

# **29th International Cosmic Ray Conference**

**August 3 - 10, 2005, Pune, India**

Organized by the

**Tata Institute of Fundamental Research**

Navy Nagar, Colaba , Mumbai, MH-400005

at the

**National Centre for Radio Astrophysics,  
Inter-University Centre for Astronomy & Astrophysics  
and University of Pune, Pune**

Under the auspices of the

**International Union of Pure & Applied Physics (IUPAP)**

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Tata Institute of Fundamental Research  
Homi Bhabha Marg, Navy Nagar, Colaba,  
Mumbai, MH-400005, India  
Tel : +91-22-22804545 ; Fax : +91-22-22804610  
E-mail : [icrc2005@icrc2005.tifr.res.in](mailto:icrc2005@icrc2005.tifr.res.in)  
Web : <http://icrc2005.tifr.res.in>

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## PREFACE

The 29th International Cosmic Ray Conference was held at the campus of the University of Pune at Pune during August 3 - 10, 2005. The conference was organized by the Tata Institute of Fundamental Research, Mumbai with active support from the National Centre of Radio Astrophysics, the Inter-University Centre for Astronomy and Astrophysics and the University of Pune. The conference was held under the auspices of the International Union of Pure and Applied Physics and was co-sponsored by a large number of Indian national organizations and research institutions.

The scientific program for the conference followed the traditional structure of the past ICRC's of three parallel sessions for the oral presentation of papers, classified under the headings, HE, OG and SH. A record number of 1225 abstracts were received from about 650 presenting authors by the deadline of April 30, 2005. Most of these abstracts were accepted for presentation at the conference.

In view of limited time available for oral presentations and poster displays during the first 6 days of the conference, it was decided by the Scientific Program Sub-Committee of the NOC to limit the presentation time to 12 minutes for each 'oral' paper and the display time to 2 days for a set of papers selected for 'poster' presentation. Following the decisions taken by the C4 Commission in the past, it was also decided to place the following restrictions: (a) only one paper was allowed for 'oral' presentation to a presenting author, and (b) a maximum of three papers were allowed for presentation by a presenting author at the conference. These guidelines led to a selection of 312 papers for SH, 408 papers for OG and 480 papers for HE sessions. Of these papers, 112, 156 and 185 papers were assigned for 'oral' presentation in SH, OG and HE sessions respectively. The papers assigned for 'poster' presentation were divided into two sets, the first set was on display in the 'Poster pandal' during August 4 and 5 and the second set was on display during August 8 and 9.

In view of the availability of the submitted papers on the internet, the C4 Commission on Cosmic Rays had decided at Tsukuba in August 2003 to change the procedure for the publication of the Proceedings of the 29th ICRC. It was decided to publish the papers actually presented at the conference as Proceedings of the 29th ICRC, soon after the conference. This new procedure allowed the presenting authors to submit the manuscripts of their papers or confirming abstracts up to the deadline of June 30, 2005, just about a month before the conference, for their inclusion in the scientific program of the conference. More importantly, the new procedure allowed the authors to update their papers right up to the time of the conference and even up to 2 weeks after the conference to submit an updated version of their paper for inclusion in the Proceedings of the conference, significantly improving their scientific value for the cosmic ray community. The very large number of contributory papers presented at the conference in Pune have been published in a set of 9 volumes with the papers divided among the 3 main topics as follows: Volumes 1 and 2 (SH papers), Volumes 3, 4 and 5 (OG papers) and Volumes 6, 7, 8 and 9 (HE papers).

Following the tradition, the Hess memorial lecture was delivered as a public lecture on August 4, 2005, by the well-known and distinguished cosmic ray physicist, Prof. Gaurang Yodh of the University of California at Irvine. In addition, a special 'Einstein' session, open to the general public, was organized on August 5 to celebrate and commemorate the centenary of the 'Miracle year' of 1905 which saw the presentation of revolutionary ideas by Albert Einstein. These ideas catalysed many new developments in physics and yielded a better and deeper understanding of many physical phenomena observed during the 19th and 20th centuries. Four lectures were given during the Einstein session highlighting various aspects of the new developments in physics with links to the ideas presented by Einstein in the 'Miracle Year' and the following years, by distinguished experts in the field of General Relativity, Field Theory and Cosmology,

Prof. Jayant Narlikar (IUCAA, Pune), Prof. T. Padmanabhan (IUCAA, Pune), Prof. Spenta Wadia (TIFR, Mumbai) and Prof. Arnold Wolfendale (University of Durham, Durham) U.K.

The year 2005 is also the 60th year of the founding of the Tata Institute of Fundamental Research at Mumbai by the very eminent theoretical cosmic ray and particle physicist, Prof. Homi J. Bhabha, in June 1945 with support from the Dorabji Tata Trust led by the well-known industrialist and philanthropist, Shri J.R.D. Tata and the then Government of Bombay. As the first Director of the Institute during the formative years, 1945-66, Prof. Bhabha provided dynamic and inspiring leadership to the young physicists and mathematicians in the Institute which led to the flowering of research in various aspects of cosmic rays in the Institute. A special 'Homi Bhabha' public lecture was organized to honour the memory and contributions of Prof. Bhabha to cosmic ray and particle physics which was given by the very distinguished neutrino physicist, Prof. Alessandro Bettini of the Universita di Padova and Istituto Nazionale di Fisica Nucleare at Padova, Italy on 'Neutrino Physics and Astrophysics', a subject of great topical interest in astro-particle physics, cosmic rays and cosmology.

