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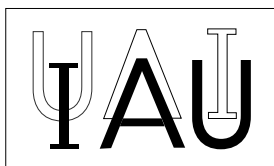
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Preface

The organization of this Symposium was first motivated by the fact that nowadays connecting astrophysical theory, observations, simulations and laboratory astrophysics is widely appreciated by the scientific community. In this respect this symposium was an important occasion to discuss recent observational, theoretical and experimental efforts in understanding the basic plasma processes in the Universe, with broad synergies among many areas of astrophysics, including the origin and dynamics of magnetic fields in astrophysical systems (the dynamo problem), the origin of x-ray emitting coronas and the role of magnetic reconnection, acceleration of charged particles, winds and jets from highly-evolved stars and supernova remnants, plasma radiation processes, turbulence of the magnetized plasma in astrophysical objects and in the interstellar and intergalactic media and the solar wind, quantum plasmas under extreme conditions in planetary interiors and in exotic stars, and other key problems in modern plasma astrophysics.

The most important goal of the symposium was therefore to bring together experts from plasma physics, MHD, laboratory experiments and numerical simulation communities. In fact, plasma astrophysicists have always been a fairly small group, often distinct from the main astrophysical community, holding their own workshops and special sessions at plasma physics conferences. Despite the identification of a rich class of physical problems of mutual interest, the plasma physics and astrophysics communities remain, for the most part, quite detached, with different societies and memberships, conferences and journals. This Symposium contributed to promote links and cooperation between these communities, to discuss the recent advances in understanding the fundamental plasma physics processes and their application to interpretation and understanding of phenomena observed in astrophysical plasmas at various scales. Despite the wide range of temporal and spatial scales and conditions the basic physics of these phenomena is often very similar. Therefore, it was a unique occasion to discuss these issues together.

Undoubtedly, such discussions and exchange of ideas from different fields have led to a better understanding of the basic mechanisms of many observational phenomena, their origin, structure and dynamics, and will guide future astrophysical observing programs, as well as theoretical and numerical modeling and laboratory experiments in plasma astrophysics. Such interdisciplinary and cross-discipline discussions become increasingly important as they provide a special opportunity to get a broader view of the field and new ideas about methodologies and approaches. This aspect is particularly crucial for younger researchers because the learning curves in various sub-disciplines become steeper and steeper. For this reason during the Symposium, in addition to traditional review and contributed talks covering outstanding observational and theoretical problems of astrophysical plasmas, considerable time was devoted to exciting discussions at the end of each day session.

We would like to dedicate this meeting to Stirling Colgate, Gerhard Haerendel, Jumber Lominadze, Don Melrose, and Lucio Paternò, who made outstanding contributions to the field of plasma astrophysics.

It is also a great pleasure to acknowledge the financial support of our sponsors listed on page *xvi* of these Proceedings and the active support of the members of the LOC for performing so efficiently and enthusiastically the numerous tasks always associated with such a big meeting. In particular, our sincere thanks go to his competent and patient approach of Christian Napoli who helped the participants solving technical/computer problems, Gabriella Caniglia, Fatima Rubio da Costa and Enrico Corsaro who took care of the

logistics of participants, Paolo Romano for his editorial work, to Elisabetta Palumbo, Luigia Santagati, Corrado Trigilio and Grazia Umana for assisting the participants in their numerous needs.

We also acknowledge the professional contribution made by Rainer Arlt who took the photos we published in this volume.

Finally, a special mention must be given to Daniela Recupero, whose professional skills and human gifts have been essential ingredients for the success of this meeting.

Unfortunately, a sad news arrived while we were finishing the editing of this volume, which we cannot help referring. Ilkka Tuominen, a close friend, a brilliant scientist and a mentor for many who attended the meeting, passed away in March 2011, leaving us astonished but at the same time grateful for the great heritage of human and scientific talents he left us. He attended this meeting with his usual enthusiasm and curiosity, providing the LOC with moral support and nice jokes.

We will all miss him. Ciao Ilkka.

Alfio Bonanno, Alexander Kosovichev and Elisabete de Gouveia Dal Pino, editors and co-chairs SOC

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Stirling Colgate

In 2010 Stirling Colgate has turned 85. His career has spanned more than 60 years, starting as a PhD student in physics at Cornell University and working at Lawrence Livermore and New Mexico Institute of Mining and Technology. After the success of Bravo Test in 1950s, the first deliverable thermonuclear bomb, he was encouraged to begin research on thermonuclear fusion and plasma physics. Many of his scientific successes, however, have been realised at the Los Alamos National Laboratory where he arrived in 1976, joining the Theoretical Division.

He is recognized for negotiating the cessation of high-altitude and outer space nuclear tests. Colgate also has inspired the inertial fusion and astrophysics programs at Los Alamos and Lawrence Livermore and contributed basic science to fusion ignition and burn, plasma confinement and shock wave physics. In 2006 he has been awarded the Los Alamos Medal.



