OBJECTIVES

• To administer the Jawaharlal Nehru Planetarium together with the lands, building and assets and other facilities.

• To conduct science popularisation programmes so as to strengthen the scientific temper in general public.

• To instill enthusiasm among students, children and laymen for understanding science and related fields.

• To organize introductory training programmes, courses, workshops and seminars in science and related fields, and to hold exhibitions on science and related areas.

• To establish and maintain required in-house laboratories, workshops and the technical infrastructure.

• To carry out relevant research and to collaborate with individuals and other organizations, institutions and laboratories in fields relevant to the objectives of the society.

• To generally encourage education related to science and related fields and all other similar activities.

Solar eclipse as viewed from Bengaluru on March 9, 2016
1. INTRODUCTION

Jawaharlal Nehru Planetarium (JNP), Bengaluru, was established in 1989 by the Bangalore City Corporation, now known as the Bruhat Bengaluru MahanagaraPalike (BBMP). The administration of the planetarium was entrusted to Bangalore Association for Science Education (BASE) which was formed in 1992 as an Autonomous Body which is registered under Karnataka Societies' Registration Act. It is principally supported by annual grants from the Department of Science and Technology, Government of Karnataka.

BASE is devoted to science popularisation and non-formal science education. In addition to administering JNP, BASE has established a Science Centre in the Planetarium. The Science Centre serves as a nucleus for non-formal science education at all levels. The activities of the Science Centre, along with those of the Planetarium, have made BASE a unique institution for dissemination of science with diverse activities ranging from sky-theatre shows, science exhibitions and lectures and workshops for science teachers and students as well as publication of scientific literature.

BASE is governed by a Governing Council under the Chairmanship of Prof. U. R. Rao, Former Chairman, Space Commission and ISRO, and presently Chairman, Governing Council, Physical Research Laboratory (PRL), Ahmedabad.

The BASE Governing Council consists of eminent scientists and educationists and senior officials of the Government of Karnataka.
2. ORGANISATION

### BASE GOVERNING COUNCIL MEMBERS

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Position/Institution</th>
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<tr>
<td>Chairman</td>
<td>Prof. U R Rao</td>
<td>Chairman, Governing Council, Physical Research Laboratory, Ahmedabad</td>
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<tr>
<td>Vice-Chairman</td>
<td>Prof. C V Vishweshwara</td>
<td>Formerly Senior Professor, Indian Institute of Astrophysics, Bengaluru</td>
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<tr>
<td>Member</td>
<td>Dr. T K Alex</td>
<td>Dr. Vikram Sarabhai Distinguished Professor, Indian Space Research Organisation (ISRO), Bengaluru</td>
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<tr>
<td>Member</td>
<td>Prof. Ajit K Kembhavi</td>
<td>Director, Inter-University Centre for Astronomy and Astrophysics, Pune</td>
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<tr>
<td>Member</td>
<td>Prof. P Sreekumar</td>
<td>Director, Indian Institute of Astrophysics, Bengaluru</td>
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<tr>
<td>Member</td>
<td>Prof. B R Iyer</td>
<td>Professor, International Center for Theoretical Sciences, Bengaluru</td>
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<tr>
<td>Member (Ex-officio)</td>
<td>The Principal Secretary</td>
<td>Dept. of Information Technology &amp; Biotechnology and Science &amp; Technology, Govt. of Karnataka, Bengaluru</td>
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<tr>
<td>Member (Ex-officio)</td>
<td>The Secretary</td>
<td>Finance Department (Resources), Govt. of Karnataka, Bengaluru</td>
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<td>Member (Ex-officio)</td>
<td>The Mayor</td>
<td>Bruhat Bengaluru Mahanagara Palike, Bengaluru</td>
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<td>Bruhat Bengaluru Mahanagara Palike, Bengaluru</td>
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<tr>
<td>Member Secretary</td>
<td>Dr. B S Shylaja</td>
<td>Director, J N Planetarium, Bengaluru</td>
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A Sub-Committee grants approval on matters which require attention in the periods between the Governing Council meetings. It consists of the following members:

Prof. C V Vishveshwara : Vice-Chairman, BASE
Dr. T K Alex : Member, Governing Council, BASE
Dr. B S Shylaja : Director, JNP

