Report of Astronomy Olympiad Exposure Camp
CESME, HBCSE

(Under PMMMNMTT scheme of MHRD)

Date: November 5-8, 2019

Homi Bhabha Centre for Science Education

Tata Institute of Fundamental Research

December 2019

Background:
The primary objective of this camp was to spread awareness about the national Olympiad programme, in particular, the Astronomy Olympiad. An orientation towards the academic and organizational aspects of the Astronomy Olympiad was provided. The camp also served as a platform for productive interaction within the teacher community.

Description:

The camp was conducted as part of CESME (HBCSE) activities under PMMMNMTT scheme of MHRD. It consisted of multiple lecture sessions and tutorials on different topics in astronomy such as celestial mechanics, observational astronomy, positional astronomy and observable properties of stars. Night sky observation sessions, including telescope handling, was also held during the camp keeping in mind the availability of telescopes in their institutes.

Sessions

Introduction to Olympiads – Prof. Anwesh Mazumdar (NC, Science Olympiad) welcomed the participants, and gave a brief introduction about HBCSE. This was followed by a detailed briefing about the Olympiads program. The participants were provided with olympiad program booklets and their queries were answered.

Basic terminologies – This session was conducted by Mr. P. Ranadive. In this session, a primer on the various topics and basic terminologies in astronomy was given. This included day, night, seasons, eclipses, angular measures in the sky, etc. Magnitude scale and absolute and apparent magnitude and formulas to calculate magnitudes of celestial objects were covered. The aim of the session was to familiarize and revisit various basic concepts used in astronomy and in the following tutorials.

Astronomical Coordinates – This session conducted by Dr. A. Sule was covered one of the most important topics in astronomy olympiads “Coordinate Systems”. This included a detailed picture of various coordinates used in astronomy like Altitude, Azimuth, Right Ascension, Declination, Hour angle. This was used to find the rise and setting time of celestial objects with the help of examples. Concepts like sidereal and synodic time were covered and numerical problems were used to make participants understand how to use these concepts while solving problems.

Celestial Mechanics – Prof. A. Mazumdar started the session with cartesian coordinate system and developed the basics theory of the subject. Newton's laws were extensively discussed and the misconceptions which students usually have were addressed and answered. Topics like work-energy theorem, conservation laws, orbital motion was covered with illustrations.

Telescope and Observation – This session was a demonstration of the assembly and use of a Newtonian telescope with an equatorial mount. Basic optics of the telescope were explained. The coordinate system used in the mount was demonstrated. This session was followed by sky observation on NIUS building terrace. Finding directions and identifying a few bright constellations were taught. Object like Moon, Saturn, Jupiter and h and chi double cluster was observed through telescopes. One 8” Dobsonian telescope and three 6” telescopes were used to show the objects. The telescopes were handled by Mr. Pranay Parte, Dr. Gururaj Wagle, Mr. Dhaval Dalvi, and Mr. Pritesh Ranadive.

Stellar Observations(BB and Stars) – This session was aimed at linking the theory of black body radiation with stars. Stars are considered as blackbody causes confusion with many students. Dr. Aniket Sule started by explaining the details of black body radiation. He explained the Planck curve and how the B-V photometric system was explained. Magnitudes, flux, and luminosity was explained.

Role Play activities – This activity was conducted in order to demonstrate teaching techniques for various astronomical concepts. Mr. Pranay Parte started by discussing time zones, phases of the moon, eclipses and

motion of the earth around the sun and tilt of the earth. Later on, participants were called ahead and were asked to imitate sun, moon, and earth and each of the above concepts was demonstrated using role play.

Physics of stars (I and II) – Prof. Anwesh Mazumdar conducted this session using a questionnaire prepared by him to teach stellar evolution and stellar structure. This included questions like how big are stars, what is the temperature, density, and pressure inside the star. Participants were asked to do order of magnitude estimates using dimension analysis. The evolution of stars of different masses and their end states was explained in detail qualitatively.

