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India's Exciting Space Journey: Chandrayan 2



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This is a quarterly e-magazine published by Navi Mumbai Science Foundation, a society engaged in spreading science education among students of Navi Mumbai region for last one decade. The magazine will cover all the activities of the society as well as articles on educating science to the students and teachers.



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Image courtesy:

<https://www.isro.gov.in>

From Editor's Desk!!....

In the month of November every year, science community throughout the world eagerly waits one of the greatest announcements of the year i.e. Noble prizes. This year also the prizes have been won by the scientists who have spent their whole life for the betterment of science. Science is a journey and not the destination, you have to work hard day and night without expecting faster results.

If you see the list of this year's noble prizes you will find that noble prize for Physics has shared by James Peebles, Michel Mayor and Didier Queloz for their outstanding contribution in cosmology and discovery of an exoplanet orbiting a solar-type star.

The noble prize for Chemistry has been shared by John Goodenough, Stanley Whittingham and Akira Yoshino for the development of lithium-ion batteries. Lithium based batteries has revolutionized the modern world of mobile phones and electronics. The contribution of these scientists is immense for this field.

The Nobel Prize in Physiology or Medicine has been shared by William Kaelin Jr, Sir Peter Ratcliffe and Gregg Semenza for their discoveries of how cells sense and adapt to oxygen availability.

Interesting thing about this year's chemistry noble prize winner is that Goodenough has become oldest winner of noble prize (97 years). This emphasizes that age is not a limitation for doing research. He is still continuing his work to develop new polymers and battery concepts. He is now largely focused on developing all-solid-state batteries as they can offer better safety. These examples give the importance of hard work and patience required for doing the research. Let us salute the winners of this year's noble prize winners and take the message of hard work.

Third issue of EduREKA is full of exciting scientific stories including Chandrayan, World nuclear energy day and others. On this eve, I wish all the readers very happy Christmas and wonderful New Year ahead.

Editor....

India's Exciting Space Journey: Chandrayan 2

It was indeed a giant leap for the mankind when Neil Armstrong landed on the moon in July 1969. It took 8 days 3 hours 18 min and 35 seconds for him and his two colleagues, Michael Collins and Edwin Aldrin to complete the entire trip (nearly 4 lakh km one way) in which Neil Armstrong and Edwin Aldrin landed on the moon and Michael Collins was standing guard in the orbiter.



Fig 1. Neil Armstrong, Michael Collins, Buzz Aldrin

More details of the mission are available on following website

https://en.wikipedia.org/wiki/Apollo_11.

The government of USA concluded the Apollo programs for economic reasons.

Now we are going to understand the India's success story similar to this.

Chandrayan missions are unmanned missions. They have experimental kits to be put on the moon or carry out the experiments in the orbiter.

Chandrayaan -1 (Figure - 2), launched in 2008 by Indian Space Research Organization (ISRO) had aim of orbiting the moon and also throw a probe on to the pole on moon's surface. It collected very essential data for Chandrayaan-II for the next 320 days and then lost communication with earth.

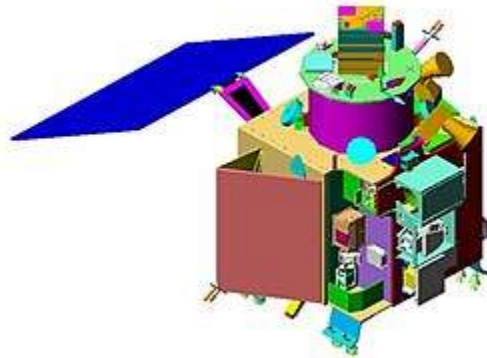


Fig 2. Orbiter of Chandrayaan-1.

Soft landing was absolutely required for the instruments to be installed and to be functional. Chandrayaan – II had an orbitor, a lander (Vikram) and a rover (Pragyan). The orbiter, Lander and rover were launched in to an elliptical earth orbit with apogee (farthest point from earth) of 40,400 km and perigee (nearest point to the earth) of 170 km. using a powerful rocket Geosynchronous Satellite Launch Vehicle Mark III (GSLV-III).