A Permanent Standing Committee as detailed below oversees the human resource management of BASE staff. Its members are:

Prof. C V Vishveshwara, Vice-Chairman, BASE - Chairman
Prof. B R Iyer, Professor, ICTS, Bengaluru - Member
Dr. H Honne Gowda, Member Secretary, Karnataka Science and Technology Academy - Member
Prof. S Lokanathan, Former Dean, University of Rajasthan, Jaipur - Member
Dr. B S Shylaja, Director - Convener

The Advisory Committee consisting of the following members is constituted for guidance and advice on the present and future programmes and projects:

Prof. C V Vishveshwara, Vice-Chairman, BASE - Chairman
Prof. M L Munjal, Department of Mechanical Engineering, IISc - Member
Dr. T K Alex, Dr. Vikram Sarabhai Distinguished Professor, ISRO - Member
Dr. B S Shylaja, Director - Member
Sri Pramod G Galgali, Joint Director - Member

The Review Committee with the following as members reviews the activities and suggests improvements and oversees the implementation of activities:

Dr. B S Shylaja, Director - Chairman
Shri Pramod G Galgali, Joint Director - Member
Shri H R Madhusudan, Senior Scientific Officer - Member

A Committee for Negotiation and Finalisation of Contract (CNFC) has since been constituted with the following members:

Dr. T K Alex, Dr. Vikram Sarabhai Distinguished Professor, ISRO - Chairman
Dr B Raghavendra Prasad, Professor, Indian Institute of Astrophysics - Member
Shri P Satyanarayana, Sr. Head, Accounts & IFA, ISRO - Member
Shri Pramod G Galgali - Member Secretary
1. **Director** : Dr. Smt. B S Shylaja  
2. **Joint Director** : Sri Pramod G Galgali  
3. **Administrative Officer** : Sri K K Kutty  
4. **Sr. Scientific Officer** : Sri H R Madhusudan  
5. **Sr. Planetarium Engineer** : Sri V Muralikrishna  
6. **Sr. Technical Assistant** : Sri A P Lokesh  
7. **Assistant Officer (Admin)** : Smt. G K Rajeshwari  
8. **Assistant Officer (Accounts)** : Smt. R S Sujatha  
9. **Desk Officer (GA)** : Sri C Somashekhara  
10. **Jr. Scientific Officer** : Smt. B R Lakshmi  
11. **Jr. Planetarium Engineer** : Sri Azgar Ali N  
12. **Second Division Assistant** : Smt. R Pushpa  
13. **Second Division Assistant** : Sri L Lokesh  
14. **Junior Technical Assistant** : Sri K R Srinivasa  
15. **Attendant 'D'** : Sri T Venkatapathy  
16. **Attendant 'C'** : Sri Sanganagouda A Patil  
17. **Attendant 'A'** : Smt Y Shanthamma  
18. **Driver 'A'** : Sri N Muneshwara

Sri M Nagaraja Babu, Senior Planetarium Engineer, superannuated in August 2015.

Venus-Jupiter conjunction on July 2nd 2015
Activities of BASE can be broadly classified into three categories. They are:

A) **Science Popularisation Activities**
- Production of Sky-theatre Programmes
- Managing Sky-theatre Shows
- Production of Science Watch Capsules
- Creation of Thematic Poster Exhibition
- Managing the Planetary Weighing Scale with appropriate scientific data sheet
- The SciencePark: Installation and maintenance of models
- The monthly programme - “Know Your Stars”
- Screening of Science Films

B) **Science Education Activities**
- Organisation and production of Science Exhibitions
- Organisation of Summer Programmes
- Workshops for science teachers and students
- Weekend Sessions for High school
- Research Education Advancement Programme in Physical Sciences (REAP)
- Education and Research Projects
- Research Education Advancement Programme in Life Sciences (Bio-REAP)
- Special lectures

C) **Outreach Activities**
- Interaction of JNP with other institutions
- In-house management: Library, publications and the BASE webpages
- Consultations and Interaction with media

