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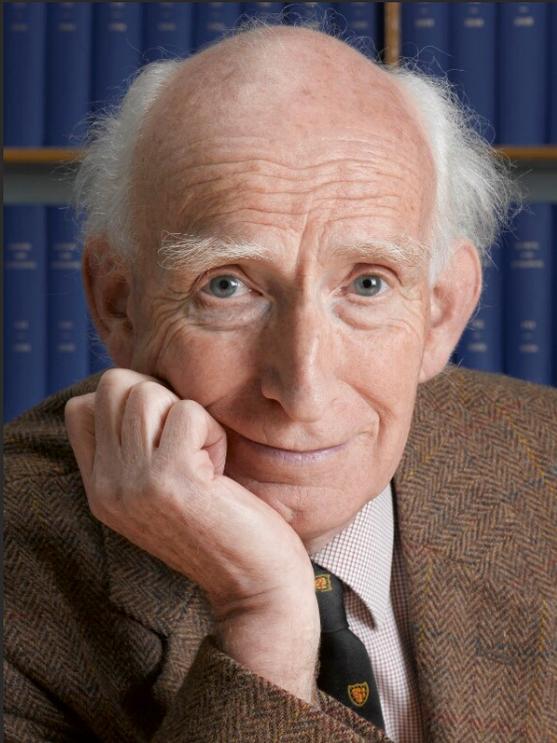
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Homage to Professor Donald Lynden-Bell



[1936 - 2018]

Professor Donald Lynden-Bell, FRS, one of the world's most distinguished scientists and an Honorary Fellow of IUCAA, passed away on February 6, 2018 at the age of 82. He was a frequent visitor at IUCAA and a life-long well-wisher of the institute. In his memory, and as a celebration of his life and his invariably cheerful scientific attitude, a condolence meeting was held at IUCAA on February 8, 2018. Several IUCAA academics recounted their most treasured memories of Professor Lynden-Bell at this gathering.

This issue of Khagol shares some of these memories of Professor Lynden-Bell and his long association with IUCAA, with contributions from Professors Naresh Dadhich, Ajit Kembhavi and T. Padmanabhan.

Contents...

Reports of Past Events	1 to 8
Colloquia, Seminars, Congratulations	4
Farewell	6
Public Outreach Activities	9 to 18
Visitors	19, 20

Ever curious and playful with ideas

Naresh Dadhich

Donald's piercing eyes, always bearing a poignant sparkle of seeing something new and insightful, as well as teasingly playful, are what the most fascinating and enchanting picture I have of him. I had first met him in 1986 in his office when he was about to leave to give lecture in a summer school. We had a warm hand shake and announced that he would throw me out in 10 minutes. And we instantly clicked because there was warmth and honesty in that welcome.

He was one of the friends who would always host you at his home, without much ado and several of us enjoyed their warm hospitality and company. He was perhaps the first visitor to IUCAA when it was still in the conceptual stage and gave a brilliant set of lectures. Since then IUCAA has enjoyed a special relation, served on the Scientific Advisory Committee

for two terms, and he had been visiting IUCAA quite regularly. It was warmly acknowledged in electing him the Honorary Fellow.

There are two profound things I learnt from him, one keep on staring at equation slowly you will understand it, and second one should stretch to one's limit of capacity, never mind if you make a few mistakes - a few wrong papers are fine, else you would always underperform. It is a different matter that for a person like me even stretching does not take one any further.

He was a very warm and dependable and a great intellectual friend, philosopher and guide. However, the image of his ever engaging and searching eyes would always be reassuring and won't let him go!

A calculation by Donald Lynden-Bell

Ajit Kembhavi

I first met Donald Lynden-Bell when I arrived as a post-doctoral fellow at the Institute of Astronomy, Cambridge, in the early 1980s. I had heard about him, and knew that he was a great astrophysicist, but little else. Since my interaction with him was limited to saying hello at coffee, I was rather surprised when he invited me and my wife Asha to lunch at his place on the Easter Sunday. That was the start of a long and warm association with Donald and Ruth Lynden-Bell. I learnt a great deal from Donald, about galaxies, quasars, classical dynamics and much else. I once asked Donald a question about orbits. His way of answering it was to sit in my office and to do a detailed calculation in an hour or so, a small part of which I am reproducing in the right. I also had the opportunity over the years, mainly during his visits to IUCAA, to learn from him about practical matters and how to deal with difficult situations, of which there were many in the early years of the new institute, which some of us were setting up in Pune. When he first came to IUCAA as a member of our Scientific Advisory Committee, I had expected that he would be fully focused on scientific matters and not concern himself with anything else, but on the contrary I found that he was taking a holistic view of the institute and considered every aspect of it important for ensuring excellent scientific performance over the years. In just a couple of days Donald had become fully aware of our strengths and weaknesses of those early years, and his sage advice proved to be very valuable for us in many ways. When I became the Director, Donald advised me, "not to try to please everyone"; that simple mantra provided me with great solace in many situations.

I last met Donald just a few months before he passed away, when Ruth and he visited us in our home in Pune for a very short time. When he left, he promised that he would come again quite soon for a longer stay.

$$d\phi = \frac{h^2}{r^2} dt = \frac{h}{r^2} \frac{dr}{\dot{r}} = \frac{h}{r} \frac{dr/r}{\sqrt{2\epsilon + 2\mu - \frac{h^2}{r^2}}}$$

$$\dot{r}^2 = 2\epsilon + 2\mu - \frac{h^2}{r^2}$$

$$0 = 2\epsilon + 2\mu - \frac{h^2}{r_p^2}$$

$$0 = 2\epsilon + 2\mu - \frac{h^2}{r_a^2}$$

$$u = \frac{\epsilon}{h^2} r^{-k}$$

$$d\phi = \frac{du}{\frac{du}{dr}}$$

$$m_0^2 (u_p - u_a)(u - u_a) = \frac{(2\epsilon + 2\mu - \frac{h^2}{r^2}) r^2}{h^2} \left(\frac{du}{dr} \right)^2$$

$$m_0^2 (u_p - u_a) = 2 \left(\frac{u_a^2 + \frac{h^2}{r_a^2}}{r_a^2} \right) \frac{r_a^3}{h^2} \left(\frac{du}{dr} \right)_a$$

$$-m_0^2 (u_p - u_a) = 2 \left(\frac{R_{a+1}}{R_{p+1}} \right) \left(\frac{r \frac{du}{dr} \right)_p$$

$$-1 = \left(\frac{R_{a+1}}{R_{p+1}} \right) \frac{r_a^{-k}}{r_p^{-k}}$$

$$k = \frac{\ln \left(\frac{R_{a+1}}{R_{p+1}} \right)}{\ln \left(\frac{r_a}{r_p} \right)}$$

↑
Donald Lynden-Bell.
12.12.2014.