The orbiter underwent five orbit raising maneavours in which it was place on to the lunar transfer orbit and travelled at a speed of approximately 1 km/s which is the orbital speed of the moon around earth. After reaching the moon, the orbiter found a nearly circular orbit of radium 120 km from the moon before Vikram and Pragyan separated from it. The orbit lowering in the moon was achieved over 10 days and was completed on 2nd Sept 2019. The details of orbit raising and lowering are available on following link.

<https://twitter.com/cnnnews18/status/1153246094962253824>

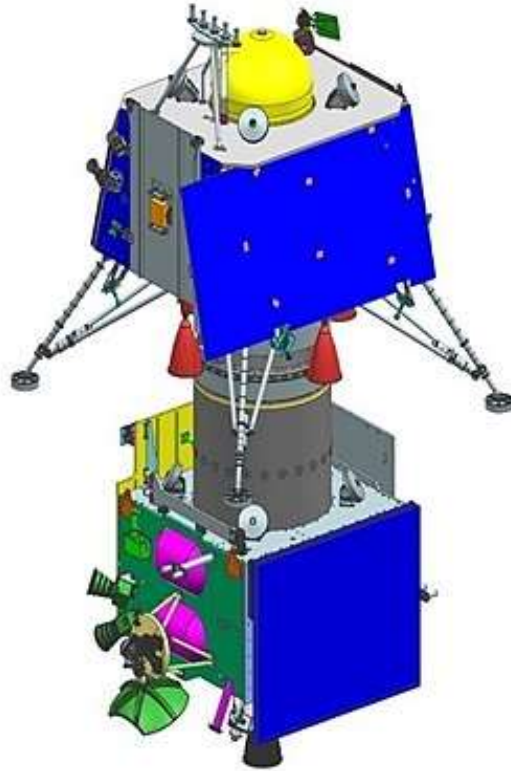


Fig 3. Orbiter, Lander (Vikram) of Chandrayaan-2.

The next phases are the trickiest and most exciting phase of the lander. The lander reduced the orbit gradually towards the moon so that the landing on the moon is as soft as possible. It gradually went around the moon with predetermined speed and direction until the last two minutes of landing. It is at this point the disaster struck the operation. The lander deviated suddenly from its calculated path and landed in an uncontrolled way. This resulted in a crashlanding instead of a softland and in all probability the lander and other pay load was destroyed.

China is another country which was successful in orbiting, landing and even communicating to the far side of the moon (remember, moon always shows one side to earth and it is a real challenge to even communicate to the other side – Figure-4). The chinese mission was called *Chang'e* (meaning moon). Chang'e 3 and Chang'e 4 landed on the moon with rovers.

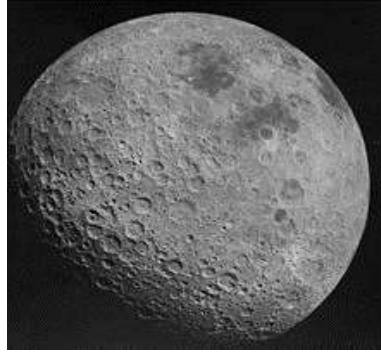


Fig 4. The far side of the moon - pitted with craters

Failures in moon missions are very common. Even Apollo missions have seen failures and fatalities. Apollo 13 is said to have had a 'successful failure' – meaning though the mission failed all the astronauts could land safely on earth as planned for the event of a failure. In the case of Chandrayaan 2, both ISRO and NASA have made a massive search and found the place where the lander crashed. NASA had kept the data accessible to the public. A Chennai-based space enthusiast Shanmuga Subramanian studied these images from NASA's Lunar Reconnaissance Orbiter (LRO) Camera and tipped off NASA about the location of the debris.

https://en.wikipedia.org/wiki/Lunar_Reconnaissance_Orbiter.

Though ISRO had already located the debris, the fact that such data are available to public is itself great news for those who are interested.

Every failure is a step to success. There is one saying in Tamil "Anaikkum ati sarukkum", which means even an elephant can slip and fall. But every failure should become a lesson well learnt and a step stone for the success. ISRO is planning for further Chandrayaan missions along with other missions to Moon and Sun. These endeavours will make the engineers and scientists of India to interact with scientists from other countries which will enable them to share and gather knowledge. An effort of this magnitude also improves the international co-operation.