The additional activity taken up this year is the up-gradation of the Sky theatre Projector
The Department of Science and Technology, Government of Karnataka has approved the proposal to upgrade the projection system to Hybrid. A grant of Rs.12.00 crore was released for the purpose. The process of identifying a vendor, negotiating and placing order has been completed.
After close interaction with the vendor M/s. Carl Zeiss, Jena, Germany, site preparation requirements have been finalized.
Sky theatre shows have been suspended from March 1, 2016 and preparatory works have been started.
Dismantling of projection system, acoustic paneling and chairs is completed. Floor preparation has been initiated after getting clearance from structural engineers.
The up-gradation job is expected to be completed by September 30, 2016.
4. SCIENCE POPULARISATION ACTIVITIES

Production of Sky theatre shows
This year the classical show - *The Sun – Our Star* was launched on 24th August by Prof. P Sreekumar, Director, Indian Institute of Astrophysics, Bengaluru. It is a classical show that comprises of stories, anecdotes, mythology apart from scientific content presented in a lucid manner. The lounge is complementing it with large interactive exhibits, posters and videos.

Screening of Sky-theatre Shows
During the year 2015-16, the following shows were on offer.

1. Our Solar System (hybrid show – using both Zeiss projector and mirror dome)
2. Dawn of the Space Age (mirror dome show)
3. The Sun – Our Star (hybrid show – using both Zeiss projector and mirror dome)

There was a good increase of over 3% in the number of visitors. Almost 2.5 lakh people visited the planetarium during the year. In addition about 1800 students from underprivileged section were given free show. The total number of shows conducted during the year is 1586.

The shows were suspended from 1st March 2016 for taking up the site preparation activities in view of the up-gradation of the sky theatre projector.

The Planetary Weighing Scale
The Planetary Weighing Scale displays and provides a colourful printout of one’s weight on various planets. It continued to be an attraction for visitors. This year over 40629 printouts were taken out. It provides a print out of the weights of an individual on various planets. Astro-facts about the moon was provided on the reverse side of print out.

Science Watch Capsules
This 5-minute capsule describing the recent advances in science and technology is being shown at the beginning of the planetarium show. The Kannada version of a special 5 minute capsule produced by ESA on light pollution was prepared and screened.

As the new one gets ready, the old ones are being screened for about one or two months outside in the lounge.
The Science Park: Installation and maintenance of models

The science park with dynamic models illustrating scientific principles has got a new face lift. A brief write-up on the exhibit and its scientific concept accompanies each of the models. An interactive page is also provided on the webpage with some added explanation.

The new models that are added this year include the scaled down models of the instruments in the Observatories of Jai Singh, popularly known as Jantar Mantar. The models of Samrat Yantra, Nadivalaya and Dakshnotara Bhitthi are installed in the park.

A 3m dia rotatable globe is installed in the park; this is used for demonstrations of concepts related to astronomy.

Construction of two exhibits viz., Ames Chamber and Antigravity Cottage are nearing completion. They are expected to be opened to public in the next year.

Know Your Stars

This sky-watch programme is being held on the evening of first Sunday of every month. It is a live show inside the sky-theatre. It introduces the audience to night-sky viewing and also the celestial highlights of the month. A lecture demonstration is followed by viewing of the moon, planets and clusters in the open sky through telescopes set up for the purpose. Eight sessions of “Know Your Stars” held this year attracted about 1000 visitors.
Screening of Science Films

Science Films are screened on the third Sunday of every month. The following films were screened:

1. How the Universe works - Extreme Planets
2. How the Universe works - supernovas
3. How the Universe works – Alien moons
4. Extreme Planets
5. Across the Universe
6. Kings of Camouflage
7. Human Planet: Oceans
8. Human Planet - Deserts
9. Human Planet: Arctic
10. Human Planet: Jungles
11. Human Planet: Mountains

Science in Action: three-day science exhibitions

The first exhibition was organized from September 11 to 13, 2015. About 25 models illustrating various scientific principles and concepts, like Scattering of Light, Total Internal Reflection, Spectrum of Elements produced by JNP, were on display. Prof. Sanjay P Sane, Associate Professor, National Centre for Biological Sciences, Bengaluru, inaugurated the exhibition which was visited by about 5300 people.

