salvaterra), but their SFR is still debated (high or low? for a given stellar mass).

*Low-metallicity star formation in local dwarf galaxies*

Blue Compact Dwarf galaxies (BCDs) are the most metal-poor star-forming galaxies in the Local Universe, with metallicities ranging from 1/3 to 1/50 that of the Sun. However, oxygen abundances less than about 1/20 solar are quite rare, even in light of new surveys such as the SDSS. Some BCDs have very high-ionization emission lines, exceeding 4 Ryd (Thuan), and some have a broad emission-line component which suggests the presence of an active nucleus (Izotov). Emission lines are good diagnostics of SFRs and chemical abundances, but care needs to be exercised to avoid spurious systematics which may have significant consequences on e.g., the mass-metallicity relation (Stasinska). Star-forming properties may not be dictated exclusively by metallicity however. There appear to be two “families” of star-forming dwarf galaxies distinguished by the compactness and density of their star-forming complexes: “active” ones with dense compact regions and relatively high SFRs; and “passive” ones with more tenuous diffuse regions and low SFRs (Thuan, Hiroiyuki). Active BCDs are also expected to have optically thick thermal radio sources, but these also are quite rare (Johnson). At higher redshifts, new narrow emission-line surveys (DEEP2 and Subaru) are providing more “active”-like low-metallicity dwarf candidates with high specific SFRs (Rosario, Kakazu).

*Metal enrichment, chemical evolution, and feedback*

Feedback effects from the first massive stars and SNe regulate galaxy formation/evolution and the metal enrichment of the intergalactic medium. The top-heavy IMF would have created an overabundance of GRB-like events at high redshift, and the presence of dust from the first SNe could lead to the formation of low-mass stars via fragmentation (Ferrara). The role of low-mass galaxies in the metal enrichment at early epochs may help explain the “missing metal” problem (Ferrara). Mass is well correlated with nebular oxygen abundance over a wide range of redshifts (Mannucci), but there are also large variations from the general trend which are not yet well understood (Lee). In fact, the universal validity of the mass-metallicity relation was one of the main debates at the symposium. Metal depletion through dust grains and chemical enrichment and mechanical feedback were shown to shape the observed properties of galaxies at all redshifts (Matteucci, Font, Marcolini, Sabbi). Such effects however are particularly influential at early epochs when metal enrichment can drive the form of the IMF (Smith), and primordial SNe could have triggered dark-matter halo destruction (Whalen).

Dust grains together with chemical and mechanical feedback also have important consequences on spectral energy distributions (Levesque, Schurer). Late accretion from low-mass halos can leave relics in otherwise quiescent dwarf galaxies in the Local Universe (Ricotti). The high-redshift population of Damped Lyman Alpha systems helps understand the trend of metal enrichment with cosmic time (Dessauges-Zavadsky), and a local example has provided for the first time absorption-line and emission diagnostics for the cold and warm phase of the ISM (Schulte-Ladbeck). Finally, dwarf galaxies can be a potentially significant contribution to the magnetization of the intergalactic medium (IGM) (Klein).

#### *Population III and metal-free star formation*

Detailed simulations of the processes by which the first stars form from metal-free gas give new insight, and help understand the ensuing metal enrichment of the IGM and stellar end products (Bromm, Abel, Tan, Yoshida). The transition of metal-free to low-metallicity star formation occurs at  $\sim 0.001-0.01\%$  solar (Omukai), and chemical modelling suggests how metal-free gas transforms into a metal-enriched medium (Glover). Dark-matter annihilation from weakly interacting massive particles may play an important role as a heat source for the first stars (Freese, Iocco). At zero and low metal abundance, turbulence and angular momentum shape the IMF and may govern the formation of primordial stellar clusters (Klessen, Clark). Galaxy formation can be simulated with sophisticated algorithms which consider ensembles of intermediate-mass Population III stars (Greif). There are several observational signatures of such systems including  $\text{HeII}\lambda 1640$  and  $\text{Ly}\alpha$ , but searches for them at high redshift are as yet futile (Schaerer, di Serego Alighieri). Nevertheless, novel new selection techniques may prove useful for detection of galaxies hosting Population III (metal-free) stars in the early universe (Nagao).

Because of the tight three-month deadline for manuscript submission to the CUP, we were unfortunately unable to incorporate any discussion into the proceedings.

## **Concluding remarks**

The Symposium was enriched by two factors:

- The significant presence of young scientists added vigor and enthusiasm to the meeting; 25 PhD students (15% of participants) were in attendance, and 7 of them gave talks. We have heard reports that students were “inspired” by the meeting, and everyone benefited from the interaction among all age groups.
- There was a large number of women scientists, comprising 32% of participants; 29% of the speakers were women. This result was not planned; there was more than a factor of two over-subscription of requests for orals relative to available time. In fact, oral contributions were determined on a purely numerical basis, by acquiring a majority vote among the SOC members. Hence, the relatively large fraction of women speakers was apparently a function of the quality of their science, rather than their gender.

Lastly, we would like to comment briefly on the financial (down)side of organization. Even with our additional funding, it was difficult to cover meeting costs (airport transportation, coffee breaks, abstract booklet, hall rental, etc.) with the low registration fee suggested by the IAU. Like some previous Symposia organizers, we suggest that current costs would dictate something like 170–200 Euros *exclusive* of proceedings. Moreover, exchange rates make it more difficult for some countries, relative to others; hence a consideration of the different currencies might facilitate budget management (e.g., in terms of US dollars, the Euro is quite expensive at the moment, so prices in dollars are unrealistically low).

**IAU Symposium 255**  
**Low-Metallicity Star Formation: From the First Stars to Dwarf Galaxies**  
**Oral Program**

**Monday, 16 June**

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**Dust and gas as seeds for metal-poor star formation**

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**Chair:** Suzanne Madden

09:00-09:25	<i>WELCOME</i>	Mayor of Rapallo, Assessor of Culture, Province of Genova
09:25-09:55	<i>Marco Spaans</i>	Molecule formation in primordial conditions
09:55-10:15	<i>Simon Glover</i>	Modelling the chemistry of very low-metallicity gas
10:15-10:35	<i>Alberto Bolatto</i>	The resolved properties of extragalactic Giant Molecular Clouds in low-metallicity systems
10:35-10:55	<i>Juergen Ott</i>	Molecular cloud and star formation near the vigorously star-forming 30 Doradus region in the Large Magellanic Cloud
10:55-11:25		COFFEE BREAK AND POSTER VIEWING
11:25-11:55	<i>Elias Brinks</i>	The gas phase in a low-metallicity ISM
11:55-12:15	<i>Vianney Lebouteiller</i>	Is there any pristine gas in nearby starburst galaxies?
12:15-12:45	<i>Frederic Galliano</i>	Dust in a metal-poor ISM
12:45-15:15		LUNCH

**Chair:** Daniel Schaerer

15:15-15:35	<i>Takaya Nozawa</i>	Destruction and Transport of Newly Formed Dust in Population III Supernova Remnants and Its Affect on the Elemental Composition of Population II.5 Stars
15:35-15:55	<i>Anne Verhamme</i>	Constraints on the dust content from Lyman-alpha spectral fitting of star-forming galaxies at redshift 3 to 5
15:55-16:15	<i>Ute Lisenfeld</i>	Dust properties and distribution in dwarf galaxies

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**Metal-poor IMFs, stellar evolution, and star-formation histories**

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16:15-17:00	<i>Evan Skillman</i>	Metal-poor IMFs, stellar evolution, and star-formation histories
17:00-17:30		COFFEE BREAK AND POSTER VIEWING
17:30-18:00	<i>Raphael Hirschi</i>	Stellar evolution at low metallicity
18:00-18:20	<i>Monica Tosi</i>	SMC in space and time: a project to study the evolution of the prototype interacting late-type dwarf galaxy
18:20-18:50	<i>Pavel Kroupa</i>	Low-metallicity star clusters and the IMF in metal-poor environments

## Tuesday, 17 June

**Chair:** Eduardo Telles

09:00-09:45	<i>Deidre Hunter</i>	Dust and gas as seeds for metal-poor star formation
09:45-10:05	<i>Claus Leitherer</i>	Revision of Star-Formation Measures at Low Metallicity
10:05-10:25	<i>Sven De Rijcke</i>	Truncated star formation in dwarf spheroidal galaxies and photometric scaling relations
10:25-10:45	<i>Alessandra Aloisi</i>	A New Age and Distance for IZw18, the Most Metal-Poor Galaxy in the Nearby Universe
10:45-11:15		COFFEE BREAK AND POSTER VIEWING
11:15-11:45	<i>Eline Tolstoy</i>	Star-formation histories at low metallicity in dwarf galaxies
11:45-12:05	<i>Stefania Salvadori</i>	Life and times of dwarf spheroidal galaxies
12:05-12:35	<i>Tim Beers</i>	Local relics of primordial star formation: the Milky Way halo and local dwarfs
12:35-12:55	<i>Anna Frebel</i>	Stellar archaeology: Using metal-poor Galactic halo stars to test theories of the early Universe
12:55-13:15	<i>Yutaka Komiya</i>	Galactic Archeology with Extremely Metal-Poor Stars
13:15-15:45		LUNCH

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## Explosive events in low-metallicity environments

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**Chair:** Francesca Matteucci

15:45-16:15	<i>Roger Chevalier</i>	SNe and their evolution in a low-metallicity ISM
16:15-16:35	<i>Sylvia Ekstrom</i>	Powerful explosions at $Z=0$
16:35-16:55	<i>Ken Nomoto</i>	Typical masses of First Stars as constrained from their nucleosynthesis
16:55-17:15	<i>Nozomu Tominaga</i>	Supernova nucleosynthesis in the early universe
17:15-17:45		COFFEE BREAK AND POSTER VIEWING
17:45-18:15	<i>Sandra Savaglio</i>	Low-mass and metal-poor GRB host galaxies
18:15-18:35	<i>Ruben Salvaterra</i>	The Luminosity Function of long Gamma-Ray Bursts and their rate at $z \geq 6$
18:35-18:55	<i>Cyril Georgy</i>	Wind anisotropy and impact on stellar evolution
18:55-19:15	<i>Francesco Calura</i>	The Star formation history of the GRB 050730 host galaxy
21:30		AFTER-DINNER CONCERT/POETRY AT THE CLARISSE: "NOTTE DELLE STELLE" ( <i>STARRY NIGHT</i> ), KINDLY OFFERED BY THE PROVINCE OF GENOVA

**Wednesday, 18 June**

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**Low-metallicity star formation in the local Universe**

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**Chair:** Leslie Hunt

09:00-09:45	<i>Trinh Thuan</i>	Low-metallicity star formation in local dwarf galaxies
09:45-10:05	<i>Hiroiyuki Hirashita</i>	The size-density relation of HII regions in blue compact dwarf galaxies
10:05-10:25	<i>Kelsey Johnson</i>	Probing Globular Cluster Formation in Low Metallicity Dwarf Galaxies
10:25-10:45	<i>Matteo Monelli</i>	The ACS LCID project: accurate measurements of the full star formation history in low metallicity, isolated, Local Group dwarf galaxies
10:45-11:15		COFFEE BREAK AND POSTER VIEWING
11:15-11:45	<i>Grazyna Stasinska</i>	Ionized gas in dwarf galaxies: abundances and star-formation indicators
11:45-12:05	<i>Yuri Izotov</i>	Broad line emission in dwarf galaxies: the first detection of extremely low-metallicity AGN
12:05-12:25	<i>David Rosario</i>	Luminous Low Metallicity Dwarfs at $z \approx 0.7$ : Keys to the Origin of Metallicity Scaling Relations
12:25-12:45	<i>Yuko Kakazu</i>	Extremely Metal Poor Galaxies at $z < 1$
12:45-13:15		DEDICATED POSTER SESSION
		FREE AFTERNOON
21:30		AFTER-DINNER PUBLIC LECTURE (IN ITALIAN) BY PROF. FRANCO PACINI: "DA GALILEO ALL'ASTRONOMIA MODERNA"

Thursday, 19 June

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**Metal enrichment, chemical evolution, and feedback**

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**Chair:** Deidre Hunter

09:00-09:45	<i>Andrea Ferrara</i>	Cosmic metal enrichment
09:45-10:05	<i>Filippo Mannucci</i>	The Mass-Metallicity Relation at $z>3$
10:05-10:25	<i>Henry Lee</i>	Surprises in the universal galaxy relationship between stellar metallicity and stellar mass
10:25-10:45	<i>Emily Levesque</i>	Modeling the ISM Properties of Metal-Poor Galaxies and Gamma-Ray Burst Hosts
10:45-11:15		COFFEE BREAK AND POSTER VIEWING
11:15-11:45	<i>Francesca Matteucci</i>	Chemical enrichment and feedback in low-metallicity environments (**galaxies**)
11:45-12:05	<i>Andreea Font</i>	Chemo-Dynamical Simulations of Milky Way-type galaxies
12:05-12:25	<i>Andrea Marcolini</i>	About the chemical evolution of dwarf Spheroidal Galaxies (and the peculiar Globular Cluster Omega Cen)
12:25-12:45	<i>Andrew Schurer</i>	Modeling the effects of dust evolution on the SEDs of galaxies of different morphological type
12:45-13:15		DEDICATED POSTER SESSION
13:15-15:30		LUNCH

**Chair:** Evan Skillman

15:30-15:50	<i>Britton Smith</i>	Three Modes of Metal-Enriched Star Formation at High Redshift
15:50-16:10	<i>Daniel Whalen</i>	The Destruction of Cosmological Minihalos by Primordial Supernovae: Triggered Star Formation?
16:10-16:30	<i>Massimo Ricotti</i>	Effects of reionization feedback on dwarf galaxy evolution
16:30-17:00	<i>Miroslava Dessauges-Zavadsky</i>	Damped Ly-alpha systems as probes of chemical evolution over cosmological timescales
17:00-17:30		COFFEE BREAK AND POSTER VIEWING
17:30-17:50	<i>Regina Schulte-Ladbeck</i>	Connecting high-redshift galaxy populations through observations of a local dwarf
17:50-18:10	<i>Elena Sabbi</i>	Young Star Clusters in the SMC: impact of local and global conditions on star formation
18:10-18:30	<i>Uli Klein</i>	Dwarf galaxies and the magnetisation of the IGM
20:00		CONFERENCE BANQUET AT THE HOTEL EXCELSIOR

**Friday, 20 June**

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**Population III and metal-free star formation**

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**Chair:** Raffaella Schneider

09:00-09:45	<i>Volker Bromm</i>	Pop. III and metal-free star formation
09:45-10:15	<i>Naoki Yoshida</i>	Primordial building blocks: from dark matter halos to the first stars (I)
10:15-10:45	<i>Jonathan Tan</i>	Population III stars: formation and evolution
10:45-11:15		COFFEE BREAK AND POSTER VIEWING
11:15-11:45	<i>Tom Abel</i>	Primordial building blocks: from dark matter halos to the first stars (II)
11:45-12:05	<i>Katherine Freese</i>	Dark Stars: Dark Matter Annihilation in the First Stars
12:05-12:25	<i>Fabio Iocco</i>	Effects of Dark Matter annihilation on the First Stars
12:25-12:45	<i>Ralf Klessen</i>	What can we learn from present-day star formation about stellar birth in the early universe?
12:45-15:15		LUNCH