In view of the fact that a few major experiments started taking data in the recent past, a few others completed a major part of the analysis of data taken over many years, some were close to the completion of their instrumentation phase and ready for launch and some groups are planning very ambitious and new experiments, a large number (14) of talks were arranged, spread over the first 6 days of the conference, for 'highlighting' recent achievements, successes and plans. For example, several new and very interesting results were reported by the HESS and Pierre Auger collaborations in their 'highlight' lectures. Exciting observations with Voyager 1 beyond the termination shock in the heliosphere were presented in another 'highlight' talk. Several important results were reported by the AMANDA, GMRT, GRAPES, L3+C and MILAGRO collaborations who have been analysing their data taken over many years. The achievements of challenging milestones were reported by the AMS and PAMELA collaborations. Recent advances in scientific ballooning were highlighted by the CREAM collaboration which achieved remarkable success in having a very long duration flight in the Antarctica. Some details of very ambitious and challenging new projects were presented by the Indian colleagues, for example, the India-based Neutrino Observatory and the High Altitude Gamma Ray Observatory at Hanle (4250m) in the Ladakh region, adjoining Tibet.

The last day of the conference, August 10, was devoted to the presentation of the 9 rapporteur talks by well-known experts, covering all aspects of cosmic ray physics and astrophysics discussed by the authors of the contributory papers during the conference and highlighting the significant results obtained since the last conference. This volume (no. 10) of the Proceedings of the 29th ICRC contains all the review, highlight and rapporteur papers received up to the deadline which was considerably extended right up to December 24, 2005 to accommodate the special needs of the contributing authors to a great extent. Volume 10 also lists all the major collaborations and their members along with their institutions and the references to their papers in the Proceedings. A list of the names of the pre-registered or registered participants and their e-mail addresses is also given in this Volume. Finally, a comprehensive author index to all the papers contained in the volumes 1 to 10 is given at the end of the Volume 10.

We are very thankful to all the authors of the contributed papers and the distinguished experts for providing us their manuscripts for these 10 volumes and for sorting out the occasional formatting problems. A special thanks is due from the NOC to the distinguished scientists for giving excellent lectures during the Hess, Einstein, Homi Bhabha and Rapporteur sessions. The contents of all the 10 volumes of the Proceedings are available on-line at the website of the ICRC 2005, <http://icrc2005.tifr.res.in/>.

It is well-known that the 29th ICRC was held in a time of great weather disturbance over western India, including Mumbai and Pune. The Mumbai international airport, the gateway to India used by most of the participants to reach Pune, received 944 mm of rain within 24 hours on July 26, leading to severe flooding and closure of the airport for almost 48 hours. As the recovery was in progress, another 200 mm of rain fell over Mumbai on July 31, causing severe dislocation of air traffic to and from Mumbai again over

the next few days. While most of the participants braved through the disturbed conditions to reach Pune, some of them late by as much as a few days, we regret that some of our colleagues could not travel to Pune due to flight cancellations and very adverse and exaggerated reports in the world news media. The members of the local organizing committee tried to do their best to minimize the hardship suffered by the participants during their travel to Pune and during the early days of their stay in Pune. We are indeed very thankful to all the participants for their encouraging and understanding attitude and their contributions towards creating a cheerful environment which was very conducive for a successful scientific and social program during the conference. In view of the absence of some participants at the conference due to flight cancellations and other difficulties, the guidelines about the number of oral/poster presentations by collaborating authors were suitably relaxed to enable the presentation of papers which were to be presented by participants who could not reach Pune in time, despite their best efforts. Such papers have also been included in the Proceedings of the conference.

The members of the National Organizing Committee are thankful to the members of the International and the National Advisory Committees for their valuable suggestions and comments over various aspects of the scientific program and other matters related to the organization of the ICRC 2005. A special thanks is due to Prof. Peter Wenzel, Chairman of the C4 Commission, who took great personal interest in the successful organization of the conference and gave very valuable advice whenever approached by the members of the Local Organizing Committee.

We also hope that all the participants were able to get some idea about the historical and cultural environment of Pune and surrounding areas through their direct interaction with people in Pune and through the excursion on Sunday, August 7 to the Champagne India winery, Giant Metrewavelength Radio Telescope (GMRT), Ojhar Ganpati temple and the Shivneri fort. A glimpse of Indian culture and traditions was given through the classical dance recitals arranged on the evening of August 6, covering the dance styles of two major classical dance schools in India. We also hope that the accompanying persons enjoyed the variety of programs and visits arranged for them, to the museums, temples, shopping areas, etc., covering different aspects of the life of common people in Pune. We were pleased with the response of the participants to the cuisines of different parts of India at the lunches served during the conference. It was nice to observe that some of the participants were able to utilize their visit to India for the ICRC 2005 for brief visits to the Ajanta caves and the Ellora temple near Pune and the famous Taj Mahal in Agra.

**B. Sripathi Acharya, Sunil Gupta, P. Jagadeesan,  
Atul Jain, S. Karthikeyan, Samuel Morris and Suresh Tonwar**

**December 2005**

**ICRC 2005 Proceedings Editorial Committee**