A second exhibition was arranged during November 27 to 29, 2015 with models / activities illustrating various scientific principles and concepts like diffusion, electroscope, biodegradable plastic, produced by various schools were on display. It was inaugurated by Prof. M R N Murthy, Professor of Molecular Biophysics, Indian Institute of Science, Bengaluru. The exhibition attracted about 2200 visitors.

Science in Early Education and Development (SEED)

Several programs are conducted to facilitate young children learn science by hands on activities during summer vacation. They are:

“Tiny Tots” programme

The ten day annual programme, “Tiny Tots” was organized in four batches for the students of classes IV and V. The first and second batches were held
from 1st to 11th April, 2015 and the third and fourth batches were held from April 15th to 25th 2015. Nearly ninety students participated in all. The students were introduced to various topics in science and mathematics through recreational activities and discussions.

**BASE Camp**

This is a ten day programme for students of classes VI to X. M/s. Dynam Creativity Programmes moderated the sessions through experiments and demonstrations. Students of classes VI and VII form the junior batch and students of classes VIII – IX form the senior batch. The first batch of junior camp and senior camp was held from 15th to 28th April and the second batch of junior camp was held from April 29th to May 13th. A total of about 120 students participated in this programme.

**Summer Programmes for High School and College students**

Every year Summer Programmes in Science are conducted for high school and college students. The fifteen day programme from April 15 to May 2, 2015 comprised lectures, demonstrations, computer based activities and laboratory experiments for students of classes VIII to X. The theme of the course this year was “Evolution”, and was covered in forty sessions, conducted by scientists from various research institutes and the academic staff of JNP. About 30 students participated in this programme.

Summer programme for PUC and B.Sc. students entitled “From Web of Life to Universe” was conducted from 20th to 30th May 2015. The lectures covered a variety of subjects from biochemistry, evolution, ecology, fluid mechanics, astrophysics, galaxies and cosmology by scientists from IIA, RRI, IISc and UAS. About 21 students of PUC and B.Sc. attended this programme.

**Computer Aided Learning (Applying C-Graphics to Geometry)**

Computer Aided Learning, a short-term introductory course was organized in two batches from 1st to 11th April, 2015 with forenoon and afternoon sessions. Students were taught elements of programming using processing software with emphasis on applying them to solve problems in mathematics, mainly geometry. About 30 students attended this programme.
One-Day Summer Workshops for High School Students

Six one-day workshops on the topics Day Time Astronomy and Solar Physics were conducted for students of age group 12-15 on 5th, 12th, 19th and 26th April & 3rd and 10th May 2015. A total of 110 students participated in these workshops.

Workshops for science teachers

Over the years, JNP has established itself as an institution that provides active support for enhancing teaching efficacy. Informal discussions have led to identification of several difficult areas in science and mathematics teaching. JNP conducts workshops for science and mathematics teachers. Participation in each workshop is limited to thirty teachers. Academic Staff of JNP and invited educators from other organizations conduct the sessions. Conducting experiments and preparing models form an integral part of the workshop.

“Seeing The Invisible” - a special workshop was organized on June 27th, 2015, in association with the Public Outreach and Education Committee of the Astronomical Society of India and Raman Research Institute. Prof. Somathan Bharadwaj and Prof. Biman Nath gave lectures; Prof. A. Raghunathan, and Prof. R Somashekar demonstrated the operation of the radio telescope. Undergraduate students and physics lecturers (about 70) participated.

“Seeing The Invisible”

Number of teachers participated is 50.


Number of teachers participated is 25.

Number of teachers participated is 40.
“Electronics” - August 6th, 2015. Number of teachers participated is 35.
“Electromagnetism” - September 22nd, 2015. Number of teachers participated is 17.

**Special workshops**

A three-day workshop - tiny tots for class 3rd to 5th was held on October 15-17, 2015. Number of participants 30.

To commemorate the birthday of the famous mathematician S Ramanujan, a special half-a-day workshop on Mathematics for class 7th to 10th was held on December 22, 2015. Number of participants 50.

- To commemorate the International Year of Light a special half-a-day workshop on LIGHT for class 8th to 10th was held on November 15, 2015. Number of participants 30.