Scholarly science done in style - A personal perspective of Donald's approach to science

T. Padmanabhan

The process called violent relaxation is ubiquitous in Nature and is used extensively in astrophysics and cosmology to describe a wide variety of cosmic structures. Violent relaxation leads particles, interacting through their mutual gravitational attraction, to reach a (quasi) steady state, similar to that in thermodynamic equilibrium, far more quickly than one would have naively expected.

This important physical process could have been discovered by several other major players in statistical mechanics like, e.g., Maxwell, Boltzmann, Gibbs, or James Jeans, just to name a few¹. It was Donald-Lynden-Bell who realised the importance of this process, worked out its theory and named it as violent relaxation. This is just one of the many, major, creative gems Donald has contributed to science (and is my personal favourite). How come Donald could figure out such a fundamental process occurring in Nature, which escaped the attention of so many others?

I believe, the answer, to a great extent, is related to the way Donald approached Science. Most of what he did in Science was driven by his curiosity and the enjoyment he derived from figuring things out. He did not particularly worry whether the problems he worked on had the "approval" of the community.

He was fascinated by any interesting problem, and once his curiosity was awakened, he would not mind spending any amount of time tackling it - and incidentally, talking about it with a childlike delight to anyone he could catch! He enjoyed the process of discovery so much that everything else was secondary. Such unshackled creativity is what one needs to make a discovery like violent relaxation. I encountered this aspect of Donald pretty early on during my post-doctoral interaction with him in 1986. Donald once got hold of me during a lunch at Cavendish and described to me a problem he was currently thinking about. The problem was a very practical one and had to do with improving the performance of telescopes. It involved paraphrasing some of the techniques, used to study the semi-classical limit in quantum mechanics, to understand better the transition from ray-optics to wave-optics. Since the essence of the problem was several decades old, I knew it must have been tackled in some of the classic textbooks like, for example, Born and Wolf; and I mentioned this to him. His reply was very nice and deeply inspirational: "Yes, Paddy; but it is a lot more fun doing it yourself".

Donald's habit of spending time on any question he found interesting transcended conventional physics problems. Once while visiting IoA, Cambridge, I was interested in an age-old problem, viz., what is the minimal number of weighings you need to figure out the odd-ball among N -balls - using just a scale pan without weights and not even knowing whether the odd-ball was lighter or heavier. This problem and its solution, again, are well-known, but I wanted to quantify it from the information-theory perspective. I mentioned this to Donald who immediately got interested in it and had no hesitation spending a large part of the next couple of days thrashing it out. I have seen very few other scientists who are so strongly driven by a desire to figure things out for themselves.

Another aspect of Donald is his supreme scholarship, a quality which is fast disappearing among scientists and - much worse - is no longer respected as something which a scientist should necessarily possess. Donald was a scholar *par excellence*, even by the Cambridge standards of his times. He knew so much about so many things and had thought so deeply about all the important questions in theoretical astrophysics. I have spent hours - as I am sure have many others - discussing everything from Mach's principle to the correct way of learning elliptic functions. (Yes, there is a correct way. Donald introduced me to an unusual book "*Elliptic Functions as they should be*" by Albert Eagle which tells you how; needless to say, very few experts in mathematical physics know about this book.) He could always bring in a fresh perspective into any problem, whether it dealt with the nine-point circle or the gravitational wave, drawing upon his comprehensive classical education, supplemented by the sharp intellect.

These qualities also made Donald fairly immune to peer recognition or its absence. I, for one, believe that Donald's capabilities, and even contributions, have not been given their due recognition by the peers; if it bothered him, I never saw a sign of it. If you enjoy the process of science so much, it is probably natural that you do not care about unimportant side-issues, like peer opinion.

He was also unafraid to hold views which ran totally counter to the mainstream science. (Even as late as March 2017, when we last met, he did not believe in the existence of non-baryonic dark matter!) Once he explained to me in detail the importance of writing wrong papers. The argument went roughly like this:

¹ In fact, if only Newton had thought about a system with large number of particles moving under their mutual gravitational attraction, and abandoned deterministic evolution for a probabilistic description, he would have discovered statistical mechanics of gravitating systems - and probably violent relaxation - centuries before even the statistical mechanics of normal matter was developed!

If you keep tackling research problems which require, say, eighty percent of your ability, you will probably never write a wrong paper. But you will also be wasting your talent. If you keep tackling problems worthy of your steel, then, simply due to random fluctuations, a few of your papers will turn out to be wrong. His own estimate was that it is perfectly fine - even desirable! - to choose problems such that about two percent of your papers are wrong!

What is interesting is that Donald's scientific career also proves that you can make great contributions to the front-line research even if you take a couple of days off to solve brain teasers or re-invent a result already present in Born and Wolf. Obviously, exercising of your brain is never a waste; the training that your brain gets from tackling these little problems helps it in solving much bigger problems. More importantly, this also leads you to make connections between completely different problems which you might not have thought existed.

The only preprint which I co-authored with Donald stands testimony to such a connection. At that time Donald was

interested in the possibility of tackling the Local Group dynamics by simulating on a computer the action principle - rather than the equations of motion - for the particles. In the conventional action principle, you would fix the three coordinates of the particle at the end points. But for celestial objects, what we often know with some accuracy are the two (transverse) coordinates and one (radial) velocity. So Donald asked me whether the standard action principle can be reformulated with mixed boundary conditions. We found a way of doing it fairly quickly, but what was interesting was that the structure of such an action principle happened to be exactly the structure exhibited by the Einstein-Hilbert action, a connection neither of us originally suspected. It is gratifying that a question about Local Group dynamics can lead to the holographic nature of gravitational action.

Given the current trend in science, which confuses technical expertise with scholarship and craftsmanship with creativity, the best homage one could pay to Donald, is probably to recognize the values he held important and try to incorporate them in your own approach to science. The more people do this, the better it will be for the future of theoretical physics.