**Chair:** Andrea Ferrara

15:15-15:45	<i>Kazuyuki Omukai</i>	Population III to Pop. II transition: chemical vs. radiative feedback
15:45-16:05	<i>Thomas Greif</i>	The Formation of the First Galaxies
16:05-16:25	<i>Paul Clark</i>	The Formation of the First Stellar Clusters in the Universe
16:25-16:55		COFFEE BREAK AND POSTER VIEWING
16:55-17:25	<i>Daniel Schaerer</i>	Searches for Pop. III and very metal-poor populations in the distant universe
17:25-17:45	<i>Tohru Nagao</i>	Observational search for Population III stars in high-z galaxies
17:45-18:05	<i>Sperello di Serego Alighieri</i>	The HeII 1640 line signature of PopIII stars in a z=6.5 galaxy
18:05-18:15	<i>CLOSING</i>	



**IAU Symposium 255**  
**Low-Metallicity Star Formation: From the First Stars to Dwarf Galaxies**  
**Poster Program**

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**Dust and gas as seeds for metal-poor star formation**

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|---------|-----------------------|--|
| ( I-1 ) | - <i>Ekta</i>         | HI and star formation in the most metal-deficient galaxies   |
| ( I-2 ) | <i>Maud Galametz</i>  | Studying the Dust Properties of Low-Metallicity Dwarf Galaxies at Submillimetre Wavelengths with LABOCA. |
| ( I-3 ) | <i>Pierre Gratier</i> | Large scale CO(2-1) mapping of Local Group galaxies: the case of the dwarf galaxy NGC 6822               |
| ( I-4 ) | <i>John Hibbard</i>   | GBT HI Observations of Low-Metallicity Galaxies from the SDSS  |
| ( I-5 ) | <i>Seyit Hocuk</i>    | Thermodynamic Properties of Molecular Clouds and the IMF in Dwarf Galaxies                               |
| ( I-6 ) | <i>Leslie Hunt</i>    | The Spitzer View of Low-Metallicity Star Formation: Haro 3 and Mrk 996                                   |
| ( I-7 ) | <i>Adam Leroy</i>     | Using THINGS to Compare Star Formation in Nearby Dwarf and Spiral Galaxies                               |
| ( I-8 ) | <i>Joana Oliveira</i> | Ice chemistry in Young Stellar Objects in the Magellanic Clouds  |
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**Metal-poor IMFs, stellar evolution, and star-formation histories**

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- |           |                                |   |
|-----------|--------------------------------|---|
| ( II-1 )  | <i>Arturs Barzdis</i>          | High-resolution spectroscopy of metal-poor star HD 187216                                       |
| ( II-2 )  | <i>Edouard Bernard</i>         | The ACS LCID Project: - RR-Lyrae stars as Tracers of Old Population Gradients in Dwarf Galaxies |
| ( II-3 )  | <i>Daniel Brito de Freitas</i> | Lithium abundances in evolved members of Galactic open clusters                                 |
| ( II-4 )  | <i>Ines Brott</i>              | Nitrogen enrichment to understand rotational mixing in Magellanic Cloud O and B stars           |
| ( II-5 )  | <i>Lynn Carlson</i>            | A Panchromatic View of Magellanic Star Formation: From UV to IR                                 |
| ( II-6 )  | <i>Michele Cignoni</i>         | Star formation history in the SMC: the case of NGC602 and NGC346                                |
| ( II-7 )  | <i>Sergio Cristallo</i>        | AGB nucleosynthesis at very low metallicities   |
| ( II-8 )  | <i>Ignacio de la Rosa</i>      | Galaxy Assembly in the Densest Environments   |
| ( II-9 )  | <i>Bi-Qing For</i>             | Searching for $\alpha$ -poor stars in the Galactic Halo   |
| ( II-10 ) | <i>Claus Goessl</i>            | “Blue” pulsating variable stars in metal poor dwarf galaxies – some “northern” samples          |
| ( II-11 ) | <i>Adam Hosford</i>            | Lithium Abundances of Halo Dwarfs Based on Excitation-Energy Temperature.                       |

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## Metal-poor IMFs, stellar evolution, and star-formation histories (cont.)

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- |           |                              |  |
|-----------|------------------------------|--|
| ( II-12 ) | <i>Laura Husti</i>           | Theoretical interpretation of the low metallicity barium giant HD 123396   |
| ( II-13 ) | <i>Jennifer Johnson</i>      | The Origin of the Carbon-Rich, Neutron-Capture-Poor, Very Metal-Poor Stars   |
| ( II-14 ) | <i>Sara Lucatello</i>        | Binaries at low metallicity  |
| ( II-15 ) | <i>Dmitry Makarov</i>        | Star Formation History Reconstruction of Nearby Dwarf Galaxies   |
| ( II-16 ) | <i>Thomas Masseron</i>       | Mass constraints on low and intermediate mass metal-poor stars.  |
| ( II-17 ) | <i>Andre Milone</i>          | Single-aged stellar population models with real variable Mg-enhancement  |
| ( II-18 ) | <i>Vinicius Placco</i>       | A Search for Metal-Poor Stars Based on Carbon Overabundance  |
| ( II-19 ) | <i>Katharine Schlesinger</i> | Determining the Low-Mass End of the Initial Mass Function using Metal-Poor Stars   |
| ( II-20 ) | <i>William Schuster</i>      | SAN PEDRO MÁRTIR SURVEY OF HIGH-VELOCITY AND METAL-POOR STARS  |
| ( II-21 ) | <i>Fernando Selman</i>       | The Arches, the Tarantula, and the universality of the IMF.  |
| ( II-22 ) | <i>Tammy Smecker-Hane</i>    | The Star Formation History of the Leo I dSph Galaxy  |
| ( II-23 ) | <i>Jan Snigula</i>           | AGB stars in metal poor dwarf galaxies - using LPVs and the Fuel Consumption Theorem as tracers of the stellar population                                      |
| ( II-24 ) | <i>Else Starkenburg</i>      | What more can we learn from spectroscopy in the CaII Triplet region?   |
| ( II-25 ) | <i>Takuma Suda</i>           | The Star Formation History of the Milky Way Halo Explored with Stellar Evolution and Nucleosynthesis of EMP Stars, and with Thier Stellar Abundances Database. |
| ( II-26 ) | <i>Ovidiu Tesileanu</i>      | Jets from young stars - radiative MHD simulations  |
| ( II-27 ) | <i>Takuji Tsujimoto</i>      | New Insights into the First Stars in the Galactic Halo and Dwarf Spheroidal Galaxies   |
| ( II-28 ) | <i>George Wallerstein</i>    | A Comparison of the Globular Clusters Associated with the Sagittarius and Fornax Galaxies  |
| ( II-29 ) | <i>Taras Yakobchuk</i>       | Relatively young age of the red stellar populations in extremely metal-deficient dwarf galaxies  |
| ( II-30 ) | <i>Laimons Zacs</i>          | Abundance analysis of extremely metal-poor star HD-112869  |

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## Explosive events in low-metallicity environments

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- (III-1) *Simone Bianchi* Dust formation and survival in supernova ejecta  
(III-2) *Christa Gall* Dust formation modeling in Supernovae ejecta
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## Low-metallicity star formation in the local Universe

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- (IV-1) *Hakim Atek* Lyman-alpha emission regulators in star-forming galaxies  
(IV-2) *Jonathan Braine* Star Formation in M33, a very nearby subsolar-metallicity galaxy  
(IV-3) *Robert Cumming* Stellar kinematics in blue compact galaxies: local clues to processes at intermediate  $z$   
(IV-4) *Gary Da Costa* Exploring the Virgo Stellar Stream  
(IV-5) *Dimitrios Gouliermis* The Magellanic Clouds as Templates of Star Formation at Low Metallicities: The Census of Pre-Main Sequence Stars.  
(IV-6) *Natalia Guseva* Most metal-deficient emission-line galaxies: new discoveries  
(IV-7) *Ana Hidalgo-Gamez* Luminosity functions and SFRs in dwarf spiral galaxies  
(IV-8) *Michael Hood* Kinematics of the Stellar Populations of M33  
(IV-9) *Bethan James* Spectral Mapping of Anomalous Blue Compact Dwarf Galaxies  
(IV-10) *Luc Jamet* Surprising results of a probabilistic analysis of I Zw 18  
(IV-11) *Mina Koleva* Stellar populations in dEs from high quality integrated spectroscopy  
(IV-12) *Ryan Leaman* First Metallicity Distribution from VLT FORS2 CaT Spectroscopy of RGB Stars in the Dwarf Irregular Galaxy WLM  
(IV-13) *Vianney Lebouteiller* MIR Properties of Giant HII Regions  
(IV-14) *Lidia Makarova* Ancient and Recent Epoch of Star Formation in Nearby Dwarf Galaxies  
(IV-15) *Mariluz Martin-Manjon* POPStar, a new grid of evolutionary synthesis models: Emission-line Diagnostics for Evolving HII Regions.  
(IV-16) *Mariluz Martin-Manjon* Modelling Starbursts in HII Galaxies: From Chemical to Spectro-photometric Evolutionary Self-consistent Models  
(IV-17) *Polychronis Papaderos* Stellar Populations and Extended Ionized Gas Emission in Blue Compact Dwarf Galaxies  
(IV-18) *Simon Pustilnik* DDO 68 as a testbed for models of very low metallicity star formation, massive stars and cosmological mergers  
(IV-19) *Zhengyi Shao* The radial gradient of stellar population of dwarf galaxies  
(IV-20) *Caroline Simpson* VII Zw 403: A BCD Case Study

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## Low-metallicity star formation in the local Universe (cont.)

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- |           |                       |   |
|-----------|-----------------------|---|
| ( IV-21 ) | <i>Eon-Chang Sung</i> | Photometric properties of blue compact dwarf galaxies (BCDGs) from SDSS DR6   |
| ( IV-22 ) | <i>Eduardo Telles</i> | Optical and Near-Infrared IFU kinematics and the interplay with the ISM phases in the prototype HII galaxy II Zw 40 |
| ( IV-23 ) | <i>Brent Tully</i>    | The Offset between Dwarf Irregulars and Spheroidals in Luminosity–Metallicity Plots                                 |
| ( IV-24 ) | <i>Sander Valcke</i>  | Simulations of the formation and evolution of isolated dwarf galaxies   |
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## Metal enrichment, chemical evolution, and feedback

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- |         |                              |  |
|---------|------------------------------|--|
| ( V-1 ) | <i>Aycin Aykutalp</i>        | Star formation and their feedback effects in the early Universe                                    |
| ( V-2 ) | <i>Gabriele Cescutti</i>     | Inhomogeneous chemical evolution models:- from the Galactic halo to the dwarf spheroidal galaxies  |
| ( V-3 ) | <i>Nicolas Champavert</i>    | Chemical evolution of galaxies using a new multiphase chemodynamical code                          |
| ( V-4 ) | <i>Andrey Doroshkevich</i>   | The observed metal systems and reionization of the Universe  |
| ( V-5 ) | <i>Denise Goncalves</i>      | Planetary Nebulae: enlightening the luminosity-metallicity relation of Local Group dwarf galaxies. |
| ( V-6 ) | <i>Gustavo Lanfranchi</i>    | The evolution of $\alpha$ /Fe in Carina dwarf spheroidal galaxy: constraints from new data.        |
| ( V-7 ) | <i>Kenta Matsuoka</i>        | Cosmic Metallicity Evolution traced by Radio Galaxies  |
| ( V-8 ) | <i>Carlos Rodriguez-Rico</i> | VLA H53 $\alpha$ Observations of the Central Region of the SSCs Galaxy NGC 5253                    |
| ( V-9 ) | <i>Sukyoung Yi</i>           | First stars as a possible origin for the extreme helium populations in globular clusters           |
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## Population III and metal-free star formation

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- |          |                               |  |
|----------|-------------------------------|--|
| ( VI-1 ) | <i>Ena Choi</i>               | The Chemical Enrichment of the Early Building Blocks   |
| ( VI-2 ) | <i>Kenji Hasegawa</i>         | Secondary star formation in a Pop III object: Dependence of UV feedback on the mass of source star |
| ( VI-3 ) | <i>Anne-Katharina Jappsen</i> | The Influence of Metallicity on Fragmentation of Proto-galactic Gas                                |
| ( VI-4 ) | <i>Jarrett Johnson</i>        | The Occurrence of Metal-free Galaxies in the Early Universe  |
| ( VI-5 ) | <i>Jaime Klapp</i>            | Evolution and Nucleosynthesis of the First Stars   |
| ( VI-6 ) | <i>Jiri Krticka</i>           | CNO driven winds of hot first stars  |
| ( VI-7 ) | <i>Umberto Maio</i>           | Primordial star formation  |
| ( VI-8 ) | <i>Dominik Schleicher</i>     | The Dark Ages of the Universe  |

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### Population III and metal-free star formation (cont.)

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- |           |                         |   |
|-----------|-------------------------|---|
| ( VI-9 )  | <i>Athena Stacy</i>     | Protostellar Accretion in the Early Universe      |
| ( VI-10 ) | <i>Luca Tornatore</i>   | Population III stars: hidden or disappeared ?     |
| ( VI-11 ) | <i>Masayuki Umemura</i> | First Star Simulations down to CDM Damping Scales |



## POST MEETING REPORT FORM

for meetings other than Joint Discussions and Special Sessions

Deadline for Submission: within 1 month after the meeting

**the following information should be sent  
to the IAU Assistant General Secretary**

The following documents should be attached:

- i Final Scientific Program
- ii List of participants
- iii List of recipients of IAU Grants, including amount and country
- iv Receipts signed by the recipients of IAU Grants (This does not apply to Scientific Meetings held during General Assemblies)
- v Brief report (text.txt file or word.doc) to the Executive Committee on the scientific highlights of the meeting (1-2 pages)

1. Meeting Number: [IAUS256](#)
2. Meeting Title: [The Magellanic System: Stars, Gas, and Galaxies](#)
3. Dedication of meeting (if any): [to the memory of Bengt E. Westerlund](#)
4. Location (city, country): [Keele University, United Kingdom](#)
5. Dates of meeting: [28 July – 1 August 2008](#)
6. Number of participants: [152](#)
7. List of represented countries: [by residence \(countries of origin further include Portugal, Serbia, The Netherlands\): Argentina, Australia, Austria, Azerbaijan, Belgium, Brasil, Canada, Czech Republic, Chile, China, Finland, France, Germany, Greece, India, Iran, Israel, Italy, Japan, Lithuania, New Zealand, Poland, South Africa, Spain, Switzerland, UK, USA](#)
8. Report submitted by: [Jacco van Loon](#)
9. Date and place: [17 October 2008, Keele University](#)
10. Signature of SOC Chairperson:

## Final report IAUS 256, The Magellanic System: Stars, Gas, and Galaxies

Keele University's rural campus was host to IAUS 256, the scientific programme of which ran from 28 July to 1 August 2008. A total of 27 countries and 30 nationalities were represented by 152 participants. The topic of the symposium, the Magellanic System and all that it contains, is extremely broad, and the variety of contributions was unsurprisingly extraordinary.