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A Tool called SCIENCE

Inventor of Dynamite, Alfred Nobel, had a multidimensional personality. He was an outstanding innovator with as many as 355 patents, a successful businessman who could speak four languages and owned nearly 100 factories. He was a visionary philanthropist too who devoted most of his wealth to a series of five prizes for those who have benefitted mankind in an exceptional manner. Three prizes were for research in Physics, Chemistry and Medicine. Fourth one was for literature. Interestingly, the subject of fifth one was promotion of Peace-Yes, Peace!



Alfred Nobel (1833-1896) Image Curtsey <https://wikipedia.org>

Notwithstanding the fact that his family name was deeply associated with arts of war rather than peace, Alfred Nobel decided to institute a prize for peace as well. This reflects his strong scientific temperament because of which he could repurpose and re-imagine his inventions so that they became consistent with the backdrop of the societal needs. Thus relationship between science and scientific temperament can be seen quite like that between sun and sunshine.

This visionary decision of Alfred Nobel has catalyzed a sustained growth of Science in society and has continued to fuel its popularity amongst individuals as well. In 1901 Nobel prizes were awarded for the first time. Founder of 'Red Cross' Henry Dunant - a Swedish humanitarian, Sally Prudhomme - a French poet and a German scientist, Wilhelm Rontgen - discoverer of X-rays, became the first recipients of these inaugural

Nobel prizes. Since then over 900 historic personalities ranging from Winston Churchill to Martin Luther King (Jr), Alexander Fleming to Mother Teresa and Albert Einstein to Marie Curie have been awarded with this prize and the Nobel prize fund has become quite famous and has earned global respect.

Out of these awardees, Mari Curie was the first woman to win Nobel Prize. She has a unique distinction of winning this award two times; first in physics for her research on radiation and then in chemistry for her work on radioactivity a process through which an unstable nucleus becomes stable by emitting radiation i.e. gamma rays and particles such as α , β and neutron. Enrico Fermi was the first scientist who used neutrons for breaking Uranium (U) nucleus. Otto Hahn and Strassman showed that Barium is produced when Uranium nucleus is broken. Lise Meitner revealed that the two nuclei formed through fission of U will be lighter than the original nucleus and this mass difference was responsible for release of a very large amount of energy ($E=mc^2$). She thus showed that a lot of energy can be harnessed from U nucleus. On 02 Dec. 1942, Fermi and his colleagues showed that by using Cadmium it is possible to carry out fission reaction in a controlled manner.

At a time when all these pioneering activities were being oriented towards military operations of Nuclear energy, Dr. Homi Bhabha the architect of Indian Nuclear program could repurpose and reimagine the potential of nuclear energy towards improving quality of lives of millions of people in terms of availability of electricity and food as well as health care. For this to happen, APSARA and CIRUS reactors were set up in India in the years 1956 and 1960 for production of various radioisotopes. These reactors in consequence prompted the application of radioisotopes in health care and agriculture sectors and inspired developments in instrumentation as well.

The nuclear science through applications of radioisotopes can protect food from destruction by microorganisms and thus improve food security and safety. In this manner it can help agricultural sector to fight hunger and malnutrition. Nuclear science related techniques can help in conservation of soil, water and crops as well as in

producing new plant varieties that have better yield and have superior resistance against diseases and also the ones that can thrive in draught conditions. Nuclear science and related techniques can help in diagnosis and treatment of cancer and cardiovascular diseases. Further these techniques can find and protect water resources as well as monitor their quality. Using these techniques it is also possible to diagnose industrial processes and improve their efficiency.

In spite of all these applications and their direct benefits to humanity, society perceives nuclear science and technology mainly in terms of Hiroshima and Nagasaki and invariably puts up a strong resistance against the construction of new Nuclear reactors.