**Introduction to Night Sky**

Sky Watch program for public was organized on the evening of second Saturday of April and May 2015. The available objects like, clusters, planets, etc. was shown through the different telescopes provided the sky is clear. About 500 people enjoyed the view.

All naked eye planets Jupiter, Mars, Saturn, Venus and Mercury were visible in the pre-dawn sky during the months January and February 2016. Planetarium made arrangements to show all these objects through telescopes on 7th January, 6th February and 13th February. Nearly 750 people gathered to see the planets at dawn.

**Zero Shadow Day**

The north-south passage of the sun can be effectively explained by the demonstration of the noon shadow becoming zero on two specific days of the year. This demonstration was arranged on 24.04.2015 & 19.08.2015.
**Special Events: Meet the ASTROSAT Astronomers**

A press meet was held on September 29th, 2015 to have an interaction with the scientists involved in the instruments and experiments on board the first astronomical satellite ASTROSAT. Annapurni S (Associate Professor, IIA), Rekhesh Mohan (Scientist D), Stalin C S (Associate Professor, IIA), Sutaria F K (Reader, IIA) and Koshy George (PDF, IIA) participated as panelists.

This was organized in association with the Public Outreach and Education Committee of the ASI. Prof Dipankar Banerji, Secretary, ASI also was present.

**Special Events: Detection of Gravitational waves**

A special press meet was organized in light of the excitement created by the first ever detection of gravitational waves by the LIGO team in the context of the prediction made by Professor C.V. Vishveshwara, the Founder-Director of Jawaharlal Nehru Planetarium and Vice-Chairman, BASE Governing Council, 45 years ago in 1970. Further, Prof Bala Iyer, member of BASE Governing Council, was also involved in the scientific component of LIGO. The special press meet was presided over by Professor U.R. Rao, Former Secretary to Department of Space and Chairman, BASE Governing Council. Professor C.V. Vishveshwara and Professor Bala Iyer were present on this occasion for interactions.
**Special Lectures**

Special lectures are organized to provide a face-to-face interaction with scientists by utilizing the opportunity when eminent scientists are visiting Bengaluru.

To mark the Silver Jubilee Year special lectures were held on second Sundays from November 2014 to November 2015.

- Prof. Biman Nath, Raman Research Institute, delivered a special lecture “Our Neighborhood Stars”, on June 14th, 2015.
- Prof. Vidyanand Nanjundiah, Formerly Professor at Indian Institute of Science, delivered a special lecture “What is a gene?”, on July 12th, 2015.
- Prof. Ravi Subrahmanyan, Raman Research Institute, delivered a special lecture “Radio Waves from the Early Universe”, on May 10th, 2015.
- Prof. Vidyanand Nanjundiah, Formerly Professor at Indian Institute of Science, delivered a special lecture “What is a gene?”, on July 12th, 2015.

Prof. Ravi Subrahmanyan, Raman Research Institute, delivered a special lecture “Radio Waves from the Early Universe”, on May 10th, 2015.

Prof. S Lokanathan, Formerly Professor of Physics at University of Rajasthan, Jaipur, delivered a special lecture “Noble Prize for Neutrino Oscillations”, on November 8th, 2015.

Each of these lectures attracted an audience consisting of students including those of REAP, amateur astronomers, JNP Club members and general public. All these lectures were videographed and made available on youtube. The lectures received a very good response. Numbers of audience were around 400. The viewership of the videos also has touched 2000 per lecture.

Science over Weekends (SOW)

This is a programme for high school students held over weekends from July to February. Experiments and problem-solving form an integral part of it. The topics are discussed with an inter-disciplinary approach. About 25 students attended the programme. The topic for 2015-16 was “Optical Astronomy”; from July 5th, a total of twenty-eight sessions were conducted discussing the magnetic properties of materials.

Research Education Advancement Programme in Physical Sciences (REAP)

The primary objective of REAP is to motivate students towards research in pure sciences and prepare them for a career in science. It is actively supported by Indian Institute of Science, Raman Research Institute and Indian Institute of Astrophysics. Faculty members from these institutes and professors from Universities conduct interactive sessions for students pursuing B.Sc. or B.E. Courses. Lectures expose students to basic concepts in physics and astronomy with emphasis on problem-solving, experiments and use of computers. Some special lectures introducing them to research areas of current interest are also held. The second year covers advanced topics supplementing the first year basic course. In the third year students do a project under the guidance of a research scientists to acquaint students with the research environment.