Scientific highlights were many. To mention but a few, the recently redetermined proper motions of the Magellanic Clouds, suggesting either a much more massive SMC-LMC-Milky Way system or a more independent history of these galaxies, obviously drew plenty of attention and discussion as modellers attempt to come to grips with this new reality. Certainly the Magellanic Clouds appear to be much more extended than one dared imagine, with stars as far away as twenty degrees sharing a common motion with the LMC. The two clouds may be even more intimately linked than previously thought, possibly sharing a pan-galactic magnetic field and a common dark halo. Compared to a decade ago, much progress has been made in unravelling the spatial and temporal variations in star formation history throughout the Magellanic System, but it is clearly too early yet for the implications of these detailed data to have fully sunken in.

The powerful combination of detail and full coverage of the Magellanic Clouds was exemplified in several important new surveys, from X-rays to the infrared and radio wavelengths. The Spitzer Space Telescope has now made it possible to study the embedded stages of star formation in these low-metallicity environments, providing a stepping stone on the way to understand star formation in the early Universe. In a similar way, a much more complete picture is being obtained of the production of dust on all timescales, from supernova remnants to low-mass red giants. The Hubble Space Telescope, despite having been around for some time now, continues to enable unprecedented measurements and new discoveries; one of the most spectacular and new notions arising from these observations is that many populous star clusters in the Magellanic Clouds appear to host multiple stellar populations, rendering the massive Galactic globular cluster  $\omega$  Centauri perhaps no longer a freak.

The importance of the Magellanic Clouds as unique laboratories for astrophysics, as well as for understanding other interacting gas-rich galaxies that abound in other galaxy groups and cluster, is now giving way to a new generation of surveys, including several optical and near-infrared imaging surveys, spectroscopic surveys and the Herschel successor of SAGE. At the time of the next Magellanic Cloud symposium, when these surveys will have started to influence our views of the Universe, ALMA and possibly JWST will have come into operation, and the next generation of extremely large optical telescopes may about to see their first light. One thing is certain: no matter how much we learn from them, the Magellanic Clouds remain full of surprises to keep us wonder for some time ahead.

Besides the scientific programme, a very successful cultural programme was organised by the local organising committee. This started with a performance of the Shakespeare drama "Othello" by Anvil Productions, in Keele Hall and its gardens. It was followed the next day by a teacher's event and a public lecture by acclaimed archaeo-astronomer Professor Clive Ruggles, on the topic of "Astronomy before History", which was attended by an audience of around 200, with a public display of two large stands showcasing the Spitzer surveys of the Magellanic Clouds. The programme ended on Wednesday evening with a classical concert by London Concertante, in the University Chapel, including works by the famous German/British astronomer William Herschel.

The organisers are grateful to the Royal Astronomical Society, which helped fund some of the cultural activities and supported the attendance of some young researchers. The meeting was dedicated to the memory of Bengt Westerlund, a keen and influential observer of the Clouds, who sadly passed away less than two months before the symposium.

For the SOC and LOC, Jacco van Loon

# Programme

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## Sunday 27 July

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15:00-19:00	<i>Keele Hall</i>	Registration
18:00-19:30	<i>Keele Hall</i>	Dinner
19:30-21:00	<i>Keele Hall</i>	Welcome reception (closing ~22:00)

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## Monday 28 July

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9:00- 9:10	<i>Westminster Theatre</i>	Opening by Professor Janet Finch, Keele University Vice Chancellor Opening remarks by Professor Peter Styles, Director of EPSAM
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### **The structure and dynamics of the Magellanic System (I)** (Chair: Despina Hatzidimitriou)

9:10- 9:40	Jason Harris	<i>Review:</i> The distribution of stars in the Magellanic System
9:40-10:00	Nate Bastian	The spatial evolution of stellar structures in the LMC/SMC
10:00-10:20	Steven Majewski	Exploring Very Extended Stellar Populations of the Magellanic Clouds
10:20-10:40	Pierre North	New distance and depth estimates from observations of eclipsing binaries in the SMC
10:40-11:10	<i>Poster area</i>	<i>Coffee</i>
11:10-11:30	Annapurni Subramaniam	Estimation of thickness of the LMC and SMC disks
11:30-12:00	Basílio Santiago	<i>Review:</i> The star clusters of the Magellanic System
12:00-12:30	Roeland van der Marel	<i>Review:</i> The kinematical structure of the Magellanic System
12:30-14:00	<i>Comus restaurant</i>	<i>Lunch</i>
14:00-14:20	Nitya Kallivayalil	New Results on the Proper Motions of the Magellanic Clouds: Orbits, Internal Kinematics, and Distance
14:20-14:40	Gurtina Besla	The Formation of the Magellanic Stream

### **Surveys of the Magellanic Clouds** (Chair: You-Hua Chu)

14:40-15:00	Margaret Meixner	Measuring the Lifecycle of Baryonic Matter in the Large Magellanic Cloud with SAGE-LMC
15:00-15:20	Yoshifusa Ita	AKARI IRC survey of the Large Magellanic Cloud
15:20-15:40	John Dickel	Radio continuum Surveys of the Magellanic Clouds at 4.8 and 8.6 GHz
15:40-16:10	<i>Poster area</i>	<i>Coffee</i>
16:10-16:40	Scott Gaudi	<i>Review:</i> Verdict on dark matter from microlensing surveys
16:40-17:10	Yaël Nazé	<i>Review:</i> X-ray stellar populations in the Large Magellanic Cloud
17:10-17:30	Frank Haberl	The XMM-Newton view of the Small Magellanic Cloud
17:30-17:50	Igor Soszyński	OGLE-III Catalog of Variable Stars — first results
17:50-18:10	Warren Reid	Significant new Planetary Nebulae discoveries as powerful probes of the LMC
18:10-19:30	<i>Comus restaurant</i>	<i>Dinner</i>
19:30	<i>Keele Hall gardens</i>	<b>Shakespeare play: “Othello”</b> (starts 20:00)

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**Tuesday 29 July**


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**The structure and dynamics of the Magellanic System (II)** (Chair: Yasuo Fukui)

9:00- 9:30	Kenji Bekki	<i>Review:</i> Models for the dynamical evolution of the Magellanic System
9:30- 9:50	Chiara Mastrogiro	New models for the dynamical evolution of the Magellanic System
9:50-10:10	Joss Bland-Hawthorn	A new view of Galactic accretion: the shock cascade along the Magellanic Stream
10:10-10:30	Snežana Stanimirović	The many streams of the Magellanic Stream
10:30-11:00	<i>Poster area</i>	<i>Coffee</i>

**The properties of the interstellar medium** (Chair: Snežana Stanimirović)

11:00-11:30	François Boulanger	<i>Review:</i> Dust life cycle and Dust/Gas correlation in the Magellanic Clouds
11:30-11:50	Caroline Bot	Tracing the cold molecular gas reservoir through dust emission in the SMC
11:50-12:10	Adam Leroy	The State of the Molecular Gas in the Small Magellanic Cloud
12:10-12:30	Karin Sandstrom	The Spitzer Spectroscopic Survey of the Small Magellanic Cloud: Polycyclic Aromatic Hydrocarbon Emission from SMC Star-Forming Regions
12:30-14:00	<i>Comus restaurant</i>	<i>Lunch</i>
14:00-14:30	You-Hua Chu	<i>Review:</i> The violent interstellar medium of the Magellanic System
14:30-14:50	Sui Ann Mao	Magnetic Fields in the Magellanic Clouds
14:50-15:10	António Magalhães	The Magnetic Field Structure of the Small Magellanic Cloud

**The star formation process** (Chair: Jacco van Loon)

15:10-15:40	Joana Oliveira	<i>Review:</i> The star formation process in the metal-poor Magellanic Clouds
15:40-16:10	<i>Poster area</i>	<i>Coffee</i>
16:10-16:40	Norikazu Mizuno	<i>Review:</i> The properties of molecular clouds across the Magellanic System
16:40-17:10	Mónica Rubio	<i>Review:</i> The properties of star forming regions in the Magellanic System
17:10-17:30	James Green	Multibeam Maser Survey of methanol and excited OH in the Magellanic Clouds: new detections and maser abundance estimates
17:30-17:50	Takashi Shimonishi	AKARI NIR Spectroscopy of Young Stellar Objects in the LMC: Detections of H <sub>2</sub> O and CO <sub>2</sub> ice
18:00-19:30	<i>Comus restaurant</i>	<i>Dinner</i>
19:30	Clive Ruggles	<b>Public Lecture: “Astronomy before History”</b>

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**Wednesday 30 July**


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**The star formation process (continued)** (Chair: Mónica Rubio)

9:00- 9:20	Remy Indebetouw	Insights from Spitzer on massive star formation in the LMC
9:20- 9:40	Elena Sabbi	Time resolved star formation in the SMC: the youngest star clusters
9:40-10:00	Dimitrios Gouliermis	The sub-solar IMF in the Large Magellanic Cloud

**The star formation history and chemical evolution** (Chair: Beatriz Barbuy)

10:00-10:30	Vanessa Hill	<i>Review:</i> The star formation history and chemical enrichment of the Magellanic System
10:30-11:00	<i>Poster area</i>	<i>Coffee</i>
11:00-11:20	Andrew Cole	Breaking the Age-Metallicity Degeneracy: The Metallicity Distribution Function and Star Formation History of the LMC
11:20-11:40	Eva Grebel	The Age-Metallicity Relation of the Small Magellanic Cloud
11:40-12:00	Noelia Noël	The Star Formation History of 12 SMC fields
12:00-12:20	Ricardo Carrera	The chemical enrichment history of the Magellanic Clouds field population
12:20-12:30	<i>University Chapel</i>	<b>Conference Photograph</b>
12:30-14:00	<i>Comus restaurant</i>	<i>Lunch</i>
14:00-14:20	Carme Gallart	Outside-in disk evolution in the LMC
14:20-14:40	Aaron Grocholski	Metallicity and Kinematics of a Large Sample of LMC and SMC Clusters
14:40-15:00	Andrea Ahumada	Integrated spectral properties of 41 compact star clusters of the Magellanic Clouds
15:00-15:20	Alessio Mucciarelli	The chemical signatures of the Large Magellanic Cloud globular clusters
15:20-15:40	Dougal Mackey	Multiple stellar populations in rich LMC star clusters
15:40-16:10	<i>Poster area</i>	<i>Coffee</i>

**Poster Session** (Chair: Michael Feast)

16:10-17:00	(selected)	Brief poster presentations
17:00-18:00	<i>Poster area</i>	Poster viewing
18:00-19:30	<i>Comus restaurant</i>	<i>Dinner</i>
19:30	<i>University Chapel</i>	<b>Classical Concert by London Concertante</b>

**Thursday 31 July****The star formation history and chemical evolution (continued)** (Chair: Eva Grebel)

9:00- 9:20	Richard de Grijs	Star cluster evolution in the Magellanic Clouds revisited: the effects of infant mortality
9:20- 9:40	Guillermo Bosch	Gemini/GMOS detection of stellar velocity variations in the ionising cluster of 30 Dor

**The Magellanic Clouds as laboratories of stellar astrophysics** (Chair: Nolan Walborn)

9:40-10:10	Chris Evans	<i>Review:</i> The properties of early-type stars in the Magellanic Clouds
10:10-10:30	Raphael Hirschi	Stellar evolution models at the Magellanic Clouds' metallicities
10:30-11:00	<i>Poster area</i>	<i>Coffee</i>
11:00-11:20	Alceste Bonanos	A Survey of the Most Massive Stars in the Magellanic Clouds
11:20-11:40	Christophe Martayan	The WFI H $\alpha$ spectroscopic survey of the Magellanic Clouds
11:40-12:00	Vallia Antoniou	A comprehensive study of the link between star-formation history and X-ray source populations in the SMC

12:00-12:20	Robin Corbet	Properties of X-ray Binaries in the Magellanic Clouds from RXTE and Chandra Observations
12:20-12:40	Malcolm Coe	The extraordinary High Mass X-ray Binary population in the SMC
12:40-14:00	<i>Comus restaurant</i>	<i>Lunch</i>
14:00-14:30	Gisella Clementini	<i>Review: Pulsating variable stars in the Magellanic Clouds</i>
14:30-14:50	Wolfgang Gieren	Direct distances to LMC Cepheids from the infrared surface brightness technique
14:50-15:10	Paola Marigo	TP-AGB stars in the Magellanic Clouds
15:10-15:30	Leandro Kerber	Analysis of HST CMDs of 15 intermediate-age LMC clusters: self-consistent physical parameters and 3D distribution using different stellar evolutionary models
15:30-16:00	<i>Poster area</i>	<i>Coffee</i>
16:00-16:20	Rurik Wahlin	<b>did not turn up, without notice — has not responded since</b>
16:20-16:40	Thomas Lebzelter	A study of AGB stars in LMC clusters

**The final stages of stellar evolution and feedback** (Chair: Mohammad Heydari-Malayeri)

16:40-17:00	Gregory Sloan	Spitzer spectroscopy of mass loss and dust production in the Magellanic Clouds
17:00-17:20	Geoffrey Clayton	Dust Around Red Supergiants in the Magellanic Clouds
17:20-17:40	Els van Aarle	Post-AGB stars in the Large Magellanic Cloud
18:30 (bus)	<i>Wrenbury Hall</i>	<b>Conference Dinner</b>

**Friday 1 August**

**The final stages of stellar evolution and feedback (continued)** (Chair: Wolfgang Pietsch)

9:30-10:00	Letizia Stanghellini	<i>Review: Planetary Nebulae in the Magellanic Clouds</i>
10:00-10:20	Michaela Kraus	On the huge mass loss of B[e] supergiants in the Magellanic Clouds
10:20-10:40	Manfred Pakull	High-excitation nebulae around Magellanic Wolf-Rayet stars
10:40-11:10	<i>Poster area</i>	<i>Coffee</i>
11:10-11:40	Rosa Williams	<i>Review: Supernova remnants in the Magellanic Clouds</i>

**Magellanic type systems as a class** (Chair: Gary Da Costa)

11:40-12:10	Eric Wilcots	<i>Review: Magellanic type galaxies throughout the Universe</i>
12:10-12:30	Elena D'Onghia	Little Dwarf Galaxies survive with bigger Dwarfs: Understanding the Milky Way and the faintest Galaxies
12:30-14:00	<i>Comus restaurant</i>	<i>Lunch</i>
14:00-14:20	Brandon Lawton	Evidence of Magellanic-like Moderate Redshift H I-Rich Galaxies
14:20-15:20	Jay Gallagher & Joss Bland-Hawthorn	<i>Conference Summary:</i> Achievements and challenges in Magellanic Clouds research
15:20-15:30		Closing remarks

## **IAU Symposium No 257, Post Meeting Report**

1. **IAU Symposium Number:** 257
2. **Title of meeting:** Universal Heliohysical Processes
3. **Dedicated to:**
4. **Location:** University of Ioannina, Ioannina, Greece
5. **Date of meeting:** 15-19 September 2008

### **6. Scientific Organizing Committee:**

Nat Gopalswamy (USA – co-Chair)  
David Webb (USA – co-Chair)  
Kazunari Shibata (Japan – co-Chair)  
Costas Alissandrakis (Greece)  
Arnold Benz (Switzerland)  
Jean-Louis Bougeret (France)  
Claus Froehlich (Switzerland)  
Sarah Gibson (USA)  
Cristina Mandrini (Argentina)  
P.K. Manoharan (India)  
Marius Potgieter (South Africa)  
Alexander Stepanov (Russia)  
Gerard Thullier (France)  
Lidia van Driel-Gesztelyi (U.K.)  
Bojan Vrsnak (Croatia)  
Mei Zhang (China)

### **7. Local Organizing Committee:**

Alexander Nindos (Chair, Greece)  
Costas Alissandrakis (Greece)  
Angeliki Fotiadi (Greece)  
Vassiliki Tsikoudi (Greece)  
Georgia Tsiropoula (Greece)  
Seiji Yashiro (USA)

8. **Number of participants:** 101 (yy IAU Grant recipients)

## **9. Countries represented: 26**

Argentina, Australia, Belgium, Brazil, Bulgaria, Croatia, Finland, France, Georgia, Germany, Greece, Hungary, India, Italy, Mexico, Peru, Poland, Romania, Russia, Slovakia, South Africa, Switzerland, Tajikistan, UK, Ukraine, USA

**10. Report submitted by:** Nat Gopalswamy, NASA Goddard Space Flight Center, Greenbelt, Maryland, USA

**Place & Date:** Greenbelt, Maryland 25 November 2008

**Scientific Program :** 71 oral presentations and 30 posters

### **Scientific Highlights :**

The focus of IAU symposium 257 was on the universality of physical processes in the region of space directly influenced by the Sun through its mass and electromagnetic Emissions: the heliospace. The symposium featured presentations that highlighted the universal physical processes in the heliospace, the space directly probed by instruments made by the humankind.