Colloquia

- 04.01.2018 **Rishi Khatri** on *The information hidden in the shape of the CMB spectrum.*
- 15.01.2018 **José Antonio Font** on *Towards asteroseismology of core-collapse supernovae from gravitational-wave observations.*
- 15.02.2018 **Patrick Brady** on *A spectacular collision: Observations of a binary neutron star merger.*
- 19.02.2018 **Alexander Vilenkin** on *Black holes from cosmic inflation.*
- 15.03.2018 **Sushanta Dattagupta** on *Saha ionization equation: A century of hindsight.*

Seminars

- 03.01.2018 **Arunava Mukherjee** on *Neutron stars in gravitational waves: Key results from recent BNS-Event.*
- 17.01.2018 **S. Ganesan** on *Errors and correlations in big data science with nuclear data covariance as example.*
- 24.01.2018 **Aditya Rotti** on *Novel tools for analyzing CMB polarization maps.*
- 07.03.2018 **Andrew Matas** on *Searching for the astrophysical stochastic gravitational wave background.*
- 28.03.2018 **Reetanjali Moharana** on *Gamma ray burst during multi-messenger era.*

Congratulations to...

Joydeep Bagchi, Shishir Sankhyayan, Prakash Sarkar, Somak Raychaudhury, Joe Jacob, and Pratik Dabhade, on being selected for *ASI New Discovery Award for the discovery of the Saraswati Supercluster.*

Sanjit Mitra, on being selected for *Outstanding Faculty Research Award from Careers360.*

International Meeting on Galaxy Evolution and Dynamical Structures

An International Meeting on Galaxy Evolution and Dynamical Structures (GEDS) was held during January 22 - 24, 2018 at IUCAA. The primary idea behind this meeting was to promote galaxy evolution and dynamics research in the country. This is indeed needed, as Indian is actively participating in a number of big telescope projects, e.g., TMT (Thirty Metre Telescope), which will produce high quality imaging and kinematics data, and modelling of these data requires advanced knowledge/ training in galaxy dynamics and evolution. The meeting was well attended by both Indian and international participants, who were experts in the field.



There were about 50 participants, and six sessions (a total of 31 oral presentation plus 10 posters) - each session was devoted to recent topics in the area of galaxy evolution and dynamics. In particular, focus was given to origin of spiral structures, role of bulges and bars on galaxy evolution and topics relevant to our own Galaxy, the Milky Way.



The meeting was jointly supported by the Indian Institute of Science, Bengaluru and IUCAA. GEDS - 2018 was the first in the series, and we plan to organise such meetings once every two years. Further details about the meeting and talks can be found at: <http://www.iucaa.in/ws/~geds2017/programme.html>

Farewell to ...

Anirban Ain, who left IUCAA at the end of his term.

Sabyasachi Chattopadhyay, who also left IUCAA at the end of his term.

Prasanta Bera, who has joined the NCRA-TIFR as a Post-doctoral Fellow.

Prakash Gaikwad, who has joined the Institute of Astronomy, University of Cambridge, UK, as a Research Associate.

Girjesh Gupta, who has joined the University of Cambridge, UK, as a Commonwealth Rutherford Fellow.

Anjali Rao Jassal, who has joined the University of Southampton, UK, as a Commonwealth Rutherford Fellow.

National Conference on High Energy Emission from AGN-III

The 3rd National Conference on High Energy Emission from Active Galactic Nuclei was conducted during November 28 - 30, 2017, at the University of Calicut, Kozhikode, and inaugurated by P. Mohan (Pro-Vice Chancellor, University of Calicut). Pradyumn, Professor and Head of the Department of Physics, University of Calicut, presided over the function. The key note address was given by P. Sreekumar, Director, IIA, Bengaluru.

There were 17 invited talks by faculty members and research scholars. The participants included researchers/faculty members from University of Kashmir, Srinagar; Tezpur University; Manipal University; St. Thomas College, Kozhancherry; IUCAA; TIFR, Mumbai; BARC, Mumbai; PRL, Ahmedabad; IIA, Bengaluru; and ARIES, Nainital. There was also a sizable fraction of participants from the University of Calicut, and its affiliated colleges. The topics



were mainly focussed on X-ray to gamma ray emission from Active Galactic Nuclei (AGN), giving particular emphasis on recent observations using modern facilities like the AstroSat.

There were also presentations on the recent theoretical developments by some participants aimed to explain the spectral and temporal behaviour of AGN. At the end of the

first and last days of the conference, there were extended discussions on the future course of research work and collaboration between the blazar community nationwide. A visit to the botanical garden inside the University campus, and a boat ride in Korappuzha were also organized as part of the conference.

Indo-Chilean Astronomical Dialogue - I

The First Indo-Chilean Astronomical Dialogue was organized at IUCAA, during January 10 - 11, 2018. This was an effort from the Chilean Embassy, New Delhi, at which three Chilean Astronomers, Neil M. Nagar (Universidad de Concepción), Eduardo Alejandro Unda Sanzana (SOCHIAS/ Universidad de Antofagasta), and Eduardo Ibar Plasser (Universidad de Valparaiso), and Camilo Rodolfo Millanao Llopis (Embassy of Chile in India, New Delhi) attended this dialogue.

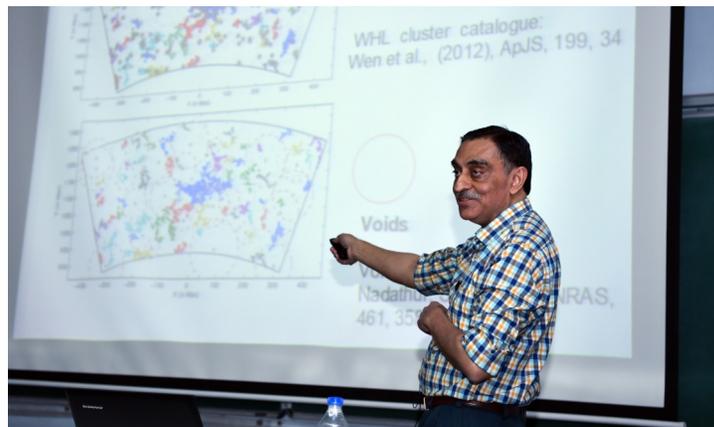
From the Indian side, there were presentations from Yashwant Gupta (NCRA, Pune) on Radio Astronomy in India and SKA Participation, G.C. Anupama (IIA, Bengaluru) on IIA Astronomy and TMT Participation, Saurabh Sharma (ARIES, Nainital) on ARIES Astronomy, D.K. Ojha (TIFR, Mumbai) on TIFR Astronomy, Asoke K. Sen (Assam University, Silchar) on Optical Polarimetric Astronomy Programme in India, Somak Raychaudhury (IUCAA) on Overview of Astronomy in India, R. Srinand (IUCAA) on IUCAA Observational Programmes,