REAP I year sessions started from August 1st with sessions in mathematical physics, classical mechanics and astrophysics. REAP II year classes commenced from July 18th. Project allocation was done for the III year students in July-August. About eight students successfully completed REAP I, nine students completed REAP II and four students - Charuhansini, Chittaspandini, Vishnu Priya, Hamsini Sukumar, Sindhu and Sourabha the completed REAP III projects successfully. Charuhansini and Chittaspandini have joined NCBS for the integrated PhD programme, Vishnupriya joined Masters programme in Technische Universität Kaiserslautern, Kaiserslautern, Germany; Hamsini Sukumar joined Masters programme in Paris. Sindhu and Sourabha are pursuing Masters programme in physics in Bangalore University and St Joseph’s College respectively.

This year Profs B R Iyer (ICTS), Arun Mangalam (IIA), Vijayakumar (ICTS), Ranjani Vishwanatha (JNCASR), Yashodhan Hatwalne (RRI) and Jayant Murthy (IIA) conducted the sessions.

Research Education Advancement Programme in Life Sciences (Bio-REAP)

The Bio-REAP programme, counterpart of REAP for life sciences, conducted with academic support from IISc entered the seventh year of its formalised structure. Fifty six lectures on various concepts in biology and chemistry were delivered by IISc scientists and faculty from University of Agricultural Sciences. In this year about fifty students were enrolled in Bio-REAP.
6. OUTREACH ACTIVITIES

A. Interaction of JNP with other institutions:

JNP Staff are often invited as advisory committee members, resource persons and mentors during events conducted by other institutions. They participate in workshops for teachers and students on their request, deliver guest lectures on different topics and suggest and guide in conducting science exhibitions by way of the design of experiments and models.

Special poster exhibition was set up at Cubbon Park during November to mark the Children’s day; it was well received. Poster exhibitions were subsequently arranged in other schools including Siddhaganga Public School and the Planetarium at Ballari.

JNP has designed and fabricated demonstrative exhibits explaining basic concepts. These are in great demand by schools for display in their in-house exhibitions to add to the effectiveness of the programme. Teachers/students are trained to set up these experiments and explain the underlying concept before they are taken to schools for a few days. During 2015-16, JNP has lent scientific models/exhibits to 30 schools/colleges in conducting science exhibitions.

B S Shylaja has served on advisory capacity to Visveswaraya Industrial and Technological Museum, Bengaluru; Kannada University, Hampi; Positional Astronomy Centre, Kolkata, Outreach Cell of the Astronomical Society of India, Research Council of the Indian National Science Academy, New Delhi. She was invited by KSTePS as an expert on the committee for gauging the 3D functionality of the planetarium at Singapore. She was invited to deliver lectures at the workshops on eclipses by the Islamic University at Palangkaraya, Indonesia, during March 8-11, 2016.

H R Madhusudan is serving on the Board of Studies (Physics) at Mt. Carmel College – involved in revising B.Sc. syllabus and setting up laboratory experiments.

Pramod G Galgali is on the evaluation committee for selection of mini-planetariums by the Government of Karnataka.

B. Conferences:

JNP set up a stall at the Indian Science Congress held in Mysore by setting up various posters and interactive exhibits during January 2016; the S&T wing won the best stall award.