The inaugural session (Session I) retraced the development of heliospace science from the beginning of space exploration during the successful International Geophysical Year (IGY) 1957 to the International Heliophysical Year (IHY), currently underway. The fierce competition between the Soviets and the Americans, the creation of space agencies in various countries, the development of a broad and active scientific community, and the unprecedented international cooperation were listed as the primary drivers behind the successes. The presentations also laid out a potential scenario of space exploration and research for the next 50 years, emphasizing the need for investment in new technologies, continued international cooperation involving new partners, joint planning and road maps, and rejuvenation of the scientific community. Session I updated the current status of material composition in the heliosphere and how the Sun affects the planets, particularly Earth from a climate point of view.

Session II focused on the science and applications of space weather, the conditions in space that can be hazardous to humans and their technology. The space weather is mainly caused by the Sun. The session also featured papers that discussed the effects of solar irradiance and magnetic flux variation on space weather.

Session III was on Solar sources of heliospheric variability. The session started with an overview of the dynamo process applicable to both solar and planetary dynamos. Special emphasis was placed on how numerical simulations have become important in understanding

the real dynamos. It was noted that the mean field model of solar dynamo has seen resurgence during the past decade, with the helioseismic constraints greatly reducing the arbitrariness in the Sun. The helioseismology discussion highlighted the recent controversy on the Oxygen abundance in the solar photosphere and how it has spoiled the excellent agreement between the standard solar model and the solar structure obtained from solar oscillations. Chromospheric and coronal variability was then discussed with the aid of recent data from the Hinode satellite. The anti-correlation between coronal temperature and the solar wind speed linked the coronal variability to the heliospheric variability.

Session IV continued with the solar variability featuring a keynote address on solar mass emissions. Coronal mass ejections (CMEs) are the most energetic phenomenon in the heliosphere, whose kinematics and structure in 2D have been well described. The 3D kinematics and structure are just being established from the STEREO observations. Understanding of how CMEs are initiated is still in a primitive state. It is still not clear whether all CMEs in the interplanetary medium have a flux rope structure. The inner core of CMEs is the cool dense gas observed as prominences from ground based observations. Prominences are also observed in stars and astronomers are trying to get a handle on the magnetic field structure in stellar atmospheres using prominence observations, which may have important implications for dynamo theories. Another aspect of CMEs is the associated flares. CMEs always occur in association with flares, but the reverse is not true. When a CME lifts off, reconnection under the CME span is supposed cause the flare. This simple fact could not be confirmed for decades, but now it is confirmed, thanks to the extensive observation made by the Solar and Heliospheric Observatory (SOHO) mission. Papers were also presented on another important aspect of CMEs: EUV waves that are also linked to shocks driven by CMEs.

Session V focused on the radio emission processes in space plasmas, an important tool to investigate thermal and nonthermal properties of the plasma in the inner heliosphere. Radio emission is almost always caused by accelerated electrons in various locations in the heliospace that provide a wealth of information on particle acceleration. Discussion included the production of energetic electrons on the Sun, Jupiter and Earth's magnetosphere. Attempts to settle the controversy regarding the acceleration of solar energetic particles (from the flare site, CME driven shocks, or both) has not been successful so far.

Sessions VI and VII dived deep into the reconnection process, which has been shown to be ubiquitous in the heliospace starting from the Sun (flares, chromospheric jets), the planetary magnetospheres, and the solar wind itself. One of the interesting results presented is that reconnections in some locations lead to particle acceleration, while there is no evidence of particle acceleration in other locations. Reconnection is also credited with the production of flux ropes in the interplanetary medium. Although the investigations are in the early stage,

quantitative connection between solar and interplanetary structures has started emerging. Discussion also included the evolution of tiny current sheets that may lead to small-scale energy release and the establishment of turbulence in active regions.

Session VIII was devoted to the energetic particles in the heliosphere (accelerated by CMEs and flares from within the heliosphere and by supernova shocks outside the heliospace). An interesting aspect of energetic particles in the heliosphere is interaction between particles coming from outside the heliosphere (galactic cosmic rays) and the solar wind structures generated by the Sun. Voyager spacecraft crossing the termination shock have provided new data and new challenges to the theorists to explain the cosmic ray modulation in the heliosheath and the acceleration mechanism of anomalous cosmic rays. Forbush effect is the direct consequence of interaction between CMEs and the galactic cosmic rays. There were several papers on Forbush effect and its connection to solar, interplanetary and geomagnetic phenomena. The highly controversial topic of cosmic-ray induced cloud-cover changes was also addressed; no cloud-cover changes were found during large Forbush decreases.

Session IX dealt with the heliospheric boundaries, interfaces, and shocks. Launching of the Interstellar Boundary Explorer (IBEX) mission during the IHY caps the fifty years of advances in space science from the time humans explored the near-Earth space leading to the exploration of the boundary between the heliosphere and the interstellar medium. Details of the IBEX mission and the new science that is going to come out were discussed in this session. Shock waves were discussed as a universal process: both astronomical and heliospheric shocks were considered as a source of high energy particles.

Session X highlighted the recent developments in planetary atmospheres, ionospheres, and magnetospheres. Planetary auroras are an excellent example of universal process involving energetic particles, planetary magnetic fields, and neutral atmospheres of planets. Detailed measurements of Jovian aurora have shown that the planet-averaged ratio of auroral to solar radiation input is 20-50 times more at Jupiter than at Earth. Although planetary ionospheres are well understood, recent missions such as Cassini have provided details of how the same physical processes occur under vastly different environments. For example, the night-side of Titan's ionosphere seems to be maintained by the magnetospheric electrons suggesting a Mars - Venus analog.

Session XI was devoted to the turbulence process in heliospace as investigated by experimental (radio remote-sensing, energetic particles) and theoretical methods. Turbulence in the solar wind as well as in the vicinity of interplanetary shocks was discussed. A peculiar form of MHD turbulence in closed magnetic structures in the corona was also reported; the turbulence spectrum was found to have a magnetically dominated pre-inertial range, where boundaries have a strong influence. Existence of strong turbulence in the vicinity of CME-

driven shocks was found to be critical for the production of large solar energetic particle events.

The final session XII dealt with flows, obstacles and circulation in the heliospace that included the three dimensional view of the heliosphere using Voyager and Ulysses data. The out-of-the ecliptic view from Ulysses for the past 18 years has helped characterize solar wind flows, magnetic fields, energetic particles, cosmic rays, radio and plasma waves, and dust up to 80° latitude. The third set of polar passes revealed a stunning change in the solar wind: magnetic field, density, temperature and dynamic pressure of the solar wind all were smaller compared to previous solar minima. Comparison of the shock sheaths of various types was also reported: heliospheric sheath, magnetospheric sheaths, and interplanetary shock sheaths. Even though the shock structures are similar, the CME sheaths were found to be the thinnest. The flows in the heliospace were compared with stellar winds using MHD simulations. In particular the evolution of stellar wind from the Sun to the red giants was discussed. MHD simulations suggest that the disappearance of steady coronae followed by the onset of dense winds.

This symposium was undoubtedly unique in the sense it brought a diverse group of scientists that were able to take part in discussions, appreciate the scientific disciplines of others, and discover commonalities of the physical processes.

**Proceedings:**

N. Gopalswamy & D. F. Webb (eds.), 2009, Universal Heliohysical Processes, Proc. IAU Symp. No. 257, Ioannina, Greece, 15-19 September 2008. (Cambridge: CUP) ISBN:

e-book:



# IAU SYMPOSIUM 257; UNIVERSAL PHYSICAL PROCESSES

Ioannina, Greece; 15-19 September 2008

*Post-meeting Program as revised & presented (D. Webb)*

## Sunday, September 14

19:00 - 21:00 **REGISTRATION & OPENING RECEPTION** (Scientific and Technological Park of Epirus, University of Ioannina, the conference venue)

## Monday, September 15

8:00 – 9:00 Registration continued.

### 9:00 **I. OPENING SESSION (Chair: C. Alissandrakis)**

9:00 Welcome: N. Gopalswamy, K. Shibata, D. Webb, A. Nindos

9:20 Logistics

9:25 R. Bonnet (KEYNOTE): Next 50 Years of Space Research

10:05 J. Davila – INVITED: International Heliophysical Year

10:30 - 10:50 BREAK

10:50 P. Bochsler – INVITED: Composition of Matter in the Heliosphere

11:15 J. Beer – INVITED: Sun and Planets from a Climate Point of View

11:40 I. Usoskin – INVITED: Do Solar/Heliospheric Changes Affect the Earth's Climate?

### 12:05 **II. SPACE WEATHER (Chair: K. Shibata)**

12:05 N. Crosby – INVITED: Space Weather: Science and Effects

12:30 M. Gigolashvili: Total and Spectral Solar Irradiance Variation and its Connection with Some Characteristics of the Space Weather

12:45 T. Girish: Secular Changes in Solar Magnetic Flux Amplification Factor and Prediction of Space Weather

13:00 - 14:15 LUNCH

### 14:15 **III. SOLAR SOURCES OF HELIOSPHERIC VARIABILITY (Chair: J. Davila)**

14:15 K. Petrovay- INVITED: Solar and Planetary Dynamos

14:40 H. Antia – INVITED: Solar Oscillations

15:05 V. Abramov-Maximv: A Comparison of Parameters of 3-minute and 5-minute Oscillations in Sunspots from Synchronous Microwave and Optical Observations

15:20 L. Fisk – INVITED: The Heliospheric Magnetic Field

15:45 - 16:00 BREAK

16:00 S. Hasan – INVITED: Physics of Magnetized Chromospheres

16:25 A. Nindos – INVITED: Helicity of Solar Active Regions

17:15 A. Gabriel: Outflow Velocity Structure at the Base of the Solar Corona  
17:30 I. Kim: On the Electron Velocity Field of the Inner Corona  
17:45 K. Marti: History of the Solar Environment  
18:00 Adjourn

Evening

## Tuesday, September 16

### 9:00 IV. SOLAR-HELIOSPHERE VARIABILITY – CMEs (Chair: C. Alissandrakis)

9:00 R. Howard (KEYNOTE): Solar Mass Emission

9:40 M. Jardin – INVITED: Stellar Mass Ejections

10:05 B. Schmeider –INVITED: Solar Prominences

10:30 - 10:55 BREAK

10:55 S. Yashiro – INVITED: The Flare-CME Connection

11:20 N. Narukage – INVITED: Coronal Waves Associated with Solar Flares

11:45 D. Prosovetsky: “EIT waves” in Coronal Loops During Non-flare Stage

12:00 C. Dumitrache: CMEs 'en Raffales' - Observations and Simulations

12:15 V. Fainshtein: Expansion of Coronal Mass Ejections within LASCO Field of View

12:30 C. Mandrini: The Link Between CME-associated Dimmings and Magnetic Clouds

12:45 B. Vrsnak: Aerodynamic Drag and Mass of Coronal Mass Ejections

13:00 - 14:15 LUNCH

### 14:15 V. PLASMA AND RADIO EMISSION PROCESSES (Chair: N. Gopalswamy)

14:15 D. Melrose – INVITED: Coherent Emission in Space Plasmas

14:40 J. Cecatto: CME-associated Radio Spectrum Observed at 1-2.5 GHz

14:55 V. Melnikov: Formation of Anisotropic Distributions of Mildly Relativistic Electrons in Flaring Loops

15:10 G. Thejappa: Localization of the Type III and Type II Radio Sources Using the Multiple Spacecraft Observations

15:25 R. MacDowall: Reexamining the Correlation of Complex Solar Type III Radio Bursts and Solar Energetic Particle (SEP) Events

BREAK

### VI. 3D RECONNECTION PROCESSES (Chair: C. Mandrini)

J. Gosling – INVITED: Magnetic Reconnection in Heliospace

K. Shibata: Discovery of Chromospheric Anemone Jets as Evidence of Ubiquitous Reconnection in the Solar Atmosphere

N. Lugaz: Importance of Magnetic Reconnection during the Aug 24 2002 CME

S. Dasso – INVITED: Magnetic Helicity Content in Solar Wind Flux Ropes

A. Satya Narayanan: Alfvén Waves in a Gravitational Field with Flows

A. Nulsen: Lower Hybrid Wave Properties in Heliospheric Environments

Adjourn

Evening

## Wednesday, September 17

EXCURSION All day

## Thursday, September 18

### 9:00 VI. 3D RECONNECTION PROCESSES, continued (Chair: B. Vrsnak)

9:00 H. Karimabadi – INVITED: Recent Advances in Understanding of Magnetic Reconnection

9:25 L. Vlahos – INVITED: Magnetic Energy Release

9:50 T. Zic: Signatures of Reconnection in the Post-CME Rays

10:05 N. Gopalswamy: The Global Solar Magnetic Field and MC structure

10:20 - 10:40 BREAK

### 10:40 VII. ENERGETIC PARTICLES IN THE HELIOSPHERE (Chair: D. Webb)

10:40 G. Zank – INVITED: Shock Theory

11:05 E. Cliver – INVITED: A Historical Introduction to Energetic Particles in the Heliosphere

11:30 J. Calogovic (Combined his & Svensmark talks): Cosmic Rays and Cloud Cover, & Forbush Decreases: No Change of Global Cloud Cover

12:10 S. Ferreira (Combined his & Heber's talks) – INVITED: Solar and Heliospheric Modulation of Cosmic Rays, & Theory of Cosmic Ray Modulation

13:00 - 14:15 LUNCH

14:15 A. Belov – INVITED: Forbush Effects and their Connection to the Solar, IP and Geomagnetic Phenomena

14:55 E. Eroshenko: Anomalous Forbush Effects from Remote by Longitude Solar Sources

15:25 I. Roth: Relativistic Terrestrial and Delayed Solar Electrons – Similarities and Differences