Dipankar Bhattacharya (IUCAA) on Space Astronomy in India, and Durgesh Tripathi (IUCAA) on Solar Astronomy in India. Chilean presentations were from Neil M. Nagar and Eduardo A. Unda Sanzana on Facilities in Chile: Optical/Radio Telescopes, ELT Timelines, etc. and Funding: International Programmes through Conicyt (how to setup funds, lessons from Chile-China/Chile-France), and Eduardo Ibar Plasser on Science in Chile: Planetary, Galactic, Extragalactic.

Also showcase science of individual institutes and possible tentative scientific synergies from Chilean perspective (GMRT-ALMA, AstroSat, Simulations, Theory, etc.) were put forth. In addition, there were Indian university participants, H.P. Singh (University of Delhi) and Rupjyoti Gogoi (Tezpur University). Both sides agreed on some common interest areas in Radio and Optical Astronomy where future collaborations can be planned. Ranjan Gupta (IUCAA) was the coordinator of this dialogue.



The Franco-Indian School on From Reionization to Large Scale Structure - A Multi-wavelength Approach



Under the auspices of the Indo-French Centre for Promotion of Advanced Research (IFCPAR/CEFIPRA), a Franco-Indian School was organised at IUCAA during February 11 - 17, 2018. The theme was: From Reionization to Large Scale Structure - A Multi-wavelength Approach. The school was aimed at reviewing major advances in theoretical simulations and observational results on a wide range of extragalactic astrophysical contexts such as: Epoch of reionization, Cosmology with emission and absorption lines (Redshifted 21 cm Hydrogen, CO, H-alpha, Ly-alpha, etc.), Ly-alpha galaxies at high redshift, Gravitational lensing, Non-thermal and CO emission in cluster of galaxies and feedback, Nearby galaxies, Giant radio galaxies, AGNs, etc.

The school was attended by more than 35 PhD research scholars from both India and France, while the tutorials on various topics of current interest were taken by experts drawn from Indian and French universities, as well as IUCAA and NCRA/TIFR. On the last day, the participating research scholars presented results from their area of research. The school was inaugurated by Mukesh Kumar (Director, IFCPAR/CEFIPRA), who also delivered a talk on Indo-French programmes. Joydeep Bagchi (IUCAA) and Mamta Pandey-Pommier (Centre de Recherche Astrophysique de Lyon, France) were the coordinators of the school.



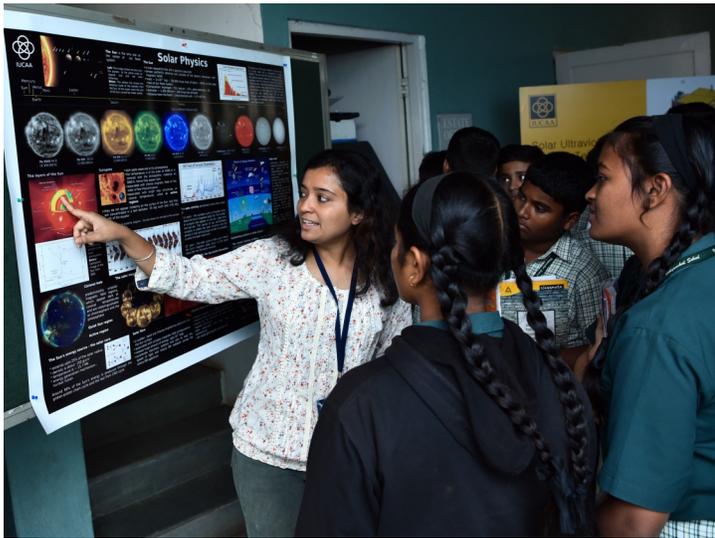
Public Outreach Activities

National Science Day

The celebrations of National Science Day and Open Day on February 28, 2018 attracted numerous groups of students, came from in and around Pune, and from other parts of Maharashtra. This really shows the hunger of people to associate better with Science and Scientists.

The main campus of the institute was adorned by the scale-models of different A & A projects of public interest like, LIGO-India, Aditya-L1, etc. The number of spectacular posters designed and presented enthusiastically by research scholars of IUCAA, made people aware of the on-going research and new developments in the subject. Apart from these, the Foucault pendulum, the statues of great scientists, demonstrations of Laser Interferometry, IFU and Polarisation, Radio Astronomy, etc. pulled in a large crowd.

Telescope making, coordinated by Tushar Purohit had people thronging the Science Park.



Short talks on the pictures of the universe in different wavelengths, large telescopes around the world, story of mathematics, galaxies, measuring astronomical distances were delivered by Ruchika Seth, Jameer Manur, Sonali Sachdeva, Pranoti Panchbhai and Yash Bhargava respectively, which kept the public rooted in the Chandrasekhar Auditorium during the morning. Parallel events like Science Toys demonstrations by students of Aksharnandan School, coordinated by Sonal Thorve, and demonstrations of

In the afternoon, during a live interaction, Jayant Narlikar and Somak Raychaudhuri eloquently answered several Astronomy related questions from the public.



Samir Dhurde hosted this programme, which was coordinated by Aseem Paranjape. Some very interesting questions regarding our universe came from young school kids. The auditorium was full, and many had to enjoy this via the live webcasting of the sessions online. Following this, there were two special talks on AstroSat Science and Discoveries by Dipankar Bhattacharya, and on Gravitational Wave: Multi-Messenger Astronomy by Sanjit Mitra. The evening lecture on the "2017 Physics Nobel Prize", titled, "Gravitational Waves: Einstein's Messengers" was proudly delivered by Sanjeev Dhurandhar, an important member of the Gravitational Waves Discovery Team.





The National Science Day and Open Day events saw a footfall of about 7,000 odd people, who visited IUCAA in the day sessions, and a whopping about 1,800 odd people who attended the sky watching at night!

