

## **A Brief Report on Bhaskara900**

Bhaskaracharya, a great Indian mathematician, was born in shalivahan shake 1036 that is 1114 AD. The shalivahan shake 1936, that is, 2014 AD, thus, marks the completion of 900 years to the birth of this great son of India. On this occasion the Vidya Prasarak Mandal, Thane decided to organise Bhaskara900: International Conference on the 900<sup>th</sup> Birth Anniversary of Bhaskaracharya in the year 2014. Once it was decided to arrange an international conference the group started thinking of suitable time span. Taking into account the festivals and vacations in India a time slot in the third week of September was considered suitable. With due considerations the duration of 19 to 21 September 2014 was finalised as conference dates. Once the dates were frozen the second task was to choose and appropriate venue for the conference. The Vidya Prasarak Mandal has recently set up an engineering college in the konkan region of the state of Maharashtra. This college, located in rural set up, was considered to be the suitable venue as it has state of art facilities. However, taking into account the difficulties encountered in travelling to this place from Mumbai the decision was taken against it. Finally, it was decided that the conference be held in the college campus at Thane and the lecture hall namely the Thorale Bajirao Peshave Sabhagruh be the venue of the conference.

For the proper planning of the conference an Advisory Committee was constituted in the initial stages itself. Academicians from different parts of the world engaged in conducting research associated with the work of Bhaskaracharya were invited to be the members of the committee. All of them gladly accepted to be the members of the Committee and took keen interest in the planning of the international conference. The names of Advisory Committee members are given below.

**Vijay Vasudev Bedekar**

Chairman, Vidya Prasarak Mandal, Thane

**Sreeramula Rajeswara Sarma**

Düsseldorf, Germany

**Michio Yano**

Professor, Kyoto Sangyo University, Kyoto, Japan

**Takao Hayashi**

Professor, Doshisha University, Kyoto, Japan

**K. Ramasubramanian**

Professor, Indian Institute of Technology, Mumbai

**Arvind P Jamkhedkar**

Mumbai, India

**Sudhakar Agarkar**

Dean, VPM's Academy of International Education & Research, Thane

In consultation with the members of the Advisory Committee the discussion themes of the conference were finalised. They were as follows:

1. Bhaskaracharya as a Poet
2. Lilavati
3. Bijaganita
4. Siddhantashiromani Ganitadhyaya
5. Siddhantashiromani Goladhyaya
6. Karaṇ akutihala
7. Translations of Bhaskaracharya's Works
8. Pedagogical Importance of Bhaskaracharya's Works

Suitable plenary speakers, as listed below, were then identified to speak on each of these themes.

Prof. S. M. Razaullah Ansari, Aligarh, India

Prof. Mohamad Bagheri, University of Tehran, Tehran, Iran

Prof. S. G. Dani, Indian Institute of Technology, Mumbai, India

Prof. Pierre-Sylvain Filiozat, Académie des Inscriptions et Belles-Lettres, Paris, France