15:40 C. N. Arge – INVITED: Magnetic Flux Transport in the Heliosphere

16:05 -16:30 BREAK

### 16:30 VIII. HELIOSPHERE BOUNDARIES, INTERFACES & SHOCKS (Chair: J. D. Richardson)

16:30 R. MacDowall (McComas's talk) – INVITED: The Interstellar Boundary Explorer (IBEX): Imaging the Global Heliospheric Interaction

16:55 T. Terasawa – INVITED: Astronomical Shocks

17:20 A. DeLucas: Multi-spacecraft Observations to Study the Shock Propagation in the Inner Heliosphere

17:35 Yu. Tsap: Generation and Propagation of Alfvén Waves in Solar Atmosphere

17:50 G. Livadiotis: The Maximum Magnetic Flux in an Active Region

18:05 Adjourn

*Evening*      **DINNER** (*Traditional food from Ioannina area with folk songs/dance*)

**Friday, September 19**

**IX. PLANETARY ATMOSPHERES, IONOSPHERES, MAGNETOSPHERES (Chair: J. Davila)**

- 09:00-09:15      L. Vieira: Longitudinal Anomaly in the Lower Stratospheric Temperature in Southern Hemisphere: Effects of Particle Precipitation in the Southern Hemisphere Magnetic Anomaly?
- 09:15-09:40      M. Galand – INVITED: Comparative Planetary Auroras
- 09:40-10:05      J. Grebowsky – INVITED: Planetary Ionospheres -Sources and Dynamic Drivers
- 10:05-10:20      O. Malandraki: Characteristic Signatures of Energetic Ions Upstream from the Kronian Magnetosphere as Revealed by Cassini/MIMI
- 10:20-10:35      G. Tisnado: Universal Euclidean Forms Emerging by Remote Sensing of the Sun-Earth System

**X. WAVES AND TURBULENCE IN HELIOSPACE (Chair: A. Nindos)**

- 10:35-11:00      R. Vainio – INVITED: Particle Acceleration and Turbulence in Heliospheric Plasmas
- 11:00-11:25      S. Spangler – INVITED: Radio Remote Sensing of the Corona and Solar Wind
- 11:25-13:00      BREAK and POSTER VIEWING
- 13:00 - 14:15      LUNCH
- 14:15-14:40      F. Malara – INVITED: Energy Balance and Cascade in MHD Turbulence in the Solar Corona and in the Solar Wind

**XI. FLOWS, OBSTACLES, CIRCULATION (Chair: R. J. MacDowall)**

- 14:40-15:05      J. D. Richardson – INVITED: Flows and Obstacles in the Heliosphere
- 15:05-15:30      R. Forsyth – INVITED: 3-D View of the Heliosphere
- 15:30-15:55      T. Suzuki – INVITED: Evolution of Stellar Wind from the Sun to Red Giants
- 15:55-16:05      Closing Remarks, Publication Plan (N. Gopalswamy & D. Webb)
- END

## How Old is that Star?

The age of a star is fundamental in determining its physical state, yet the age cannot be measured directly and age-estimation techniques are imprecise and inadequate.

David R. Soderblom

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A recent symposium in Baltimore (1) brought together astronomers to examine the problems involved in estimating the ages of stars and groups of stars. Determining how long it has been since a star formed is a lot harder than it seems like it ought to be, and many very basic questions hinge on stellar ages. For instance, we'd like to know the ages of stars that have planets. We hope to detect signs of life on planets around other stars, but, if we do, knowing the star's age is central to interpreting what is observed. Among the youngest stars, we'd like to know how long it takes for planetary systems to form and evolve.

On a grander scale, the ages of stars and clusters of stars are needed to infer the history of our Milky Way galaxy and the pieces from which it was built. Did the halo of our Galaxy form on its own or from fragments of captured satellite galaxies? How about the thick disk (2): did it form after the halo or contemporaneously? Has the thin disk (of which the Sun is a member) formed stars continuously, or in episodes? Many very basic questions can only be addressed if we can establish reliable ages.

The physical state of a star – its size, temperature, and total energy output – are determined mainly by the star's mass, chemical composition, and age. Age is relevant because as a star gets older, nuclear reactions in its core alter the composition, leading to changes in the overall structure. We can directly

measure the masses of stars that have companions by applying Kepler's laws, and we can directly determine the surface composition of a star through careful analysis of its spectrum. But we can measure a precise and exact age for just one star: the Sun, and that's because we can analyze solar system material in the laboratory, something we can do for no other star. That makes the Sun's age fundamental, and the Sun's case is particularly important because it presents a well-constrained situation that can then be modeled to gain insight into the detailed physics of stellar interiors. Helioseismology provides critical information on the inside of the Sun, which is again available for no other star.

By calibrating models against the Sun, we can comprehend stars that are both more and less massive. Our understanding of the evolution of stars is closely tied to studying star clusters, groups of hundreds to thousands of stars that were formed together and so share the same composition and age. Or do they? Some of the most exciting astrophysics from the *Hubble Space Telescope* in the past few years has been the discovery of multiple populations within single globular clusters (3), which are some of the oldest components of the Milky Way. Given what we know today about stellar physics, the available explanations include multiple ages (i.e., several epochs of star formation spread well apart in time), very different compositions of the cluster's members, or both. Neither alternative works all that well to explain what is observed, and a very basic conundrum has been exposed.

Most stellar ages are model-dependent and generally have large uncertainties (at least 10–20%) with poorly-understood systematic effects. Relative ages are more believable, and that is why the globular clusters with multiple populations have been so intriguing. Some of the oldest stars in our Galaxy have ages estimated from the decay of thorium or uranium (4). In these cases the physics of the age determination is very well understood, but the derived age is that from when the

isotopes were formed, not necessarily the age of the star, and, in any case, the initial abundance of the element remains uncertain.

Other age-estimation methods are empirical: we can see a consistent relation between a physical quantity and age, but we do not understand the underlying physical relationship, even though we may have at least a reasonable scenario. For instance, stars like the Sun lose angular momentum with time. Convective stars (like the Sun) generate magnetic fields through the interaction of that convection with rotation, particularly differential rotation. That magnetic field can grip an ionized wind (like the solar wind) to a considerable distance, transferring angular momentum and leading to spin-down, a process we witness on the Sun. Barnes (5) has used clusters to calibrate the rotation-age relations for stars of different colors (a proxy for mass on the main sequence), resulting in a “gyrochronology.” A star’s magnetic field manifests itself as activity in various forms that can be observed, and activity can also be seen to decline with age and can be calibrated too (6). A fundamental problem with these age indicators is that they are best calibrated against clusters of stars because clusters offer many stars with well-determined ages, but older clusters are rare (due to Galactic forces that rend them) and it is the older stars we most want to get the ages of.

Asteroseismology may offer a solution. The European space mission Corot (7) and the soon-to-be-launched Kepler mission (8) of NASA are both obtaining ultra-precise measurements of variations in the brightness of solar-type stars at a level good enough to detect stellar oscillations. On an unresolved star (unlike the case for the Sun), only the lowest-order modes can be seen, but those modes penetrate the core of the star, the part that changes the most as a star ages and its core fuses hydrogen into helium. That makes asteroseismology a potentially powerful technique for deriving the ages of older stars. Such ages also depend on stellar models, but we believe those models are sound for solar-type stars, and the model dependence is very different than for other techniques.



Overall, the situation for determining stellar ages is still sobering and progress has been slow. It has reached the point where cosmologists claim better precision for their measurements than we can for the ages of the nearest and brightest stars. The challenge remains.

## Figure

This image shows a region of our Galaxy in the constellation of Scorpius. Some of the stars in the foreground (at a distance of about 400 light years) have been formed and have emerged from their enshrouding dust and gas within the past 1-2 Myr, making them among the youngest stars. In the lower left is Antares, illuminating material thrown out earlier from its own wind. The blue star at the top is  $\tau$  Ophiuchi, a massive, young star. The globular cluster in the lower right, Messier 4, is much further away (7,200 light years) and yet is one of the closest globulars. It happens to lie in the same line of sight, and it is among the oldest objects at an age of about 13 Gyr. Each of these kinds of stars and clusters poses particular problems in determining an age. [An image can be seen at [http://www.seds.org/messier/more/m004\\_rho.html](http://www.seds.org/messier/more/m004_rho.html)]

## References

1. International Astronomical Union Symposium 258, *The Ages of Stars*, Baltimore, MD, 13 to 17 October 2008.
2. G. Gilmore, R. F. G. Wyse, K. Kuijken, *Ann. Rev. Astron. & Astrophys.* **27**, 555 (1989).
3. L. R. Bedin, et al., *Astrophys. J.* **605**, L125 (2004).
4. C. Sneden, J. J. Cowan, R. Gallino, *Ann. Rev. Astron. & Astrophys.* **46**, 241 (2008).
5. S. A. Barnes, *Astrophys. J.*, **669**, 1167 (2007).
6. E. E. Mamajek & L. A. Hillenbrand, <http://arXiv.org/abs/0807.1686> (2008).
7. M. H. Montgomery, *Science* **322**, 536 (2008).
8. J. Christensen-Dalsgaard et al., <http://arXiv.org/abs/astro-ph/0701323v1> (2007).
9. IAU Symposium 258 was supported in part by the International Astronomical Union, the U.S. National Science Foundation, the Space Telescope Science

Institute, and the Las Cumbres Observatory Global Telescope Network. The proceedings will be published by Cambridge University Press.

**Meeting number:** Symposium 258

**Meeting title:** The Ages of Stars

**Dedication:**

None

**Location:** Baltimore, Maryland USA

**Dates of meeting:** October 13 through 17, 2008

**Number of participants:** 155

**Represented countries:**

Australia, Belgium, Brazil, Canada, Chile, Denmark, France, Germany, India, Italy, Japan, Korea, The Netherlands, Poland, Romania, Spain, Sweden, Switzerland, United Kingdom, United States

**Report submitted by:**

David R. Soderblom

Chair, Scientific Organizing Committee

Baltimore MD USA

October 31, 2008

IAUS

# “The Ages of Stars”

Symposium 258 of the International Astronomical Union

Science

Program

# Table of Contents

<b>Welcome.....</b>	<b>4</b>
<b>Scientific and Local Organizing Committees.....</b>	<b>4</b>
<b>Program schedule (block diagram).....</b>	<b>5</b>
<b>Daily Agenda.....</b>	<b>7</b>
<b>Information for Participants.....</b>	<b>13</b>
<b>Information for Presenters.....</b>	<b>17</b>
<b>Oral Presentations: Monday, October 13.....</b>	<b>21</b>
<b>Oral Presentations: Tuesday, October 14.....</b>	<b>35</b>
<b>Oral Presentations: Wednesday, October 15.....</b>	<b>49</b>
<b>Oral Presentations: Thursday, October 16.....</b>	<b>55</b>
<b>Oral Presentations: Friday, October 17.....</b>	<b>71</b>
<b>Poster abstracts.....</b>	<b>77</b>
<b>List of participants.....</b>	<b>109</b>

**Posters are listed in alphabetical order of the author.**

**Oral presentations have abstracts listed in the order of the schedule.**

# Welcome

Welcome to Baltimore! I have wanted to convene a conference on stellar ages for a very long time and I am pleased that all of you can now come to make that a reality. And I have also wanted to host a meeting in downtown Baltimore, "Charm City," where you will find many delights and diversions.

I have had the help of many people in bringing this together. Please join me in thanking all of them.

*David Soderblom*

## **Scientific Organizing Committee**

David R. Soderblom, Chair, Space Telescope Science Institute  
H. M. Antia, Tata Institute for Fundamental Research  
Nobuo Arimoto, National Astronomical Observatory of Japan  
Michael S. Bessell, Mount Stromlo Observatory, Australian National University  
Corinne Charbonnel, Observatoire de Geneve  
Vanessa Hill, Observatoire de Paris, GEPI  
Lynne Hillenbrand, California Institute of Technology  
Birgitta Nordström, Niels Bohr Institute  
Helio J. Rocha-Pinto, Universidade do Rio de Janeiro  
Eline Tolstoy, Kapteyn Astronomical Institute  
Don A. VandenBerg, University of Victoria  
Rosemary Wyse, Johns Hopkins University  
Manuela Zoccali, Universidad Católica de Chile

## **Local Organizing Committee**

Jeff Valenti, Chair  
Jay Anderson  
Luigi Bedin  
Tom Brown  
Katrina Exter  
Aaron Grocholski  
Roelof de Jong  
Jason Kalirai  
I. Neill Reid  
Massimo Robberto  
Eva Villaver

## **STScI Support Staff**

Darlene Spencer  
Pat Brown  
Catherine Riggs  
Karyn Keidel

	Monday, 2008 October 13	Tuesday, 2008 October 14	Wednesday, 2008 October 15	Thursday, 2008 October 16	Friday, 2008 October 17
8:30	Welcome and News				
8:45	<b>Soderblom</b>	News of the day	News of the day	News of the day	News of the day
9:00	<b>Wyse</b> The star formation history of the Milky Way	<b>Fernandez</b> Kinematic traceback and ages of stars.	<b>Sarajedini</b> Relative and absolute ages of globulars	<b>Salaris</b> White dwarf cosmochronology	<b>Lebreton</b> Ages from asteroseismology
9:30	<b>Fulbright</b> The Bulge of the Milky Way	<b>Deliyannis</b> Lithium depletion and age: models and observations	<b>Piotto</b> Multiple populations in old clusters	<b>Kalirai</b> White dwarfs as astrophysical probes	<b>Christensen-Dalsgaard</b> The Sun as a fundamental calibrator
10:00	Posters and Coffee	<b>Randich</b>	<b>Hidalgo</b>	<b>Catalan</b>	<b>Vauclair</b>
10:30	Posters and Coffee	Posters and Coffee	Posters and Coffee	<b>Richer</b>	Highlights 1: The younger population
11:00	<b>Feltzing</b> The age of the Galaxy's thick disk	<b>Pinsonneault</b> The ages of open clusters. I	<b>Yi</b> Theory of multiple populations	Posters and Coffee	Posters and Coffee
11:30	<b>Nordstrom</b> Disk heating in the Galactic thin disk	<b>Jeffery</b> The ages of open clusters. II	<b>Decressin</b> Ages of globulars in the context of self-enrichment	<b>Burgasser</b> Brown dwarfs as Galactic chronometers	<b>Hill</b> Ages of old stars from isotope decay
12:00	<b>Pipino</b> Time scales of chemical enrichment in the Galaxy	<b>Bragaglia</b>	<b>Mackey</b> Massive clusters in the Magellanic clouds	<b>West</b> Ages of M dwarfs	<b>Frebel</b>
12:30	Lunch	Lunch	adjourn	<b>Dupuy</b>	Highlights 2: Older and low-metal stars
13:00	Lunch	Lunch	Lunch	Lunch	Farewell
13:30	Lunch	Lunch	Lunch	Lunch	
14:00	<b>Gallart</b> Star formation history of the Magellanic clouds	<b>Stassun</b> Eclipsing binaries as tests of stellar models		<b>Barnes</b> Gyrochronology	
14:30	<b>Tosi</b> Star formation histories of resolved galaxies	<b>Dotter</b>		<b>Melbom</b>	
15:00	<b>Bernard</b>	<b>Meynet</b> Models for Population I stars		<b>Inwin</b> Angular momentum evolution of low-mass stars	
15:30	Posters and Coffee	<b>Catalanida</b>		<b>Mamaeek</b> The evolution of activity on solar-type stars	Afternoon at STScI
16:00	<b>Palla</b> Pre-main sequence evolutionary models	Posters and Coffee	Excursions: Waiters and Aquarium	Posters and Coffee	
16:30	<b>Hillenbrand</b> Observations of low-mass PMS and ZAMS stars	<b>Stetson</b> CMDs: a homogeneous calibration		<b>Demarque</b> The solar abundance mixture and its effects	
17:00	<b>Jeffries</b>	<b>Chaboyer</b> Models of low-metal stars		<b>Guinan</b> The Sun in time	
17:30	<b>Naylor</b>	<b>Catalan</b> Ages of evolved low-mass stars: HB and beyond		<b>Burke</b> Ages of stars known to host planets	
18:00	<b>Meyer</b> Obs. constraints on planet system formation	<b>Grand</b> adjourn		<b>Cacciari</b> GAIA	
	adjourn	adjourn		adjourn	



# Daily Agenda

All oral presentations are in the Corinthian Room. Posters and refreshments are in the Marble Room.  
Times indicated are start times.