Planets around other stars – Mr. Pritesh Ranadive started the session by discussing the 2019 noble prize in physics given for the discovery of exoplanets. Various techniques of detection of exoplanets like transit method, radial velocity curve were discussed in detail. A demonstration of the transit method was shown by Prof. Anwesh Mazumdar and Mr. Shirish Pathare. This included a working model of balls (depicting) planets of various sizes going around a light source (stars) was used and the light curve in real-time was plotted on the screen.

Tutorials: Three tutorial sessions were conducted during the program. Interesting problems from past years of International Olympiad on Astronomy and Astrophysics were selected. Tutorial sheet containing these problems was provided with the registration kit. Participants were expected to solve the problems and explain them to others. The session was conducted by Dr. Aniket Sule, Mr. Pranay Parte, Mr. Gururaj Wagle, Mr. Pritesh Ranadive, Dr. Vinita Navalkar who explained the intricacies of the problems.

Interesting Problems from Past INAO's: Some interesting problems form past Indian National Astronomy Olympiad (INAO) were selected and discussed during the session. This was to give a flavor of the type of questions asked during INAOs which are different than the IOAA problems. This session was conducted by Dr. Aniket Sule and Mr. Swapnil Jawkar.

The session was concluded with certificate distribution and teachers were asked to give their feedback. The entire program was well received by teachers and a few sample feedbacks are given below.

Some representative Feedback

From Participants:

The programme was effective and well organized, but duration should have been longer.

Learned basic mechanics and mathematics to astrophysical problems.

Sky watch and role play activities are very useful, more time should be allotted for these activities.

We are from Srilanka, we need more such camps to help train our teachers.

Got many concepts regarding telescopes and other astronomical subjects cleared. Some of the teaching methods are very much useful for me and I will adapt it in my classroom.

Annexure A

Astronomy Olympiad Exposure Camp – Schedule
November 5-8, 2019

Day	Date	Time	Title	Speaker
Tuesday	**05/11/2019**	09:00 to 09:45	**Registration**	
		09:45 to 10:30	Introduction to Olympiads	AM
		10:30 to 11:00	*Tea break*	
		11:00 to 12:30	Basic Terminology	PR
		12:30 to 13:30	*Lunch*	
		13:30 to 15:00	Astronomical Coordinates	AS
		15:00 to 15:30	*Tea break*	
		15:30 to 17:00	Celestial Mechanics	AM
		17:00 to 17:30	*Tea and Snacks*	
		18:00 to 20:30	Telescopes + Observations	PR + PP
Wednesday	**06/11/2019**	9:00 to 10:30	Optics	VK
		10:30 to 11:00	*Tea break*	
		11:00 to 12:15	Stellar Observations (BB and Stars)	AS
		12:30 to 13:30	*Lunch*	
		13:30 to 15:00	Tutorial	AS+PR+PP+ VN
		15:15 to 15:30	*Tea break*	
		15:30 to 17:00	Role Play Activities	PP + VN
Thursday	**07/11/2019**	9:00 to 10:30	Physics of Stars – 1	AM
		10:30 to 11:00	*Tea break*	
		11:00 to 13:00	Physics of Stars – 2	AM
		13:00 to 14:00	*Lunch*	
		14:00 to 15:45	Tutorial – 2	AS + PP + VN
		15:45 to 16:00	*Tea break*	
		16:00 to 17:30	Tutorial – 2 ctd...	AS + PP + VN
Friday	**08/11/2019**	9:00 to 10:30	Planets around other stars	PR
		10:30 to 11:00	*Tea break*	
		11:00 to 12:30	Interesting Problems from past INAOs	AS + PP + PR + SJ
		12:30 to 13:30	*Lunch*	
		13:30 to 15:00	Problem proposals from participants	
		15:30 to 16:30	Valedictory	

Annexure B

List of resource persons

Prof. V. Katdare, Ruparel College (Rtd.)	(VK)
Prof. Anwesh Mazumdar, HBCSE	(AM)
Dr. Aniket Sule, HBCSE	(AS)
Mr. Swapnil Jawkar, SIES College Sion	(SJ)
Dr. Vinita Navalkar, UM-DAE-CEBS	(VN)
Mr. Pranay Parte, HBCSE	(PP)
Mr. Pritesh Ranadive, HBCSE	(PR)