Dr. Setsuro Ikeyama, Kyoto Sangyo University of Kyoto, Japan

Dr. A. P. Jamkhedkar, Mumbai, India

Dr. Toke Knudsen, State University of New York, Oneonta, USA

Prof. Takanori Kusuba, University of Economics, Osaka, Japan

Dr. Clemency Montelle, University of Canterbury, Christchurch, New Zealand

Dr. Kim Plofker, Union College, New York, USA

Dr. K. Ramasubramanian, Indian Institute of Technology, Mumbai, India

Dr. Sita Sundar Ram, Kuppuswamy Sastri Research Institute, Chennai, India

Prof. S. Balachandra Rao, Bharatiya Vidya Bhavan, Bengaluru, India

Prof. Sreeramula Rajeswara Sarma, Dusseldorf, Germany

Prof. M. D. Srinivas, Centre for Policy Studies, Chennai, India

Prof. M. S. Sriram, University of Madras, Chennai, India

Prof. Michio Yano, Kyoto Sangyo University, Kyoto, Japan

Announcement of the conference was a challenging task. Different groups are working on the literature created by Bhaskaracharya. It was necessary that all these groups receive intimation about the conference so that they can submit their proposals well in time. Appeal for participation in the conference was printed and mailed to a large number of academicians known to the members of Advisory Committee. Electronic mode of announcement came handy in this regard. Email messages were sent to different associations like Indian Association for the History of Mathematics (IAHM), National Council of Teachers of Mathematics (NCTM), Association of Mathematics Teachers of India (AMTI), different institutions like Kuppuswamy Research Institute, Chennai; Gandhi Centre for Science and Values, Bangaluru; Bhaskaracharya Pratishtan, Pune, etc. In addition, the conference announcement was uploaded to the website of the Vidya Prasarak Mandal, Thane ([www.vpmthane.org](http://www.vpmthane.org)). As a result, a large number of academicians in this field came to know about the conference. There was an overwhelming response to the appeal and the organizers received a large number of proposals. After going through them critically the Academic Committee of the conference approved 28 proposals for oral presentation during the conference. As mentioned earlier there were 17 plenary lectures to be accommodated in the conference. Hence the conference was arranged in two parts: Plenary lectures in the forenoon sessions and paper presentations in the afternoon sessions. To accommodate all the accepted papers, five parallel sessions were arranged in the afternoon sessions.

A formal Inaugural function was organized on the eve of the conference (that is on September 18) at Thorale Bajirao Peshave Sabhagruh in Thane College campus. The programme began with the lighting of a lamp in the hands of the dignitaries. Dr. Sudhakar Agarkar, Dean, VPM's Academy of International Education and Research described the genesis and outlined conference programme. Dr. Vijay Bedekar, Chairman, Vidya Prasarak Mandal delivered a welcome speech and formally welcomed the dignitaries on the dais. Prof S. R. Sarma described the background of the conference and expressed his wish that the deliberations would pave a way to long term collaboration among the academicians interested in the life and work of Bhaskaracharya. The Chief guest for the ceremony was Padmavibhushan Dr. Anil Kakodkar, a well known nuclear scientist of India. In his inaugural address he congratulated the Vidya Prasarak Mandal Thane, for taking the lead in arranging an international conference and expressed shock that no cognizance was taken at the government level to celebrate this occasion.

The proceedings of the conference began by a Key Note Address given by Prof. S. G. Dani, President Indian Association of the History of Mathematics (IAHM). In his key note address Prof. Dani referred to a long tradition of Mathematics in India and presented Bhaskaracharya as a gem in

this tradition. He went further to reiterate how Bhaskaracharya has contributed to the growth of mathematics through his profuse writing in 12<sup>th</sup> century. Followed by the key note address Prof. Ramasubramanian of the Indian Institute of Technology gave his plenary lecture on “Lila of Lilavati”. In his analytical lecture he discussed various places where Lila is visible in a famous book Lilavati. Taking the verses from original Lilavati he translated them into simple English and brought out the figure of speeches used by the author. This presentation was received very well. The last plenary lecture on the first day was given by Prof. Sita Sundar Ram of Kuppaswamy Sastri Research Institute, Chennai. She focused her attention on the second book written by Bhaskaracharya namely Bijaganita. Using a variety of verses from the book she tried to show how Bhaskaracharya was ahead of his contemporaries in the field of Algebra.

Two parallel sessions were arranged in the afternoon. The first session (IA and IB) incorporated the papers pertaining to Lilavati and Bijaganita. Three papers each were read in these sessions. Second parallel session (IIA and IIB) also included three presentations each pertaining to the themes of Lilavati and Bijaganita. After a day long academic deliberations a cultural programme was arranged for the benefit of participants. It was organised by the students of the Joshi-Bedekar College of Arts and Commerce. Under the guidance of their teachers the students attempted to present the cultural diversity existing in India through their performance. The unity in diversity was the main theme of the programme that was well received by the participants of the conference.

The second day began with a plenary lecture by Dr A. P. Jamkhedkar. His topic was “Learning and Patronage in 12<sup>th</sup> -13<sup>th</sup> century AD: Bhaskaracharya and Shandilya Family, A Case Study.” Referring to matters available on ancient stone carvings he came to the conclusion that there was a strong patronage to the pursuit of knowledge in ancient India. Even Bhaskaracharya and his relatives received patronage from different quarters of the society. The next plenary lecture of the day was by Prof. Pierre-Sylvain Filliozat, Emeritus Professor, Department of Sanskrit, University of Paris, France. The topic of his lecture was “The Poetical Face of Mathematical and Astronomical Works of Bhaskaracharya.” Through a variety of examples he attempted to bring out the poetical genius of Bhaskaracharya in composing matters related mathematical and astronomical concepts. The third plenary lecture that day was by Prof Sriram, University of Madras, Chennai who spoke on “Grahaganitadhya of Bhaskaracharya's Siddhantashiromani.” As the title suggests Prof Sriram attempted to narrate the mathematical formulae related to the motion of the planets described by Bhaskaracharya in his famous book Grahaganita.