## Sunday, October 12, 2008

### Opening reception

19:00 Opening reception for all participants and companions; Marble Room

## Monday, October 13, 2008

### Opening

8:30 Symposium opening and welcome. News and announcements.  
8:45 David Soderblom Some problems in studying the ages of stars

### Session 1: The Milky Way and nearby galaxies

#### Session Chair: Guido De Marchi

9:00 Rosemary Wyse The star formation history of the Milky Way  
9:35 Jon Fulbright The Bulge of the Milky Way  
10:10 *poster viewing and refreshments*  
10:55 Sofia Feltzing The age of the Galaxy's thick disk  
11:20 Birgitta Nordström Disk heating in the Galactic thin disk  
11:50 Antonio Pipino The timescales of chemical enrichment in the Galaxy  
12:25 *lunch*

#### Session Chair: Carla Cacciari

14:00 Carme Gallart The star formation history of the Magellanic Clouds  
14:25 Monica Tosi Star formation histories of resolved galaxies  
15:00 Edouard Bernard Variable stars as tracers of population gradients  
15:15 *poster viewing and refreshments*

### Session 2: Ages of pre-main sequence and zero-age main sequence stars

#### Session Chair: Michal Simon

16:00 Lynne Hillenbrand Models and observations of low-mass PMS and ZAMS stars  
16:50 Robin Jeffries Measuring age spreads in star-forming regions and young clusters  
17:20 Tim Naylor New methods for determining the ages of PMS stars  
17:20 Michael Meyer Observational constraints on the formation and evolution of planetary systems  
17:50 *adjourn*

# Tuesday, October 14, 2008

## Opening

8:45 David Soderblom Announcements and news of the day

## Session 3: Ages of young stars (continued)

### Session Chair: Andrea Dupree

9:00 David Fernández Using ages and kinematic traceback: the origin of young local associations  
9:25 Con Deliyannis Lithium depletion and age: Models and observations  
10:00 Sofia Randich On the use of lithium to derive the ages of stars like our Sun  
10:15 *poster viewing and refreshments*  
10:55 Marc Pinsonneault The ages of open clusters: I  
11:30 Elizabeth Jeffery The ages of open clusters: II  
12:05 Angela Bragaglia BOCCE: A large, homogeneous sample of Galactic open clusters  
12:20 *lunch*

## Session 4: Models of stars and tests of models

### Session Chair: Sylvie Vauclair

13:55 Keivan Stassun Eclipsing binaries as tests of stellar evolution models  
14:25 Aaron Dotter Globular cluster ages: The case of 47 Tucanae  
14:40 Georges Meynet The current state of stellar models for Population I  
15:15 Annalisa Calamida Near-infrared photometry of the Galactic globular NGC 3201  
15:30 *poster viewing and refreshments*  
16:10 Peter Stetson Color-magnitude diagrams: a homogeneous calibration  
16:45 Brian Chaboyer Models of low-metallicity stars  
17:15 Márcio Catelan The ages of evolved low-mass stars: the HB and beyond  
17:50 Leo Girardi The ages of AGB stars  
18:05 *adjourn*

# Wednesday, October 15, 2008

## Opening

8:45 David Soderblom Announcements and news of the day

## Session 5: Globular clusters and old open clusters

### Session Chair: Rosie Wyse

9:00 Ata Sarajedini Relative and absolute ages of globular clusters  
9:25 Giampaolo Piotto Observations of multiple populations in globulars and old clusters  
10:00 Sebastian Hidalgo Recovering the ages of stars in a complex population system  
10:15 *poster viewing and refreshments*  
10:55 Suhyoung Yi Multiple populations in simple stellar populations: Theory  
11:30 Thibaut Decressin The ages of Galactic globulars in the context of self-enrichment  
11:55 Dougal Mackey Massive star clusters in the Magellanic Clouds  
12:30 *adjourn*

## Optional activities

14:00 Talk and tour: Walters Art Gallery  
14:00 Tour: National Aquarium in Baltimore

# Thursday, October 16, 2008

## Opening

8:45 David Soderblom Announcements and news of the day

## Session 6: White Dwarfs

### Session Chair: Robert Rood

9:00 Maurizio Salaris White dwarf cosmochronology: Techniques and uncertainties  
9:35 Jason Kalirai White dwarfs as astrophysical probes  
10:00 Silvia Catalán Stellar chronology with white dwarfs in wide binaries  
10:15 Harvey Richer Ages of stars clusters from cooling white dwarfs  
10:30 *poster viewing and refreshments*

## Session 7: Brown Dwarfs

### Session Chair: Michael Liu

11:10 Adam Burgasser Brown dwarfs as Galactic chronometers  
11:35 Andrew West Using magnetic activity and Galactic dynamics to constrain the ages of M dwarfs  
12:00 Trent Dupuy Confronting substellar evolutionary models with stellar ages  
12:15 *lunch*

## Session 8: Age-related properties of solar-type stars

### Session Chair: Fred Walter

13:45 Sydney Barnes Gyrochronology and the rotational evolution of cool stars  
14:15 Sören Meibom Relationships between age, rotation, and mass using open clusters  
14:30 Jonathan Irwin The angular momentum evolution of low-mass stars  
15:00 Eric Mamajek The evolution of activity on solar-type stars  
15:35 *poster viewing and refreshments*  
16:05 Pierre Demarque The solar abundance mixture: Effects on atmospheric structure and dynamics  
16:40 Ed Guinan The Sun in time  
17:10 Chris Burke The ages of planet-hosting stars  
  
17:35 Carla Cacciari The promise of GAIA and how it will influence stellar ages  
18:10 *adjourn*

## Conference banquet

19:00 conference banquet

# Friday, October 17, 2008

## Opening

8:45 David Soderblom Announcements and news of the day

## Session 9: Asteroseismology; the Sun

### Session Chair: Jeff Valenti

9:00 Yveline Lebreton Ages from asteroseismology  
9:35 J. Christensen-Dalsgaard The Sun as a fundamental calibrator of stellar evolution  
10:10 Sylvie Vauclair Stellar ages from asteroseismology: a few precise cases

## Session 10: Nucleochronology; Wrap-up

### Session Chair: John Stauffer

10:25 Vanessa Hill Ages of old stars from isotope decay  
10:50 Anna Frebel The age of HE 1523-0901 from elemental abundances  
11:15 *poster viewing and refreshments*  
11:50 Marc Pinsonneault Symposium highlights 1: The younger population  
12:10 Robert Rood Symposium highlights 2: Older and low-metal stars  
12:25 *farewell*

## An afternoon at the Institute

13:00 buses leave for STScI  
14:30 HST servicing and the status of SM4, STScI Auditorium  
15:15 The promise of JWST and its current status, STScI Auditorium  
16:00 Director's tea, STScI Cafeteria  
17:30 buses leave STScI to return to hotel



# POST MEETING REPORT FORM

for meetings other than Joint Discussions and Special Sessions

Deadline for Submission: within 1 month after the meeting

**the following information should be sent  
to the IAU Assistant General Secretary**

The following documents should be attached:

- i Final Scientific Program
- ii List of participants
- iii List of recipients of IAU Grants, including amount and country
- iv Receipts signed by the recipients of IAU Grants (This does not apply to Scientific Meetings held during General Assemblies)
- v Brief report (text.txt file or word.doc) to the Executive Committee on the scientific highlights of the meeting (1-2 pages)

1. Meeting Number: 259
2. Meeting Title: Cosmic Magnetic Fields: from Planets to Stars and Galaxies
3. Dedication of meeting (if any): -
4. Location (city, country): Puerto Santiago, Tenerife, Spain
5. Dates of meeting: 3 – 7 November 2008
6. Number of participants: 151
7. List of represented countries: Australia, Austria, Brazil, Canada, Chile, China Nanjing, China Taipei, Czech Republic, Finland, France, Germany, Israel, Japan, Mexico, Netherlands, Poland, Romania, Russia, Spain, Sweden, Switzerland, UK, USA.
8. Report submitted by: K-G Strassmeier
9. Date and place: Potsdam, 13 December, 2008
10. Signature of SOC Chairperson:

## Preface

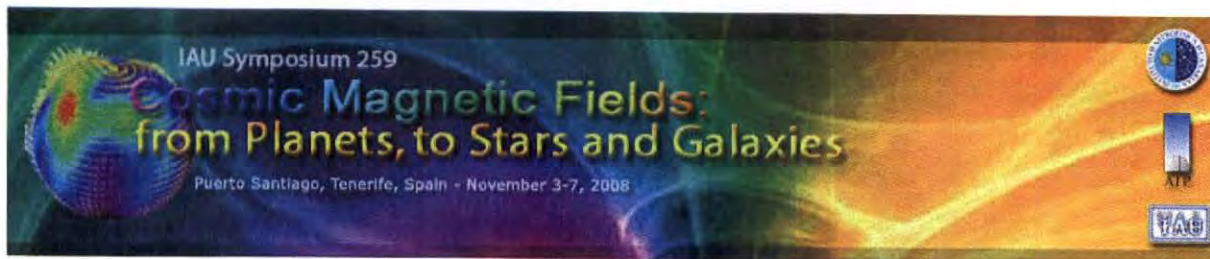
Understanding of the Universe is impossible without understanding cosmic magnetic fields, which span the enormous range of 24 magnitudes in strength and play a key role in the formation, structure and evolution of planets, stars and galaxies, and possibly the entire universe. Numerous active phenomena are associated with magnetic energy release. Magnetic fields of celestial bodies have now been studied for hundred years since the discovery of the first extraterrestrial magnetic field by George Ellery Hale in 1908, but the origin and evolution of cosmic magnetic fields is still an open question for fundamental physics and astrophysics alike. It becomes more and more clear that, despite the enormous differences in scales, the basic mechanisms of generation of magnetic fields, their evolution and dynamics may be quite similar.

The topic of this Symposium touched 10 out of 12 IAU Divisions, and is certainly of great interest to a broad astronomical community. Thus, the goal of this Symposium was to hold interdisciplinary sessions of the fundamental properties of cosmic magnetism, from planets and stars to galaxies and the early universe. This provided an interdisciplinary forum for exchange of new results, ideas, and future plans, which will help to better understand the magnetic effects in various objects. For example, the origin of a star's magnetic field is always related to the pre-existence of a seed field already in existence during star formation. The seed field is most likely the galactic magnetic field and its full understanding requires concerted stellar and galactic structural investigations.

The scientific topics of this Symposium covered today's most critical aspects of cosmic magnetism and included talks on magnetic fields in star-forming regions, the multi-scale field of the Sun and its interior, heliospheric and interplanetary fields, the Earth's magnetic field, surface fields of cool and hot stars and of degenerate objects, planetary-nebulae and Supernovae shaping by magnetic fields, jet and accretion-disk fields of very young stars, fields around black holes and magnetars, the magnetic field and dynamo of spiral galaxies, the primordial field of the early universe and, finally, instrumentation and techniques for measuring magnetic fields across all wavelengths, from the ground and space, with particular emphasis on two future facilities; the E-ELT and the SKA.

The Sun is certainly our Rosetta stone when it comes to magnetic-field studies in the entire universe. Solar magnetism is being studied in great details, from global fields of the interior by helioseismology, to the smallest resolved and even unresolved scales by new large solar telescopes from ground (GREGOR, ATST, SST and others) and from space (SOHO, *Hinode*, RHESSI, SDO, STEREO). However, in recent years the connections between the solar-physics community and night-time astronomy were pushed in the background partly due to increased emphasis on so-called "grant challenges" in cosmic vision programmes. Our Symposium not only restored and strengthened these links but established a new connection; the star-exoplanet relation. Much as a stellar wind can influence a planet, a magnetized planet may also have an impact on the stellar atmosphere. Enhanced stellar activity may result as a consequence of such a feedback interaction. However, much theoretical and observational work is required to detail this hypothetical interaction but it has the potential to impact on how we believe life has formed on Earth and other planets. In any case, we are keen to predict that the 21st century will become the century of cosmic magnetic-field research.