As per tradition, there were events for school students prior to the Open Day. IUCAA Public Outreach personnel conducted a science quiz along with essay writing, and drawing competitions for the rural students of the Ambegaon Taluka on February 3, 2018. Pratik Dabhade, Pranoti Panchbhai and Siddharth Maharana enthusiastically encouraged students from 33 rural schools, who competed at the venue generously provided by the New English School, Landewadi. A lot of help also came from the IUCAA Girawali Observatory staff, Nilesh Pokharkar along with others. On February 24, 2018, about 380 students from 63 schools in Pune city responded to IUCAA's invitation, and participated in another set of inter-school competitions. Students from classes 8 to 10 took part in the drawing, essay, poetry and science quiz competitions. A. N. Ramaprakash (IUCAA) gave an interactive talk to the

teachers, who accompanied the students. After the finals of the quiz competition, all winning students received their prizes from Somak Raychaudhuri, which included the students from the rural schools, who were specially invited to IUCAA for a visit that day. All the students were enthused and also very happy to have a chance to interact with the IUCAA scientists during these National Science Day celebrations.



The List of Prize Winners from Rural Schools of National Science Day Competitions, Held on February 3, 2018.

Science Quiz

1st: Pitamber Nareshwar Pandey, Ghanshyam Nareshwar Pandey, and Gururaj Prashant Saraf, from New English School, Ghodegaon.

2nd: Sonal Rajaram Kather, Jitesh Shivaji Mahale, and Vallabh Santosh Dukare, from New English School, Landewadi.

3rd: Srushti Devidas Hinge, Vaishnavi Avinash Kadam, and Onkar Rohidas Sonawne, from Vidya Vikas Mandir, Avasari.

Essay Writing

1st: Aadesh Suresh Chaskar, from Hutatma Babu Genu Vidyalaya, Mhalunge, Padval.

2nd: Anita Kantaram Tawhare, from Nalanda English Medium School, Manchar.

3rd: Ankita Ramesh More, from Shri Mukta Devi Vidyalaya, Narudi.

Drawing

1st: Siddhi Santosh Doke, from New English School, Landewadi.

2nd: Tanmay Prashant Wable, from Mahatma Gandhi Vidyalay, Manchar.

The List of Prize Winners from Pune City Schools of National Science Day Competitions, Held on February 24, 2018.

Science Quiz

1st: Shreyas Sameer Datar, Shriram Abhijit Jorvekar, and Srisha Bhushan Rewatkar, from Symbiosis Secondary School.

2nd: Chahel Singh (Singly represented), from Delhi Public School, Pune.

3rd: Ajinkya Rahul Sindkhedkar, Abhijoy Asish Bhattacharya, and Chris Jijo Thottakkara, from Loyola High School & Jr. College.

Essay Writing: Marathi

2nd: Sejal Sanjeev Patil, from Modern High School (Marathi Medium) for Girls.

3rd: Shambhavi Shailesh Date, from Ahilyadevi High School for Girls.

[None of the essays in Marathi was awarded the first prize.]

Essay Writing: English

1st: Dalika Rajas Joshi, from Dr. Kalmadi Shamarao High School.

2nd: Arushi Dubey, from The Bishop's Co-Ed School.

3rd: Dhruv Ravindra Naik, from Loyola High School & Jr. College.

Drawing:



1st Prize

HETAL DHIREN GANDHI

Journey in Space 2050



2nd Prize

GITESH PRAMOD DOSI

Journey in Space 2050



3rd Prize

DEEPANKITA SAHA

The Milky Way



3rd Prize

ANISHA AJAY MANE

Explosion of a Star

1st: Hetal Dhiren Gandhi, from Dr. Kalmadi Shamarao High School.

2nd: Gitesh Pramod Dosi, from Muktatangan English School & Jr. College.

3rd (Jointly): Deepankita Saha, from St. Mary's School and Anisha Ajay Mane, from Symbiosis Secondary School.

Poetry: English

1st: Isha Shakeel Syed, from St. Joseph's High School

2nd: Meenakshi Vishwas Bapat, from Dr. Kalmadi Shamarao High School.

3rd: Shambhavi Rajshekhar Police Patil, from Vidya Pratishthan's Vinodkumar Gujar Bal Vikas Mandir.

Poetry: Marathi

1st: Bhargavi Mayuresh Deshpande, from Ahilyadevi High School for Girls.

2nd: Sanika Ganesh Rasal, from Jnana Prabodhini Navanagar Vidyalaya (M).

3rd: Priya Prasad Thakurdesai, from Bharat English School.

Equinox Event

On the occasion of Vernal Equinox on March 21, 2018, Shivom Gupta (IUCAA) coordinated an event for school students from classes 8 to 11, who performed an experiment to measure the circumference of the earth by using shortest shadow method. The method was first used by Eratosthenes (276 BC - 194 BC), a Greek mathematician, geographer and astronomer in 240

BC. About 37 students from 9 schools in Pune participated in this activity. From the noon to the hot sunny afternoon, the students patiently and curiously traced the shadows of gnomons provided to them for more than 1.5 hours to get the shortest shadow, and hence determined the earth's circumference.

Other Regular Events

The Public Outreach groups conducted 2 science toys workshops, 2 basic astronomy workshops, 2 campus visits, and 4 sky-watches with an approximate reach to 700 people.

A group of faculty members and staff from the Centre for Education, Innovation and Action Research, Tata Institute of Social Sciences, Mumbai, who are inclined towards academic writing, visited IUCAA Science Centre on January 18, 2018. Samir Dhurde (IUCAA) shared information about IUCAA Science Outreach Programme, and demonstrated how does a digital medium help in this.



Workshop on Astronomy for Development

A one day Workshop on Astronomy for Development was held at IUCAA on January 20, 2018, with invited participants, who were interested in astronomy, education and social sciences. There were 23 participants, and 6 attended online. Prior to the discussions, Jayant Narlikar, Somak Raychaudhury and Ajit Kembhavi (all from IUCAA) addressed the participants.

The aim of the workshop was to bring together a community of multi-disciplinary enthusiasts, and brainstorm on possible projects in the context of Astronomy for Development.