Annexure C

List of Participants

Sr. No.	Name	Gender	Designation	Name Of Institution
1	Abdul Rahoof K A	M	Assistant Professor Of Physics	Sullamussalam Science College
2	Ahmad Abdullah Rifat	M	General Secretary, Bangladesh Olympiad On Astronomy & Astrophysics	Jahangirnagar University
3	Ajay Kumar Singh	M	PGT Mathematics	Jawaharnavodaya Vidyalaya Mau Beohari Shahdol MP
4	Anil Kumar	M	Head Master	Govt.Sec.School Dabla
5	Anindya De.	M	Assistant Master	Hindu School
6	Athivarama Venkata Sudhakar	M	School Assistant Physical Science	DNR ZPHS (Boys) Podalakur
7	Ayan Kumar Saha	M	In Charge, Sub Regional Science Centre, Udaipur Tripura Under TSCST	Tripura Astronomical Society
8	Barnali Das	F	PGT Physics	Ganesh Mandir Higher Secondary School
9	Chitlu Gangaraju	M	School Assistant Physical Science	Zillaparishad High School Brahmanagudem
10	Debendra Kumbhar	M	TGT Physics, Chemistry & Mathematics	Bhima Bhoi Govt. High School,Lachhipur
11	Dipanjan Paul	M	PGT Physics	Alipurduar High School (H.S.)
12	Raghvendra Gouraha	M	Principal Govt. School Bilaspur	Govt Multipurpose Hr Sec School Bilaspur
13	Anil Shalik Gaikwad	M	Assistant Professor	Spdm College, Jalgaon
14	Gajendra Singh Patel	M	HOD Physics	Sica S.S.School No.2
15	Durga Prasad Subedi	M	HOD Science	Shree Shitaladevi Community Secondary School
16	Ekta Vyas	F	Faculty	Nasa Education Network
17	Gaurav Kumar	M	TGT Science	Swami Vivekanand Public School
18	Huidrom Prem Kumar Singh	M	Maths Graduate Teacher	Toupokpi Govt. High School, Chandel
19	Janaki Kumari Chhantyal	F	Program Coordinator	Nepal Astronomical Society
20	Jude Vijayanga Wijesekera	M	Lecturer	Institute Of Astronomy Sri Lanka
21	Komal Prajapat	F	Secretary	Kalpana Chawala Science Club
22	Kubla Khan	M	PGT Physics	International School, Guwahati
23	Manoj Kumar Songh	M	Senior Secondary Teacher Physics	Bishweshwar Seminary, Chapra,Saran
24	Unnati Chandrakantbhai Sharma	F	TGT Physics	Aryam Educational Academy
25	Nafeesa Baby T P	F	Assistant Professor	Sir Syed College Taliparamba

26	Patel Anjana N.	F	Principal	Kanyavinay Mandir Sanskartirth; Ajol
27	Pradeep Kumar	M	PGT Physics	Hindu Inter College Jaswantnagar Etawah UP
28	Prakash	M	PGT Mathematics	Government Senior Secondary School Jhojhu Kalan
29	Prince Sharma	M	PGT Physics	Kendriya Vidyalaya No 1 Rcf Hussainpur
30	Pyarilal Vr	M	HST Physical Science	Smv Higher Secondary School Poonjar
31	Randika Mendis	M	Lecturer	Institute Of Astronomy, Sri Lanka
32	Santosh Kumar	M	PGT Physics	Kendriya Vidlaya No.1 Bathinda Cantt.
33	Shiwani	F	PGT Physics	Kamla Nehru Public School Chak Hakeem Phagwara
34	Sumit Kumar Shrivastava	M	Scientific Officer	Indira Gandhi Planetarium, Council Of Science & Technology, UP
35	Yam Prasad Subedi	M	HOD Physics And Science Coordinator	Kumudini Homes Secondary School
36	Jayashri Kalyanrao Chavan	F	Assistant Teacher Junior College	Smt. P.A Sodha Sarvajanik High School And Jr College Navapur
37	D.V. Subba Naidu	M	School Assistant Physical Science	Zilla Parishad High School , Thallamapuram