In order that our society gets a balanced perception about Nuclear energy we at Navi Mumbai Science Foundation (NMSF) decided to repurpose and reimagine the feat accomplished by Enrico Fermi and his colleagues on 02 Dec. 1942, in USA wherein Fermi and his coworkers successfully demonstrated that it is possible to carry out nuclear fission in a safe and controlled manner. In order to ensure that this pioneering achievement does not become a footnote in the history science and mankind, NMSF decided to commemorate '**December 2**' as the '**World Nuclear Energy Day**' and thus highlight the critical significance and message of this unique achievement by instituting '**Enrico Fermi Memorial Lecture**'.

Earlier paragraphs, as we have seen point towards a repetitive need of repurposing and reimagining science and technology so that they remain coherent with the backdrop of ever-changing societal priorities, and redefine the relationship between science and scientific temperament. One without other is pointless and if we focus on just any one of them, the consequences can become unfavorable. Science thus is a mere tool; it is the scientific temperament which defines the character of application.

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Picture gallery.....



Photograph 1. Homi Bhabha Bal Balvaidnyanik Competition Practical's session in progress at Fr Angle School, Vashi (2019-20 batch).



Photograph 2. Dr Bhagwat Sir felicitating a group of teachers as part of Teachers' Day Programme at Vashi (Sept 15, 2019) under "Vidyaiva Sarva Dhanam".



Photograph 3. Dr Bhagwat during “Inspiron 2019” event at Sanpada College of Commerce and Information Technology.



Photograph 4. Dr Vasudeo Rao, Vice Chancellor, HBNI, is welcomed during World Nuclear Energy Day Programme at Modern College, Vashi, - Dec. 2, 2019.



World Nuclear Energy Day Programme coverage in local newspaper

DON'T MISS IT.....
COMING UP IN NEXT ISSUE No 4
 (January to March 2020)

- 1. International year of Plant health: 2020**
- 2. Navi Mumbai Science Foundation's "Science Utsav"**
- 3. Secrets of Antarctica: Interesting journey right from Antarctica.**
- 4. Student's corner**
- 5. Teacher's Page**
- 6. Parent's views**



**INTERNATIONAL YEAR OF
 PLANT HEALTH
 2020**

**PROTECTING PLANTS,
 PROTECTING LIFE**

NMSF Events Calendar 2019

January							February							March						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5						1	2						1	2
6	7	8	9	10	11	12	3	4	5	6	7	8	9	3	4	5	6	7	8	9
13	14	15	16	17	18	19	10	11	12	13	14	15	16	10	11	12	13	14	15	16
20	21	22	23	24	25	26	17	18	19	20	21	22	23	17	18	19	20	21	22	23
27	28	29	30	31			24	25	26	27	28			24	25	26	27	28	29	30
														31						

Science Utsav

Fun with Science from 15 Feb to 15 March

Pre-RMO

April							May							June						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6				1	2	3	4							1
7	8	9	10	11	12	13	5	6	7	8	9	10	11	2	3	4	5	6	7	8
14	15	16	17	18	19	20	12	13	14	15	16	17	18	9	10	11	12	13	14	15
21	22	23	24	25	26	27	19	20	21	22	23	24	25	16	17	18	19	20	21	22
28	29	30					26	27	28	29	30	31		23	24	25	26	27	28	29
														30						

HBBVC Classes April to September (except May) every Sunday

July							August							September						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6					1	2	3	1	2	3	4	5	6	7
7	8	9	10	11	12	13	4	5	6	7	8	9	10	8	9	10	11	12	13	14
14	15	16	17	18	19	20	11	12	13	14	15	16	17	15	16	17	18	19	20	21
21	22	23	24	25	26	27	18	19	20	21	22	23	24	22	23	24	25	26	27	28
28	29	30	31				25	26	27	28	29	30	31	29	30					

RMO Guidance and Science Club every Sunday

Nobel Laureatism

October							November							December						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5						1	2	1	2	3	4	5	6	7
6	7	8	9	10	11	12	3	4	5	6	7	8	9	8	9	10	11	12	13	14
13	14	15	16	17	18	19	10	11	12	13	14	15	16	15	16	17	18	19	20	21
20	21	22	23	24	25	26	17	18	19	20	21	22	23	22	23	24	25	26	27	28
27	28	29	30	31			24	25	26	27	28	29	30	29	30	31				

Children Science Congress

HBBVC practicals full day

World Nuclear Energy Day