Discussions were focused on the following three themes: (i) Astronomy tools and techniques that can be used to aid implementation of development goals, (ii) Evaluation tools and methodologies for astronomy outreach, communication and education projects, and (iii) Education pedagogy on using astronomy for inspiration and critical thinking, and improving inclusive access to astronomy. The workshop was coordinated by Samir Dhurde (IUCAA) and Niruj M. Ramanujam (Astronomical Society of India's Public Outreach and Education Committee), together with Ramaswamy Venugopal (IAU Office of Astronomy for Development).

Total Lunar Eclipse



On January 31, 2018, there was a triple bonanza for astronomy enthusiasts. The total lunar eclipse that occurred on the second full moon of the month (i.e., a "blue moon") and close to the super-moon position. This was celebrated on a large scale by IUCAA, in which Samir Dhurde (IUCAA) coordinated the national effort to arrange viewing programmes all over the country as part of the ASI POEC effort. This resulted in more than 500 registered observation events, most of which were at remote or rural places.

2nd Saturday Lectures

January 13, 2018 : Samir Dhurde (IUCAA) on The Moon, and February 10, 2018 Shantipal Ohol (College of Engineering, Pune) on Robotics.

Public Talks



January 17, 2018: Mark Birkinshaw (University of Bristol, UK) on Ancient Light: The Microwave Background Radiation and Cosmology.



February 17, 2018: Jen Gupta (University of Portsmouth, UK) on The Invisible Universe.

Special events outside IUCAA



EDUSAT Network National Orientation Programme: Sonal Thorve participated in this orientation-cum-training workshop organised by Vigyan Prasar, in Chennai, during March 6 - 8, 2018. She presented the status report of the IUCAA satellite interactive terminal.



South Region Workshop on Zero Shadow Day: Sonal Thorve was a resource person at the workshop organised by the Tamil Nadu Science Forum and ASI POEC, at Pondicherry, during March 10 - 11, 2018. She was part of a session on role play in astronomy education.



Astronomy Lecture: As a part of the summer camps organised by Mukangan Exploratory, Pune, an introductory lecture on Astronomy was delivered by Shivom Gupta on March 26, 2018. About 50 school students attended and enjoyed the session.



Science Toys Demonstration, Sky-watching: Members of IUCAA Public Outreach team visited the social projects: Lok Biradari Prakalp (for the development of tribal people), at Hemalkasa, Gadchiroli District, Maharashtra, and at Anandwan (a community rehabilitation centre for leprosy patients and the disabled from downtrodden sections of society), Chandrapur District, Maharashtra. On March 29, 2018, with the help of local teachers, the team organised and conducted science toys demonstrations and sky-watching sessions for the tribal students of Lok Biradari Prakalp Ashram Shaala. About 600 students from classes 1 to 11 participated, enjoyed the activities and interaction. On March 30, 2018, the team conducted the same activities for students with special needs as well as for residents of Anandwan. About 100 participants enjoyed and appreciated the activities.



LIGO-India Education and Public Outreach

LIGO-India Education and Public Outreach: The LIGO-India EPO (LIEPO) effort has been formally launched in February 2018, and is now hosted at IUCAA. Several activities have been started by the associated team. It has an online presence on Facebook and twitter as well (@LIGOIndia).

Science and astronomy workshops were conducted in Podar International School, Hingoli on March 12, 2018, and at ZP Girls High School, Hingoli on March 13, 2018 as a part of LIGO-India Education and Public Outreach. These events were for the students of classes 6 - 8. Ankit Bhandari and Rupesh Labade (both from IUCAA) were the resource persons for the workshops, and Bhooshan Gadre (IUCAA Research Scholar) also interacted with the students in special talks. He explained his journey until now, and also spoke about research as a career option and the essential traits needed.

On March 27, 2018, the Department of Physical Sciences from SRTM University, Nanded, hosted a set of talks in collaboration with the LIEPO team. These were specifically meant for all post-graduate and PhD students. The topics for the talks were: Gravitational Waves: A New Frontier in Astronomy by Anirban Ain (IUCAA) and LIGO-India, and Opportunities in Astronomy and Astrophysics by Javed Rana (IUCAA). About 60 students from the department attended the talks.

On the same day, Sanjeev Dhurandhar delivered an inspiring and motivating lecture titled "Nobel Prize in Physics 2017: Gravitational Waves as Einstein's Messenger" at the Government Engineering College (GEC), Awasari (Manchar), Pune. The lecture was organised by Nilesh Pokharkar (IUCAA, IGO) and the GEC, in collaboration with LIEPO team.

CAP - 2018 Conference



Samir Dhurde secured a grant to travel to Fukuoka, Japan, to be part of the IAU's Communicating Astronomy with Public conference during March 23 - 29, 2018. This international meeting had more than 400 participants from around 50 countries. He presented a poster on Transit of Mercury in India: A crowd-sourced, large-scale observational outreach campaign, delivered a session talk on Let's Celebrate Zero Shadow Day!, and conducted a workshop on Organizing Frameworks for Communicating Science in Large, International Science Collaborations, as part of the TMT WEPOC Group. He was also the chairperson for the session on the theme: Best Practices in Outreach Engaging Children and Students. All the presentations were well appreciated by the audience and IUCAA's role in international outreach was also recognised.

Visitors (January- March 2018)

E. Aarthy, Bhagyada Abhyankar, Oluwashina Adegoke, Poonam Agrawal, Gazi Ameen Ahmed, Kedar Aitawdekar, Md. Sabir Ali, Praveen Allamsetti, Shreya Anand, G.C. Anupama, K. G. Anusree, Shikhar Asthana, Apoorva Abiramiy B.T., Kalyani Bagri, Arunima Banerjee, Ranajoy Banerji, Ravinder Kumar Baniyal, Samuzal Barua, Sudhanshu Barway, Tomaso Belloni, Aru Beri, Nutan Bharati, Anupam

Bhardwaj, Saurabh Bharswadkar, Prachi Bhatia, Sudip Bhattacharyya, Yashpal Bhulla, K.G. Biju, Priyanka Biradar, Mark Birkinshaw, Anshuman Borgohain, Arindam Bose, Robert Botet, Patrick Brady, Rijuparna Chakraborty, Sudip Chakraborty, Anirban Chanda, Ramesh Chandra, Suresh Chandra, Meera Chandran, Philip Charles, Soumyadeep Chatterjee, Subhamoy Chatterjee, Surajit Chattopadhyay,