C. Lectures:

B S Shylaja

- 29th July - Stellar Evolution - Lecture for teachers arranged by DSERT
- 26th August - The Active sun - Lecture for All India Radio
- 9th October - Moon in the class room - Lecture at Osmania University, Hyderabad
- 2nd November - Why do we need to study Venus? - Lecture at ISAC
- 24th December - Doppler Effect - Lecture for students from North-East India for NIAS, Bengaluru
- 19th January - Contribution of women in science writing - Special workshop by Kendriya Sahitya Academy
Total solar eclipse as seen from Palangkaraya, Indonesia

H R Madhusudan:

- "Sound through Experiments" at Rakum School of Blind – May 15th.
- Lecture demonstration “Light and Astronomy” at Poorna Prajna College, Udupi – June 18th.
- “Technology for Space Missions, Inspired by Biology” at ISTRAC – Aug 7th.
- “Lecture Demonstration in Physics for UG/PG students at Tumkur University – Aug 26th.
- “Our Fascinating Sun” lecture-demonstration for teachers at Chetradurga organized by KRVP – Aug 29th.
- Lecture demonstration for students of St. Annes College “Mechanics” – Nov 13th.
- Lecture demonstration for students from Northeast brought by NIAS on Dec 23rd.
- Student – Scientist Interaction on “Astronomy” organized by KRVP at Kolar.
- Taught a short course on “Reception of Sound in Animals and Analyzing Sound” for PG/Ph.D. students/faculty of Veterinary College on Jan 21th, 28th, Feb 4th and 11th.
- Talk on “Earth-Moon system” at KLE College - March 9th.

C. Free Sky-theatre Shows for Children

For about 1160 students from 15 BBMP schools, sky-theatre shows were arranged free of charge during June – July 2015. In addition 1700 students from underprivileged section were given free show. Students visiting as part of the educational programmes by KRVP, KSCST and other government agencies also enjoy the waiver.

Selected students from Odisha, Jharkhand and Jammu-Kashmir, brought to Bengaluru as part of motivation programme for higher studies in science, are waived of the entry fee on request from the respective Departments of Science and Technology.
Education and Research

The H-Alpha spectroscope, the Carl-Zeiss 6” Coude refractor telescope and two 8” Celestron telescopes are being used to image planets.

A project by REAP students Bhargava B A and Adithi Udupa on “Charged Particle in Perpendicular Electric and Magnetic Field: a relativistic study” (with Prof Jayanth Vyasankere, Tumakuru University) has been accepted for publication in Resonance.

Publications:

1. Quarterly Bulletins of the Planetarium were published in May 2015, August 2015, November 2015 and February 2016.
2. “Jantar Mantar – Observatories of Jai Singh”, bilingual in English and Kannada by B S Shylaja and Prof. V S S Sastry, was released on 22.09.2015.
3. A calendar, with introduction to the sky, phases of Moon, constellations visible at dusk, names of the bright stars, a brief introduction of planetarium objectives and information about annual programmes, Holidays of the planetarium for the year 2016 was published.

Research papers:

- “From Navigation to star hopping: forgotten formulae” B S Shylaja, – Resonance April, 2015
- “Stars of Navigators in Ancient India” – submitted to Journal of History of Ancient Astronomy
- “Measurement of coordinates of nakshtras in Indian Astronomy” – (co author – Venkateswara Pai) submitted to Current Science
- “Star Catalog from Indian Scriptures” – (co author – Venkateswara Pai ) submitted to ASI for presentation in the meeting at Srinagar
- “Variable Stars search from Archival Plates” – (co author – Viswa Keerthy S ) submitted to ASI for presentation in the meeting at Srinagar in May 2016

BASE Webpage

Our website www.taralaya.org is very popular and frequented by a large number of visitors.

The visitor history shows the frequency of visits.
Media coverage
All our activities are covered by print and electronic media.

7. DEVELOPMENT, MAINTENANCE AND CIVIL WORKS

Up-gradation of Sky theatre Projector is in progress

A three member team from ISRO (CED) has been advising us on the site preparation activities. Mr Thandapani, Mr Shridharan and Mr Bipul Das are monitoring the process.
Alternate Plans:
The Governing Council advised on introducing an alternate plan for availability of sky theatre shows during the period of up-gradation. The elevated roof design of the classrooms was exploited to introduce a small dome to show mirror dome shows for smaller groups of 40 - 50. Considering the complexities involved in housing a ready-made dome, possibilities on a customized 7.6m dome were explored. After careful examination of the design, one agency has been identified. The work order has been placed. The classroom with dome will serve as a special facility later for conducting teaching sessions and workshops pertaining to astronomy. It is expected to be commissioned in June 2016.