Like the earlier day two parallel sessions were arranged in the post lunch session. The themes of these sessions were IIIA: Bhaskara as a Poet, IIIB: Karanakutuhala, IV A: Siddhantashiromani and VB: Pedagogic Importance. Total 12 paper-presentations were made in these sessions. Each presentation was followed by a thought provoking discussions. The evening of the second day was used for showing Lilavati through Bharatnatyam to the participants. It was conceived and presented by the dance group of the Rishi Valley School at Madanapally in Andhra Pradesh. The group presented a novel act. After reading a verse from Lilavati the students would convert the problem into live actions and solve them through discussions. This mode of problem solving was appreciated by all the participants of the conference. The dance group, thus, received an appreciation from the entire audience.

The third day of the conference began with a plenary lecture by Prof. Balachandra Rao of the Gandhi Centre of Science and Human Values, Bharatiya Vidya Bhavan, Bangaluru. He threw light on Importance of Karanakutuhala as an algorithmic handbook. The second lecture that day was by Prof. M. D. Srinivas, Centre for Policy Studies, Chennai. He spoke on “Vasanbhashya of Bhaskaracharya: Explaining and Justifying the Results and Processes in Mathematics and Astronomy.” The third and the last plenary lecture of the conference was given by Prof. S. R. Sarma. The topic of his talk was “Astronomical Instruments in Bhaskaracharya's Siddhantashiromani.” Showing the pictures of various instruments described in the book he narrated their importance in astronomical observations.

Parallel session VA and VB on the last day were arranged on Siddhantashiromani and Pedagogical Importance. There were two presentations in each parallel session. The last session of the last day was arranged in the main hall where Dr. Setsura Ikeyama from Kyoto-Sangyo University, Kyoto (Japan), Dr. Kim Plofker of Union College, New York (USA) and Dr. Clemency Montelle from University of Canterbury, Christchurch (New Zealand) made presentations. Each of them gave presentation based on the work that they are pursuing in their respective countries as evident from the title of their talks.

Setsuro Ikeyama: An Application of the Addition Formulae for Sine in Indian Astronomy

Kim Plofker: Siddhant-karana Conversion- Some Algorithms in Ganitadhyaya of the Siddhantashiromani and in the karanakutuhala.

Clemency Montelle: making Tables from Text- From Karanakutuhala to Brahmatulyasarini.

A formal Concluding Ceremony was arranged to end the conference in the evening on Sunday, September 21, 2014. The participants showed their satisfaction on the meticulous

organization of the conference and expressed concern for the continued interaction. It was noted that the selection of papers and the management of time during the conference was praiseworthy. Prof. Sarma summarised the proceedings of the conference highlighting its outcomes. Prof. Deepak Phatak from Indian Institute of Technology, Mumbai was invited as the Chief Guest for the ceremony. In his valedictory address he reiterated the need to undertake serious studies in the field of history of science and mathematics in India.

It was for the first time that the conference of this nature has taken place in the college campus of Thane. Hence, a large number of faculty members and students in the campus could benefit from it. One notable feature of the conference was the recital of mangalacharan before the beginning of main events like the plenary sessions, inaugural address and valedictory address, etc. These mangalacharans were meticulously chosen by Prof Ramasubramanian and Prof Sarma. In addition, Prof Ramasubramanian also identified the singers who would present them in melodious voice which created a suitable atmosphere for academic discussions that followed. Some of the mangalacharans were chosen from the verses composed by Bhaskaracharya himself while others were chosen from the ancient Hindu scriptures.

The conference brought about 250 academicians together. Some of them were renowned indologists while many were novices. The conference, thus provided an opportunity for novice-expert interactions. More importantly, the conference has created a conducive environment to pursue studies related to History of Science and Mathematics in India. It is hoped that this tempo would lead to serious research in these areas. It is planned to prepare a study group of people participating in the conference. It will enable them to continue interaction remotely even after the conference. It is also planned to bring out a compendium of plenary lectures and selected papers. It would, of course, take a few months for its completion. Meantime, interested people can have a look at the website developed by the Vidya Prasarak Mandal, Thane ([www.vpmthane.org/bhaskara900](http://www.vpmthane.org/bhaskara900)) that provides ample information related to the work of Bhaskaracharya.

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