Raghavendra Chaubey, Bhag Chand Chauhan, Sheetal Chopde, Madhurima Choudhury, Debika Chowdhury, Arianna Cortesi, Elena D'onghia, Abhishek Das, Amit Das, Mousumi Das, Sushanta Dattagupta, Subhadeep De, Debabrata Deb, Shantanu Desai, Ralf J. Dettmar, Pooja Devi, Payaswinee Dhoke, Wim Van Driel, Savithri Ezhikode, Jose Toni Font, Jonathan Freundlich, Radouane Gannouji, Sharad Gaonkar, Thibault Garel, Akash Garg, Koshy George, Soumavo Ghosh, Sushant G. Ghosh, Tuhin Ghosh, Gourab Giri, Rupjyoti Gogoi, Anindita Goswami, G.K. Goswami, Pranjupriya Goswami, Umananda Dev Goswami, Milind Goverdhan, Shivappa B. Gudennavar, Bruno Guiderdoni, Ajesh Gulati, Anuradha Gupta, Oliver Hahn, Mubashir Hamid, Gajanan D. Harale, Ananda Hota, Nikhil Hulke, Joe Jacob, Dhairyashil Jagadale, Rajeev Jain, Priyanka Jalan, Reju Sam John, Yogesh Joshi, Yogeshkumar Dileepkumar Joshi, Aditya K., Keerthi K. R. D., Sonali Kadam, Shivaraj Kandhasamy, Sasikumar Raja Kantepalli, Tanvi Karwal, Sandeep Kumar Kataria, Olivier Kauffmann, Manjeet Kaur, Ankita Khanal, Rukaiya Khatoon, Rishi Khatri, Yana Khusanova, Renbeni Kikon, Brajesh Kumar, Brijesh Kumar, Jais Kumar, Lalit Kumar, Meghana Kumar, Mukesh Kumar, Pravir Kumar, Shibesh Kumar, Ioannis Kypriotakis, David James Lagattuta, Young-Wook Lee, Camilo Millanao Llopis, Akshaya Subbanna M.S., Sunil Malik, Soma Mandal, Suvadip Mandal, Bari Maqbool, Andrew Matas, Archana Mehendale, Ashish Mhaske, R.K. Mishra, N.P.S. Mithun, Baisakhi Mitra, Subhendra Mohanty, Abhishek Mohapatra, Reetanjali Moharana, Chayan Mondal, Mona Mostafa, Sneha Prakash Mudambi, Arunava Mukherjee, S. Mukherjee, Subroto Mukherjee, Sadaqat Mulla, Neil Mark Nagar, G. Nagarjuna, Surbhi Nagpal, Nikhil Naik, Hemwati Nandan, Rana Nandi, D. Narasimha, Rajalakshmi Narayanan, Nilam Navale, Spoorthi Nidhuram, Devendra Ojha, Amitesh Omar, Mayukh Pahari, John Paice, Barun Kumar Pal, Anil K. Pandey, Sanjay Pandey, Mamta Pandey-Pommier, Mahadev Pandge, P.N. Pandita, K. Pappooty, Manu Paranjape, Rutu Parekh, Abhishek Parida, Shashank Parimi, K.D. Patil, M.K. Patil, B.C. Paul, Debducta Paul, Nupur Paul, Surajit Paul, Devraj Pawar, Pramod Pawar, Daniel Pfenniger, Eduardo Ibar Plasser, Anirudh Pradhan, Pragati Pradhan, G. Veda Prakash, Marina

Prokopieva, Akhil Punia, Frederick J. Raab, Tanya Rabban, Farook Rahaman, Anusha Ramanathan, Nirmala A. Ramtekkar, Akshay Rana, Rahul Rana, Sandeep Rana, Geeta Rangwal, A.R. Rao, Ajay Ratheesh, Kanishka Rawat, Katherine Rawlins, Subharthi Ray, Biplab Raychaudhuri, B. Eswar Reddy, Joakim Rosdahl, Aditya Rotti, Nirupam Roy, P.C. Sachin, Sanjay Kumar Sahay, Sunder B. Sahayanathan, Shishir Sankhyayan, Varun Saraswat, Suchira Sarkar, S. Seetha, Raja Sekhar, Asoke Kumar Sen, Zahir Ahmad Shah, Rafikh Shaikh, Nigar Shaji, Mohit Kumar Sharma, Neha Sharma, Ramkishor Sharma, Ranjan Sharma, Vipin Kumar Sharma, Sherehan Shehata, Satej Shende, Yuri Shtanov, H.S. Sunil Simha, Ajay Singh, Ankit Singh, Gyan Prakash Singh, H.P. Singh, Heisnam Shanjit Singh, Aneesh Sivasankaran, Vikram Soni, L. Sriramkumar, Arun Srivastava, Varun Srivastava, Annapurni Subramaniam, Vipin Sudevan, Sita Sundar, S. Sunil, Avinash Surendran, Esha Swaroop, Lekshmi T., Sweta T., Amit Tamrakar, Sankarsan Tarai, Bindu Thirumalai, Neal Thomas, Vithal Tilvi, Alexei Toporensky, Laurence Tresse, Paniveni Udayashankar, Eduardo Alejandro Unda, Rashmi Uniyal, Amrita Unnikrishnan, Santosh Vadawale, Deepak Vaid, Monica Valluri, Manoj Varma, Ramasamy Venugopal, Anne Verhamme, Murli Manohar Verma, Sarita Vig, Amit Vikram, Alexander Vilenkin, R.G. Vishwakarma, Rahul Kumar Walia, Bal Krishna Yadav, Sarvesh Yadav, Urjit Yajnik, Khabbab Zakaria, Giulio Del Zanna, and Andrzej Antoni Zdziarski. MG University, Kottayam; Mahadev Pandge, Dayanand Science College, Latur; Geetha Paul, St. Thomas College, Kozhencherri; Ninan Sajeeth Philip, St. Thomas College, Kozhencherri; Anil Prabhakar, IIT - Madras, Chennai; Binay Rai, North Bengal University, Siliguri; Chayan Ranjit, Egra SSB College, Aklabad; Divya Rawat, IIT, Kanpur; Prabir Rudra, Asutosh College, Kolkata; Nayan Sarkar, Jadavpur University, Kolkata; Susmita Sarkar, Jadavpur University, Kolkata; Sinenhlanhla Sikhosana, University of Kwazulu-Natal, South Africa; Alkendra Singh, Banaras Hindu University, Varanasi; Anitta Sunny, University of Calicut, Kozhikode; Jean Surdej, Liege University, Belgium; Radhika T. P., University of Calicut, Kozhikode; and Vaibhav Tiwari, Cardiff University, UK.