Civil and Maintenance works:
**New Toilets for physically challenged**
Construction of an additional floor on the existing public toilet is in the final stages; the physically challenged and the ladies toilet wing is already operational. The modification of the ground floor exclusively for gents is almost ready.

**New ticket booth**
The new ticket booth with spacious waiting area is now operational. It has received good appreciation from public. Other accessories like display boards on availability of tickets and scrolling display on show schedule are also being planned.

Exhibition hall
The civil works on the exhibition hall is almost complete. Interiors are being designed to give the illusionary feeling of the anti-gravity and depth perception.

Science Park
Science park has been given a facelift with paver blocks pathways and plenty of plants which is receiving a good response from visitors.

Others
1. **Procurement of chiller unit for Central Air-conditioned plant replacing Air Handling Units.** The installation of chiller units is complete and is operational.
2. **Installation of CCTV:** Two additional outdoor and two indoor CCTV systems were procured from M/s. Tech-Tronix Security Services, Bengaluru and installed satisfactorily.
3. Sixty display boards fabricated and installed in the Science Park replacing the old ones.
4. The panels from sky theatre are being re-used in the basement hall to improve the acoustics by hiring a carpenter who recreated the walls.
5. Five more models were introduced in the science park. A globe of 3m size is now a new attraction to the visitors.
6. All the trees in the campus were surveyed for their botanical nomenclature; the name boards were displayed on plain paper for testing out the effectiveness. Permanent metal boards are designed and printed.
8. FACILITIES

Library
JNP library has books on several topics like physics, chemistry, mathematics, biology and astronomy as well as popular accounts in these subjects. Students attending our various BASE programmes refer to these books as also to the subscribed science journals. The library also subscribes to scientific journals such as New Scientist, Current Science and Planetary Report. During 2015-16 JNP has purchased ten (10) books.

Laboratories
JNP has developed physics and chemistry laboratories on a modest scale. The primary use of the laboratories is by those attending the weekend interactive courses – high school, pre-university and REAP. Open-ended experiments are set up to train students into problem solving through experiments. The students investigate how different parameters affect the phenomena under study. In addition to fabricating our own experiments, we have bought several classic experiments from the Centre for Development of Physics Education, University of Rajasthan, Jaipur.

The laboratories are extensively used during workshops for teachers / students and, for our own teaching classes. They are used to set up relevant demonstrations. Sometimes, they are also used by students other than those attending BASE programmes to carry out projects as part of their formal courses.

Science Models
During the last fifteen years, JNP has developed more than three hundred experimental models for all its educational programmes. Most of these can be dismantled and reassembled and are designed to last long. Such models are made available to schools for their exhibitions. The number of schools and other organizations availing this facility is gradually increasing with over 30 schools borrowing them this year.

The JNP Club
With a view to attract more visitors a scheme called “The JNP Club” was started in the year 2009. The number of individual members during 2015-16 is 127 totaling to 1751 this year, while the institutional membership has grown to 109.

9. RESOURCES

Human Resources
Both Technical and Administrative staff were deputed to training/study tours in their fields so as to enable them to keep abreast of the latest changes.

This year the following staff had been deputed for study tour to Kerala State Science and Technology Museum & Priyadarsini Planetarium, Kerala in three batches to create an exposure to the new hybrid system, the technical staff were deputed to visit the newly installed hybrid projector at Tiruvanatpuram.

1. Sri V Murali Krishna, Sri M Nagaraja Babu, Sri C Somashekara and Sri A P Lokesh

10. Finances

Principal grants to maintain and run JNP are received from Government of Karnataka, Department of Science and Technology. The grants received during the year 2015 - 16 amounted to Rs.130 lakh. Grants-in-Aid received from Government of Karnataka were utilized for the purpose of meeting expenditure on production of sky-theatre, science popularisation programmes and educational activities apart from salaries and expenses towards general maintenance and up-keep of the Planetarium.

This year special grant of Rs 12 crore for up-gradation of the sky-theatre projectors has been sanctioned by the Government of Karnataka and released.
JNP posters displayed at Chamaraja Nagar

New Toilets for physically challenged

JNP posters displayed at Bellary
BANGALORE ASSOCIATION FOR SCIENCE EDUCATION (BASE)
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