*Klaus Strassmeier, Alexander Kosovichev and John Beckman, co-chairs SOC,  
Potsdam, Stanford, La Laguna, January 1, 2009*



## Program

### Saturday, Nov. 1

17:00-20:00 Registration, Hotel lobby

### Sunday, Nov. 2

17:00-20:00 Registration and poster mounting

19:00 Welcome reception near Hotel lobby, offered by the Hotel

### Monday, Nov. 3

9:00-9:30 Welcome/Introduction (J. Beckman/ K.G. Strassmeier)

#### Session 1: Interstellar magnetic fields, star-forming regions, and the death valley

*Chair: Takahiro Kudoh (a.m.), Elisabete de Gouveia Dal Pino (p.m.)*

9:30-10:00 Measuring ISM magnetic fields by radio polarization (R. Beck)

10:00-10:30 Measuring ISM fields using pulsars (A. Noutsos)

10:30-11:00 *Coffee*

11:00-11:30 Orion: the structure of a magnetized HII region (G. Ferland)

11:30-12:00 Role of magnetic fields in emerging paradigms of shaping and launching Planetary Nebulae (E. Blackman)

12:00-12:15 Magnetic fields in AGB stars and (proto-) Planetary Nebulae (F. Herpin)

12:15-12:30 The magnetic field structure in the multi-source magnetized core NGC 2024 FIR 5 (F. O. Alves)

#### *Lunch*

14:30-15:00 The role of magnetic fields in Supernovae (H. Spruit)

15:00-15:15 Probing interstellar magnetic fields with Supernova remnants (R. Kothes)

15:15-15:30 A galaxy dynamo by Supernova-driven interstellar turbulence (O. Gressel)

15:30-16:00 *Coffee*

#### Session 2: Multi-scale magnetic fields of the Sun; their generation in the interior, and magnetic energy release

*Chair: Nigel O. Weiss*

16:00-16:30 Magnetic fields and dynamics in the Sun's interior (A. Kosovichev)

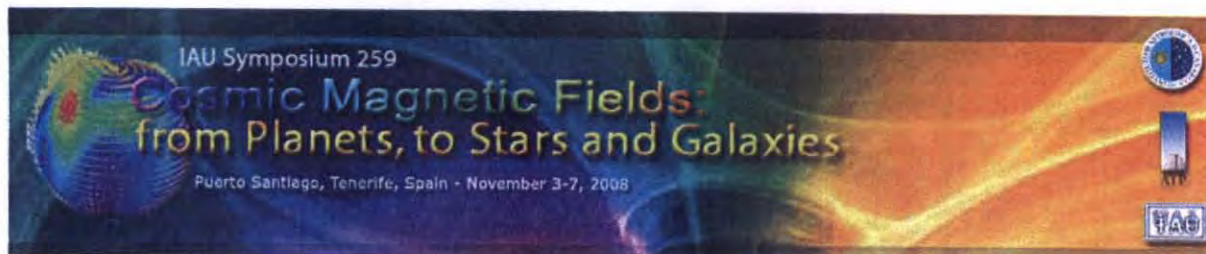
16:30-17:00 Paradigm shifts of the solar dynamo (A. Brandenburg)

17:00-17:30 Magnetic instabilities in stellar physics and in the laboratory (G. Rüdiger)

17:30-17:45 On the relation between photospheric magnetic fields and chromospheric emissions in the quiet Sun (M. Loukitcheva)

17:45-18:00 Impact of large-scale magnetic fields on stellar structure and evolution (V. Duez)





## Tuesday, Nov. 4

- 9:00-9:30 Magnetic flux emergence and solar eruptions (F. Moreno-Insertis)  
 9:30-10:00 Magnetic reconnections and energy release on the Sun and solar-like stars (L. van Driel-Gesztelyi)  
 10:00-10:30 The second solar spectrum and the hidden magnetism (J. Stenflo)  
 10:30-11:00 *Coffee*

### Session 3: Planetary magnetic fields and the formation and evolution of planetary systems and planets: exoplanets

*Chair: Karl-Heinz Glassmeier*

- 11:00-11:30 The role of a magnetic fields for planetary formation (A. Johansen)  
 11:30-12:00 Planetary dynamos: differences and similarities to stellar dynamos (P. H. Roberts)  
 12:00-12:30 The Jupiter-Io system (Yi-Jiun Su)  
*Lunch*
- 14:30-15:00 The role of intrinsic magnetic fields in the evolution and habitability of planets: planetary protection aspects (M. Khodachenko)  
 15:00-15:15 The effect of stellar magnetic braking on the evolution of close-in extrasolar planets orbiting main-sequence stars (A. Barker)  
 15:15-15:30 Feedback of the magnetic field of a close-in exoplanet to the star (U. Motschmann)  
 15:30-16:00 *Coffee*  
 16:00-18:00 *Poster talks I (see separate program)*

## Wednesday, Nov. 5

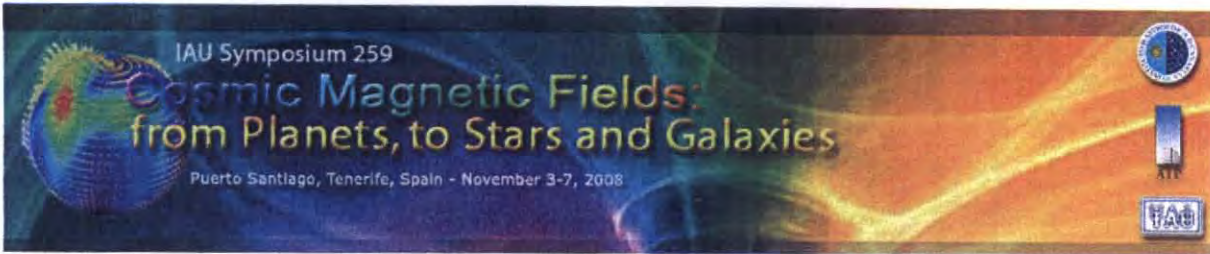
### Session 4: Stellar magnetic fields: cool and hot stars

*Chair: Svetlana Hubrig*

- 9:00-9:30 The basic role of magnetic fields in stellar evolution (A. Maeder)  
 9:30-10:00 Observational evidence for magnetic fields across the H-R diagram (S. Berdyugina)  
 10:00-10:15 Magnetic field observations of massive stars (G. Wade)  
 10:15-10:30 Magnetic field observations of very-low-mass stars (A. Reiners)  
 10:30-11:00 *Coffee*  
 11:00-11:30 Measuring T-Tauri star magnetic fields (C. Johns-Krull)  
 11:30-11:45 Magnetic coronae of active main-sequence stars (M. Jardine)  
 11:45-12:00 Starspots – signatures of stellar magnetic activity (K. G. Strassmeier)  
 12:00-12:30 Magnetic fields in White Dwarfs and direct progenitors (S. Jordan)

*Lunch*

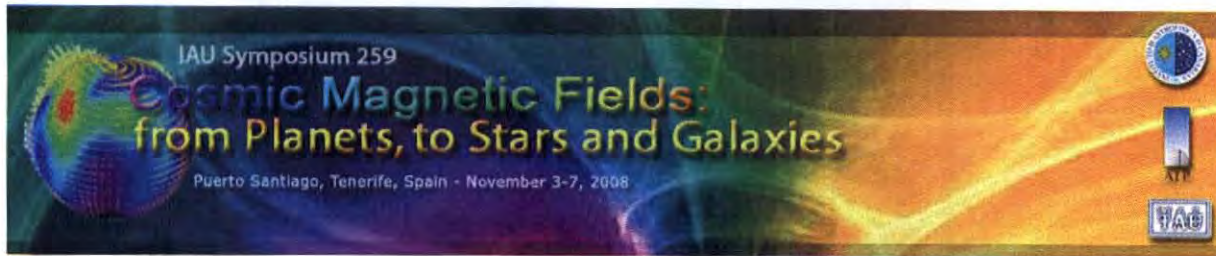
*15:00 Afternoon excursion*



**Thursday, Nov. 6**

16:30-18:00 **Poster talks II (Chair: John Beckman)**

- 16:30-16:35 *M. Auriere*: Direct detection of a magnetic field at the surface of slowly rotating giant stars: are all giants magnetically active?
- 16:35-16:40 *S. Hubrig*: Magnetic fields in O-type stars measured with FORS1 at the VLT
- 16:40-16:45 *G. Hussain*: The evolving surface magnetic field of T Tauri stars
- 16:45-16:50 *A. Lebre*: HD232862: a magnetic and Lithium-rich bright giant field star
- 16:50-16:55 *P. Petit*: Magnetic geometries of Sun-like stars: exploring the mass-rotation plane
- 16:55-17:00 *V. Petit*: Is the wind of the Oe-star HD 155806 magnetically confined?
- 17:00-17:05 *Y. Masada*: Solar-type magnetic reconnection model for magnetar giant flare
- 17:05-17:10 *B. Ruiz-Granados*: A study of the large-scale structure of the galactic magnetic field
- 17:10-17:15 *A. Kepley*: Magnetic fields in irregular galaxies
- 17:15-17:20 *M. Krause*: Interplay of CR driven wind, magnetic field, and galactic dynamo in spiral galaxies
- 17:20-17:25 *S. Trifourki*: Galactic nature versus nurture - morphological moulding through magnetic fields
- 17:25-17:30 *A. B. Meinel*: Evidence of a magnetic sheath around a jet from NGC 6543
- 17:30-17:35 *E.A. Karitskaya*: The magnetic field in the X-ray binary Cyg X-1
- 17:35-17:40 *J. Gil*: Surface magnetic fields in Pulsars
- 17:40-17:45 *I. Ilyin*: Spectropolarimetry with PEPSI at the LBT: accuracy vs. precision in magnetic field measurements
- 17:45-17:50 *H. Balthasar*: A full-Stokes polarimeter for the GREGOR Fabry-Perot interferometer
- 17:50-18:00 "Contingency"



## Poster-Session Program

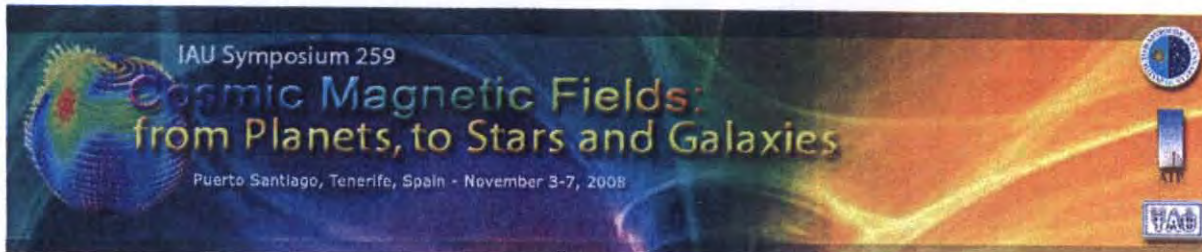
**Tuesday, Nov. 4**

16:00-16:30 **Poster preview (Chair: Moira Jardine)**

*Powerpoint-slide show at 1 minute per slide. Presenters must provide a single ppt page to the organizers well in advance of the presentation. 30 posters in total, "first come, first served".*

16:30-18:00 **Poster talks I (Chair: Rainer Beck)**

- 16:30-16:35 *A. Fletcher:* Dynamically dominant magnetic fields in the diffuse interstellar medium
- 16:35-16:40 *L. Harvey-Smith:* Faraday rotation measures in Supernova remnants
- 16:40-16:45 *E.M. De Gouveia Dal Pino:* Turbulence and star formation triggering by SNe
- 16:45-16:50 *P. Dobbie:* New global 3D MHD simulations of disk accretion and outflows around Black Holes
- 16:50-16:55 *M. G. Petr-Gotzens:* On the enigmatic radio emission from the young massive star  $\theta^1$  Orionis A
- 16:55-17:00 *A. P. Sarma:* Observations of magnetic fields toward S88B and NGC 6334
- 17:00-17:05 *R. Arlt:* Stability of magnetic fields in neutron stars
- 17:05-17:10 *C.G. Bernal:* Accretion & magnetic field submergence in neutron star surface
- 17:10-17:15 *E. M. de Gouveia Dal Pino:* Magnetic reconnection in accretion disk systems: from black holes to neutron stars and YSOs
- 17:15-17:20 *I. Kitiashvili:* Prediction of solar magnetic cycles by data assimilation methods
- 17:20-17:25 *M. Steffen:* Near surface radiative magneto-convection simulations for the Sun and a metal-poor solar analog
- 17:25-17:30 *M. L. Demidov:* The Sun as a magnetic star: on the manifestation of different surface structures in disk-integrated observations
- 17:30-17:35 *S. Koutchmy:* Isolated quasi-axisymmetric solar spots
- 17:35-17:40 *D. N. Della-Giustina:* A re-evaluation of the role of magnetic fields during planet formation in the early solar system
- 17:40-17:45 *N. Dzyurkevich:* 3D global MHD simulations of the proto-planetary disks with the dead zone
- 17:45-17:50 *R. Kuiper:* Radiative Magneto-hydrodynamics in prestellar core collapse towards massive star formation
- 17:50-18:00 "Contingency"



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International Astronomical Union  
**First Middle East Africa, Regional IAU Meeting**  
**Cairo, Egypt, April 5-10, 2008**  
مؤتمر الشرق الأوسط وأفريقيا الإقليمي الأول للاتحاد الدولي الفلكي



## **I- General Information of the meeting**

- 1-**Title of the meeting:** First Middle East Africa, Regional IAU Meeting
- 2- **Meeting website:** <http://www.mearim.cu.edu.eg>
- 3-**Venue and dates:** Cairo Egypt, April 5-10, 2008
- 4-**Total number of participants:**121
- 5- **The nationalities which have been attending** are 40Nationalities as follows:  
Afghanistan, Algeria, Argentina, Armenia, Azerbaijan, Bahrain, Canada, Czech Republic, Egypt, France, Georgia, Germany, Greece, India, Iraq, Israel, Italy, Jordan, Kenya, Lebanon, Lesotho, Libya, Morocco, Netherlands, Nigeria, Poland, Portugal, Qatar , Russian Federation, Rwanda, South Africa, Sudan, Tunisia, Turkey, United Arab Emirates , Ukraine, United Kingdom, United States of America, Zimbabwe.
- 6-**Main organizing body:** IAU
- 7-**Supporting Organizations:**
  - a- International Astronomical Union (IAU): amount of 25000 CHF as a grant distributed during the meeting for the applicants
  - b-Cairo University (CU): cover the registration fees of 4 participants from Cairo University.
  - c-Academy of Scientific Research and Technology (ASRT): cover the Internet facilities in the meeting room during the meeting
  - d- National Research Institute of Astronomy and Geophysics (NRIAG): cover the registration fees of 8 participants from NRIAG.
  - f- Computer Centre (SCC /CU): cover the meeting website publication in the centre server.
- 8-**Scientific Program** of Middle East and Africa IAU Regional meeting :
  - S1-Galaxies and Universe
  - S2-Space Astronomy and High Energy Astrophysics.
  - S3-Probing Solar and Stellar interiors
  - S4-The Dynamic Sun and Heliosphere
  - S5-Astronomical Data Management, Handling, Processing and Software
  - S6-Ground and Space Instrumentations and Telescopes
  - S7-Astronomical Research and Education in MEA countries, IYA and IHY activities.
  - S8-Training courses for young ME and Africa astronomers
  - S9-Presentation of National Astronomical Activities and suggested Programs

**9-Scientific Organizing Committee (list members):** Ali Ajabshirizadeh (Iran), Athem Alsabti (Iraq), C. Hassan Basurah (Saudi Arabia), Volker Bothmer (Germany), Catherina Cesarsky (France), Dirk Callebaut (Belgium), N. Guessoum (U.A.Emirates), Ahmed Hady (Chair, Egypt), Mouner Hamdy (Egypt), Ali Hussien (Kuwait), Tarek Hussain (Egypt), Abebe Kebede (Ethiopia), Atila Ozguc (Turkey), Amory-Mazaudier (France), Franco Porcelli (Italy), Nour Raouafi (Tunisia), Georgia Tsiropoula (Greece), Jaime Vilinga (Angola), M. I. Wanas (Egypt), Brian Warner (South Africa), David Webb (USA)

**10- Invites Speakers:** Catherine Cesarsky, R. C. Kraan-Korteweg: Kevin Krisciunas, Okkie de Jager, Franco Pacini, S. Khalil, Laurent Gizon, D.Callebaut, Mark Miesch, J-P Rozelot, S. K. Solanki, Giannina Poletto, A. Ozguc, J. M. Pasachoff , A. W. Alsabt, S. Koutchmy , P. Niarcho, M. I Wanas, V. Bothmer , Pedro Russo, K. Govender, N. Brosch,, E. S. BABAYEV, Ahmed Hady, Rosa M. Ros, S. Koutchmy , C. Ödman, Christine Amory-Mazaudier , Naoufel Ben Maaouia

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## **II- Meeting Closing Session and recommendations**

### **1<sup>st</sup> statement:**

Declaration on the Iraq Observatory at the first Middle East-African Regional Meeting of the International Astronomical Union, Cairo, April 2008

The participants of the first MEARIM, comprising representatives from 40 countries of the Middle East and Africa, have discussed the situation of the damaged observatory on Mount Korek in Iraqi Kurdistan. This is an ambitious observatory, comprising a 3.5 meter optical telescope, a 1.25 meter telescope, and a 30meter for millimeter wave length Radio Telescope. The participants consider that such an observatory would be an important asset for the development of astronomy in the Middle East & Africa Region. The participants recommend that:

- a) A mission of experts to be organized to assess the state of the installations and evaluate the cost of bringing it to working conditions, as well as the cost of operating it. The Iraqi National Academy of Science could organize such a team from the International Scientific Community, Iraq and the Middle East to carry out this assessment, with the help of the International Astronomical Union (IAU) and other relevant regional and international organizations
- b) It is hoped that the result of this mission is such as to encourage the rebuilding of the Observatory, that means be found, at the Iraqi national level, and/or at the regional level,/and/or at the international level, to reconstruct the Observatory, provided that security conditions can be guaranteed by Iraqi officials
- c) The participants of MEARIM request that the IAU helps monitoring the evaluation of the present state of the Observatory and support the search for means to rebuild it.