Stirling Colgate (right) and Alfio Bonanno

Jumber Georgievich Lominadze

September 20, 2010, was the 80th birthday of Jumber Georgievich Lominadze, one of the leading plasma astrophysicists, founder of the Plasma Astrophysics Center in Georgia, Head of the Center for Space Research, and Academician of the Georgian National Academy of Sciences. Jumber Lominadze was born in 1930 in Tbilisi. After the graduation from Moscow University in 1955 he worked at the Russian (Ural) Nuclear Center. In 1958 he returned to Tbilisi, and actively participated in the development of plasma physics and nuclear fusion research at the Georgian Institute of Physics. His studies were focused on the propagation and absorption of cyclotron waves in plasma, and were published in book 'Cyclotron Waves in Plasma' (Metsnierba, Tbilisi, 1975; Pergamon Press, Oxford, 1981). In 1976 he founded the Plasma Astrophysics Center, which under his leadership became one of the leading world-class research center. He actively developed international collaborations, and organized a series of legendary conferences, workshops, and schools on plasma astrophysics, which play very important role in the development of this field. He developed the electromagnetic theory of electron-positron plasma, which was used to explain mechanisms and properties of Crab pulsar radiation in different bands and other fundamental processes. More recently, he and his colleagues studied the physics of accretion disks, jets, resonance transformation of oscillations, excitation of waves by vortices, dynamical processes in shearing flows and instabilities in rotating plasma. For more than 40 years he has been teaching at Tbilisi University, and supervised the research of more than 20 PhD students. His former students now form a core of the Georgian Plasma Astrophysics school. On behalf of the IAUS 274 participants we sincerely congratulate Professor Jumber Lominadze on his 80th birthday and wish him all the best for the coming years.



Jumber Lominadze with his son Georgi

Gerhard Haerendel

Born in 1935, he graduated in Physics from the university of Munich in 1963. He is considered a pivotal figure in the European exploration of space, having more than 30 year of experience in space research, including the function of P.I. of several international rocket and satellite projects. His pioneering work opened a new view towards understanding of plasma in space and its interaction with the solar wind, small-scale magnetic reconnections events, high-beta plasma blobs in the magnetosphere and the in situ confirmation of reconnection, and fundamental theoretical works on basic plasma processes. He was recently awarded Jean Dominique Cassini Medal.



Gerhard Haerendel and Masaaki Yamada

Donald Melrose

Professor of Theoretical Physics since 1979, Donald Melrose made specific contributions to the theory of plasma emission and its application to solar radio burst, the theory of elector cyclotron maser emission and its application to planetary and the theory of pulsar radio emission. He is recognized as one of the leading experts of kinetic theory of plasmas, plasma instabilities and nonlinear processes with application in various fields of astrophysics.



Don Melrose (left) and Rainer Beck

Lucio Paternò

Professor at University of Catania since late 1960s, apart from a short parenthesis at Catania Astrophysical Observatory, Lucio Paternò is an outstanding figure in the Italian and international scene. His scientific activity encompasses astronomical photoelectric photometry, Solar site testing, Space physics and solar and stellar physics, in particular helioseismology and asteroseismology. He is a member of the French Academy of Sciences as well as member of the Accademia Gioenia of Natural Sciences of Catania.



Enrico Corsaro (left), Lucio Paternò (center), and Christian Napoli (right)



A table at the social dinner. From the right: Jim Drake, Klaus Strassmeier, Lucio Paternò, Alex Lazarian, Bob Rosner, Guenther Ruediger, Ilkka Tuominen, Jim Stone, Andrey Beresnyak



The LOC



Group picture

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Address of the Director of Catania Astrophysical Observatory

I am happy to give you my warmest welcome to Giardini-Naxos to attend the meeting on Plasma Astrophysics. Giardini-Naxos is today a known touristic place with a beautiful shore and a very long history. Naxos was the most ancient of all the Greek colonies in Sicily, founded in 735 BC by a body of colonists from Chalcis in Euboea. The coins of Naxos, which are of fine workmanship, may almost all be referred to the period from 460 BC to 403 BC, which was probably the most flourishing in the history of the city. In 403 BC, Dionysius of Syracuse determined to turn his arms against the Chalcidic cities of Sicily. He sold all the inhabitants of Naxos as slaves and destroyed both the walls and buildings of the city.

As known, the Greek culture has been particularly relevant for the development of the Sicilian culture. And, last night thinking about what to say today, I had a dream: a meeting was held in the same place where we are now but in 450 BC. I saw Empedocles (a great Sicilian philosopher/scientist, ca. 490-430 BC), a progenitor of the actual organizer. Empedocles philosophy is best known for being the originator of the cosmogenic theory of the four classical elements: air (the gaseous state), water (the liquid state), earth (the solid state) and fire (the fourth state that today we call Plasma). In the dream Empedocles/Alfio organized, exactly here, a meeting on the fire/plasma. I wish (and I am pretty sure that) we all are worthy of the great history that is at the root of this land. Have a great meeting and enjoy your stay in Sicily!

*Gianni Strazzulla, Director of Catania Astrophysical Observatory
Giardini-Naxos, September 2010*