Visitors (Expected)

April 2018

K. G. Biju, WMO Arts, and Science College, Muttill, Wayanad; Susmita Chakravorty, IISc, Bengaluru; Philip Charles, University of Southampton UK; Jishnu Dey, Presidency

University, Kolkata; Mira Dey, Presidency University, Kolkata; Joyee Ghosh, IIT, Delhi; K. P. Harikrishnan, The Cochin College, Kochi; Michelle Heurs, Leibniz University, Hannover, Germany; Sayeedul Islam, Jadavpur University, Kolkata; Joe Jacob, Newman College, Thodupuzha; Yasha Kaushal; Aniruddha Kembhavi, Allen Institute of Artificial

Intelligence, USA; Kenda Knowles, University of Kwazulu-Natal, South Africa; Nagendra Kumar, MMH College, Ghaziabad; Sujata Kundu, Narula Institute of Technology, Kolkata; Sreelakshmi M., Government College, Madappally; Abdulla Al Mamon, Jadavpur University, Kolkata; Abhijit Mandal, The University of Burdwan; Bari Maqbool, IIA, Bengaluru; Anupama Mohanan, Government College, Madappally; Vishnu Namboothiri, Christ University, Bengaluru; Sajal Mukherjee, IISER, Kolkata; Hemwati Nandan, Gurukula Kangri Vishwavidyalaya, Haridwar; Divya Pandey, NIT, Rourkela; Sanjay Pandey, LBSPG College, Gonda; Rutu Parekh, Dhirubhai Ambani Institute of Information and Communication Technology, Gandhinagar; K. D. Patil, BD College of Engineering, Wardha; M. K. Patil, SRTM University Nanded; Devraj Pawar, RJ College, Mumbai; Swarup Poria, University of Calcutta, Kolkata; Ananta Charan Pradhan, NIT, Roorkee; Sudipta Sarkar, IIT, Gandhinagar; Parampreet Singh, Louisiana State University, USA; Amira Ahmed Tawfeek, National Research Institute of Astronomy and Geophysics, Helwan, Egypt; Arun Thampan, St. Joseph's College, Bengaluru; and Deepak Vaid, NIT, Mangalore.

May 2018

Sheelu Abraham, Pune; Tanwi Bandyopadhyay, Adani Institute of Infrastructure Engineering, Ahmedabad; Arunima Banerjee, IISER, Tirupati; Sarmistha Banik, BITS-Pilani, Hyderabad; Ritabrata Biswas, The University of Burdwan; Koushik Chakraborty, West Bengal State University; Subenoy Chakraborty, Jadavpur University, Kolkata; Sumanta Chakraborty, Indian Association for the Cultivation of Science, Kolkata; Ritaban Chatterjee, Presidency University, Kolkata; Mamta Dahiya, SGTB Khalsa College, New Delhi; Broja Gopal Dutta, Rishi Bankim Chandra College, North 24 Parganas; Sutapa Ghosh, Barasat Government College, Kolkata; Shivappa Gudennavar, Christ University, Bengaluru; Nandini Hazra, IISER, Pune; David Hilditch, Technical University of Lisbon, Spain; Kanti Jotania, The M.S. University of Baroda, Vadodara; Kinjalk Lochan, IISER, Mohali; Soma Mandal, Government Girl's Degree College, Kolkata; Saptarshi Mondal, Bethune College,

Kolkata; Aditya Mondal, Visva-Bharati, Santiniketan; Sneha Prakash Mudambi, Sanjay Sahay, BITS-Pilani, Goa; Prasant Samantray, BITS-Pilani, Hyderabad; Somasri Sen, Jamia Millia Islamia, Delhi; Anand Sengupta, IIT, Gandhinagar; Gyan Prakash Singh, Visvesvaraya NIT, Nagpur; Maninder Pal Singh, SGTB Khalsa College, New Delhi; Heisnam Shanjit Singh, Rajiv Gandhi University, Arunachal Pradesh; Monika Sinha, IIT, Jodhpur; Parijat Thakur, Guru Ghasidas Central University, Bilaspur; S. K. Tripathy, IGIT, Dhenkanal; Amrita Unnikrishnan, IIT, Roorkee; Anisul Ain Usmani, Aligarh Muslim University; Rahul Walia, Jamia Millia Islamia, Delhi; and Jaswant Kumar Yadav, Central University of Haryana, Mahendergarh.

June 2018

Gazi Ameen Ahmed, Tezpur University; Karabee Batta, BITS, Pilani; Sudipta Das, Visva-Bharati, Santiniketan; Debabrata Deb, IEST, Howrah; Sandip Dutta, The University of Burdwan; Sushant Ghosh, Jamia Millia Islamia, Delhi; Rupjyoti Gogoi, Tezpur University; Sarbari Guha, St. Xavier's College, Kolkata; Priya Hasan, Maulana Azad National Urdu University, Hyderabad; Nikhil Hulke, Visvesvaraya NIT, Nagpur; Sai M. Jadhav, MIT, Pune; Deepak Jain, Deen Dayal Upadhyay College, Delhi; Pranav A. Kadam, MIT, Pune; Ram Kishore, Central University of Rajasthan, Ajmer; Anirudh P. Kulkarni, MIT, Pune; Suresh Kumar, BITS, Pilani; Badam Singh Kushvah, Indian School of Mines, Dhanbad; Smriti Mahajan, IISER, Mohali; Bivudutta Mishra, BITS-Pilani, Hyderabad; Soumen Mondal, Jadavpur University, Kolkata; P. N. Pandita, IISc, Bengaluru; Amit Pathak, Banaras Hindu University, Varanasi; Devraj Pawar, RJ College, Mumbai; Karthick Prabhu IISER, Pune; Shantanu Rastogi, DDU Gorakhpur University; and Saibal Ray, Government College of Engineering and Ceramic Technology, Kolkata;

Long Term Visitors

Ajesh Gulati, TMT Project Office, USA; and Dhruba J. Saikia.

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