## **2nd statement:**

About MEARIM Group in IAU

The Meeting participants from 40 countries agreed to initiate a new working group at IAU Called “middle East and Africa Working group” .Such group would be useful in developing education and astronomy in MEA.

Driven by MEA delegates – request Hady from Egypt as first chair, and Philip A. Charles from South Africa as a co-chair

The members of the office of WG will be as follows:

- 1- Ali Hussain Abdullah (Kuwait )
- 2- Ajabshirizadeh Ali (Tabriz, Iran)
- 3- Athem W Alsabti ( UK, Iraq )
- 4- Salman Jabor Althani (Qatar )
- 5- Abdel latif Amine( Tunisia )
- 6- Walid J. Azzam (Bahrain )
- 7- Shafi Nebiha Bedru, (Ethiopian)
- 8- Segun Olawale Bolaji (Nigeria)
- 9- Noah Brosch ( Israel )
- 10- Kevin Govender (South Africa )
- 11- Ocker C de Jager (South Africa)
- 12- Susan Murabona Oduori (Kenya )

## **3rd statement**

1. IYA2009

- a. Suggested approach
  - i. National point of contact / Champion
  - ii. National Steering Committee
  - iii. Email List (National and Regional)
  - iv. Status of Astronomy Survey
  - v. National plan
  - vi. Regional Plan
- b. Important to prepare for many opportunities that are already available
- c. In Africa:
  - i. Request for support from ICSU Africa

## **4th statement**

About the Next MEARIM

The Meeting participants from 41 countries agreed that the next MEARIM would be held in South Africa during year 2011,

## **5th Statement**

IAU president Catherine Cesarsky notes:

- 1 Great presentations –
- 2 good inter community sharing (solar, stellar, galaxy, etc)
- 3 Good IYA presentations
- 4 Suggestions for cooperation and collaborations , access to telescopes (SA, Israel, others)
- 5- Working Group needs to be well structured, and does not necessarily need to be under the aegis of IAU It could:
  - i. Draw a list of existing infrastructure, performances and access
  - ii. Technical know how throughout continent.
  - iii. Education and Outreach
- 6- Thanks to organizers, in particular Ahmed Hady



# Report of the 10<sup>th</sup> Asian-Pacific Regional IAU Meeting

From August 3<sup>rd</sup> through 6<sup>th</sup>, 2008, the 10<sup>th</sup> Asian-Pacific Regional IAU Meeting (APRIM) has been successfully hosted in Yun'An Hotel of Kunming in Yunnan Province, China. Details of the meeting are as follows:

## A. Meeting Program

### 1. The opening ceremony

Opening ceremony of the 10<sup>th</sup> APRIM started from 8:30 a.m. on August 3<sup>rd</sup>, 2008. Prof. Yan LI, Chair of the Local Organizing Committee and Director of Yunnan Astronomical Observatory, presided the opening ceremony; Prof. Gang ZHAO, Chair of the Scientific Organizing Committee and President of the Chinese Astronomical Society, addressed the opening, introducing the organization, themes, meaning and function of this meeting. Vice mayor of Kunming city, Ms. Xiaoshan LIAO and Deputy Director-General of Department of Science and Technology of Yunnan Province, Mr. Jianhua WANG were invited for the welcome speech. At last, Vice-President of IAU, Prof. Cheng FANG presented a speech representing IAU.

### 2. Plenary session

The plenary session was hosted on August 3<sup>rd</sup>, 2008. Through the one-day session, 12 world-renowned experts from Australia, Canada, China, China/Taipei, India, Japan, South Korea, Russia and United States presented invited talks covering status and development of astronomy in China, science and technology of FAST project, International Year of Astronomy in 2009, the supernovae legacy survey, ultraviolet universe, report of the HINODE observations, virtual observatory program developed in China and India, quasar spectroscopy, panchromatic spectral energy modeling of starburst galaxies, extragalactic stellar astronomy, large scale structure formation of the universe, frontier astrophysical problems from Taiwan, etc.

### 3. Parallel sessions

On August 4<sup>th</sup> and 5<sup>th</sup>, there were 8 parallel sessions held simultaneously, including 32 invited talks, 106 contributed talks and 80 posters. The distribution of parallel talks is as follows:

Session	1	2	3	4	5	6	7	8
Invited talk	4	4	4	4	4	4	4	4
Contributed	20	10	18	9	19	17	2	11
Poster	11	8	29	7	5	8	5	7

## B. Participants

**1. 108 participants from 17 countries other than China (including Hongkong) and China/Taipei**

Country	Number	Country	Number	Country	Number
Australia	7	India	9	Philippine	1
Azerbaijan	1	Indonesia	11	Russia	6
Brazil	2	Iran	1	South Korea	8
Canada	3	Japan	39	Thailand	1
Chile	1	Malaysia	5	United States	7
Great Britain	2	New Zealand	4		

**2. 16 participants from Hongkong SAR and China/Taipei**

Region	Number	Region	Number
Hongkong	4	China/Taipei	12

**3. 154 domestic participants from 22 institutes and universities in China**

Institute	Number	Institute	Number
National Astronomical Observatories	11	Nanjing University	10
Beijing Planetarium	2	Nanchang University	1
Yunnan Astronomical Observatory	9	Nanjing Institute of Astronomical Optics & Technology	2
Purple Mountain Observatory	3	University of Science and Technology of China	4
Peking University	6	University of Technology of Xiamen	1
Guangxi University	2	Urumqi Observational Station	2
Shanghai Astronomical Observatory	14	Huazhong Normal University	2
Tsinghua University	2	Jinan University	1
Shandong University at Weihai	1	Institute of High Energy Physics	1
National Time Service Center	1	Xiamen University	1
Zhanjiang Normal University	1	Yunnan Astronomical Observatory	77

**4. Total: 278 participants**

**C. Fund and Budget**

**1. Fund Raising (unit: 10,000RMB)**

- 1) National Astronomical Observatories: 15.0
- 2) National Natural Science Foundation of China: 12.0

- 3) Bureau of International Cooperation of the Chinese Academy of Sciences: 12.0
- 4) Department of Astronomy, Nanjing University: 1.0
- 5) Department of Astronomy, Peking University: 1.0
- 6) College of Physics, Guangzhou University: 1.0
- 7) Department of Astronomy, Beijing Normal University: 0.8
- 8) Department of Astronomy and Applied Physics, University of Science and Technology of China: 0.5

**Total: 43.3**

## **2. Registration Fee**

- 1) Foreign participants:  $88 \times 300\text{USD/person} = 26,400\text{USD} = 6.9 \times 26,400\text{RMB} = 182,160\text{RMB}$
- 2) Participants from Hongkong SAR and China/Taipei:  $13 \times 300\text{USD/person} = 3,900\text{USD} = 6.9 \times 3,900\text{RMB} = 26,910\text{RMB}$
- 3) Domestic graduate students:  $36 \times 1,100\text{RMB/person} = 39,600\text{RMB}$
- 4) Domestic participants:  $25 \times 2,200\text{RMB/person} = 55,000\text{RMB}$

**Total: 303,670RMB**

## **3. Expenditure of the 10th APRIM**

- 1) Accommodation and travel of IAU representative, SOC members and invited speakers of the plenary session:  $25 \times 3,000\text{RMB}$  (2,000 for hotel and 1,000 for food etc.) = 75,000RMB
- 2) Accommodation and travel of invited speakers of parallel sessions:  $32 \times 3,000\text{RMB}$  (2,000 for hotel and 1,000 for food etc.) = 96,000RMB
- 3) Accommodation and travel of invited speakers of volunteers and service personal:  $34$  (30 volunteers and 4 service personal)  $\times 1,600\text{RMB}$  (600 for hotel and 1,000 for food etc.) = 54,400RMB
- 4) Food and travel of participants and families, totally 205:  $144$  (participants)  $\times 1,000\text{RMB}$

+ 43 (participants from Yunnan Astronomical Observatory)×600RMB + 18 (families)×  
800RMB = 184,200RMB

- 5) Rental fee of conference venues and facilities: 48,000RMB
- 6) Souvenir: 86RMB×400 = 34,400RMB
- 7) Handbook and materials: 40RMB×350 = 14,000RMB
- 8) Network maintenance: 20,000RMB
- 9) Organization cost: 30,000RMB
- 10) Labor fee: 30,000RMB
- 11) Other expenses: 12,000RMB

**Total: 598,000RMB**

#### **4. Supporter organization**

Kunming Tengchi Conference Service Company has provided the arrangement of accommodation and travel, organization service, logistics support service, etc., for a successful meeting.

#### **5. IAU grant allocation**

- 1) IAU grant: 25,000CHF
- 2) Grant allocation: 22,660CHF were distributed to 45 participants, 44 of whom were on the IAU supporting list, while the Co-Chair of the SOC, Prof. Narlikar was newly approved.
- 3) There were 7 applicants on the IAU supporting list not attending the meeting, including 2 from India, 1 from Thailand, 2 from Vietnam, 1 from Uzbekistan and 1 from Iran.
- 4) Rest of the IAU grant: 2,340CHF were applied to help support the participations of 31 student volunteers from Yunnan Astronomical Observatory and some other unexpected costs for meeting organization and materials.

### **D. Experiences and Difficulties**

#### **1. Features of the meeting**

- 1) Attendance ratio of participants at parallel sessions was quite high, resulting in active and warm discussions and communication during questions and coffee break.

- 2) Volunteers meticulously took charge of meeting service organizations, so that talks and discussions in parallel sessions were in good order.
- 3) Talking parties in the evening provided a relaxed and friendly platform for participants to chat and discuss, to make friends and exchange ideas.
- 4) The ratio of young astronomers and graduate students among participants was relatively high, which realized the purpose to provide the youth with more opportunities to learn and communicate.

## **2. Difficulties in organization**

106 candidates who had registered the meeting online did not reply to the confirmation mails from LOC, thus caused numbers of problems in organization, especially in hotel and food reservation, material preparation, conference venue arrangement, picking-up at the airport, meeting schedule, etc.

Meeting	Number of attendees	From countries	Total IAU grant awarded (CHF)	Number of IAU grant recipients	From countries	IAU grants as fraction of number of attendees
IAUS 251	162	24	25,000	23	16	14.20%
IAUS 252	110	19	25,000	23	13	20.91%
IAUS 253	218	21	25,000	21	13	9.63%
IAUS 254	236	35	25,000	14	12	5.93%
IAUS 255	154	24	25,000	23	11	14.94%
IAUS 256	152	27	25,000	53	15	34.87%
IAUS 257	101	26	25,000	37	15	36.63%
IAUS 258	155	20	25,000	19	7	12.26%
IAUS 259	151	23	25,000	30	13	19.87%
<b>Symposia Total</b>	1439	47	225,000	243	44	16.89%
MEARIM	121	40	25,000	25	16	20.66%
APRIM	278	19	25,000	51	11	18.35%
<b>Totals</b>	1838	49	250,000	319	47	17.36%

Meeting	251	252	253	254	255	256	257	258	259	Total	08	Ratio of grants
Host Country	China Nanjing	China Nanjing	USA	Denmark	Italy	UK	Greece	USA	Spain		Contributi	on to contribution
Attendees Country												
Argentina			2500	1610			1000+1200			6310	7600	83.03%
Australia				1935		3*250				2685	22800	11.78%
Austria		1200								1200	3800	31.58%
Azerbaijan						2*1050				2100	0	
Brazil	2*1000	1000	2410		290+1150+1665+1910	250+700+800	240+528		1100	14043	7600	184.78%
Bulgaria				1610			2*700		800+1400	5210	3800	137.11%
Canada		1000	1100							2100	38000	5.53%
Chile						500		2*1212		4324	7600	56.89%
China – Nanjing	500	500		1610	1665		530			4805	53200	9.03%
China – Taipei	500									500	7600	6.58%
Colombia	3*1000								1200	4200	0	
Croatia							3*530			1590	3800	41.84%
Czech Republic		500	930						500	1930	15200	12.70%
Denmark								940		940	15200	6.18%
Egypt	1000									1000	15200	6.58%
Finland							1000		400	1400	7600	18.42%
France		400+500+1200	1200+2330		2*400	3*250		404+2*2020	400+800	12824	76000	16.87%
Georgia							530			530	0	
Germany		1900	500+2*1100		400	250			400+500	6150	76000	8.09%
Greece							500+3*530+720			2810	15200	18.49%
India	2*1000+2*1300			1775		800				7175	22800	31.47%
Israel		1000	2*1400			1050				4850	11400	42.54%
Iran							530		1500	2030	3800	53.42%
Italy	1000	2*800+3*1500	450			3*250		1212+1435+2020		12967	76000	17.06%
Japan	1000		550			250				1800	76000	2.37%
Korea (South)				1610		500				2110	7600	27.76%
Latvia					790+1315					2105	3800	55.39%
Mexico	1500									1500	15200	9.87%
Nepal							530			530	0	
Netherlands		3*1000			2*400					3800	38000	10.00%
New Zealand			1500							1500	7600	19.74%
Poland	900+1000									1900	15200	12.50%
Portugal		500								500	7600	6.58%
Romania									400	400	3800	10.53%
Russia		1200		1775	1000+1050+1150	4*530+1137	1137+5*530+620+695+500		3*400+860+3*1000	20094	38000	52.88%
Slovakia	1000	2*1000					300+390			3690	3800	97.11%
South Africa						250				250	15200	1.64%
Spain				800	400			2*1212+2020+404		6068	22800	26.61%
Sweden	1000									1000	15200	6.58%
Switzerland		400	1000	1935			310			3645	15200	23.98%





## PUBLICATION OF 2008 PROCEEDINGS by CUP

IAUS	Date of Symposium	ISBN	Expected on-line date
251	18-22 February	9780-521-88982-7	03 October 2008
252	10-14 March	9780-521-88983-4	16 October 2008
253	19-23 May	9780-521-88984-1	<i>27 March 2009</i>
254	9-13 June	9780-521-88985-8	<i>23 March 2009</i>
255	16-20 June	9780-521-88986-5	11 December 2008
256	28 July - 1 August	9780-521-88987-2	<i>15 April 2009</i>
257	5-9 September	9780-521-88988-9	<i>31 March 2009</i>
258	13-17 October	9780-521-88989-6	<i>30 April 2009</i>
259	3-7 November	9780-521-88990-2	<i>31 May 2009</i>