Navi Mumbai Science Foundation

EdUREKA

Education for Spirit of Science

Volume 3, Issue: No. 2 **July-September 2021**

Navi Mumbai Science Foundation

[Regn. No.: Maha/2592/10/ (Thane)
BPT Regn. No. F/24093/Thane]

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July-September 2021
Volume 3, Issue: No. 2
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Published by:
Navi Mumbai Science Foundation
[Regn. No.: Maha/2592/10/ (Thane),
BPT Regn. No. F/24093/Thane]

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This is a quarterly e-magazine published by Navi Mumbai Science Foundation, a society engaged in spreading science education and scientific temperament among students of Navi Mumbai region for the last one decade. The magazine will mainly cover activities and articles on science education useful to students, teachers & society at large.

Contents .....

Views expressed in the magazine are from authors and editor may not agree with it.

To receive the copy of E-magazine, send your mail id to edureka.nmsf@gmail.com

From Editor's Desk!!....

Dear Readers, students and teachers, it gives me immense pleasure to introduce myself as the new Editor-in-Chief of this magazine which has been around since April 2019. This is a great effort by Navi Mumbai Science Foundation to have a sustained effort to reach out to the young minds and their mentors (teachers) so that we can have a generation who is interested in science and original thinking.

I have been associated with teacher training programs, since 1998 as member of Bombay Association for Science Education, as in charge of Junior Science Olympiad, and various other forums. In my experience one thing that is lacking in science education is connection to real life issues. Text books carry many examples which are linked to real life but they remain embedded only in print. On the other hand, a student of commerce, sees the real life application around him/her in daily life, at every moment. Do we have such a connection in science? Thus, for many, science and maths remain a subject to be learnt, to get marks, to get degree and then finally to get a job.

Science is much more than this, "just a job getting subject". It is an experience to learn reasoning and thinking to live life with confidence and face challenges with vigor and understand nature. In the year 2020-2021, world has faced a very difficult medical challenge. But many of the citizens were taken for a ride because we did not have original thinking of our own. Young generation faced the challenge, without much understanding of the situation and this is not a healthy situation.

Science is a field where questioning and answering the question, on the basis of experimental/experiential evidence is encouraged. This is the key to the rightful progress of technology and betterment of life. In coming articles, attempt will be made to introduce you to many articles dealing with innovation,

critical thinking, out of the box science and maths approaches and recent advances in science and technology.

We will also try to bring to you the achievements of not only scientists and technology experts but also achievements of teachers and students as their contribution to learning and teaching science.

I invite you all to join this event of science teaching, learning, and enjoying with great enthusiasm.

From this issue, we also have a new team of Editorial Board members. They are as follows.

Dr. P.K. Joshi, Editor-in-Chief, is a faculty member at HBCSE-TIFR. His research areas are Nuclear Physics and Science Education. He is President of International Junior Science Olympiad and Vice Chairman of Bombay Association for Science Education (BASE). He is also Editor in Chief of science education research journal called GPG Journal of Science Education. His webpage is www.tifr.res.in\~pkjoshi

Dr A. M. Bhagwat. Chairman of Navi Mumbai Science Foundation. After retirement in 1999 from Bhabha Atomic Research Centre (BARC), Dr. Bhagwat founded NMSF and has been associated with it from the time of writing of the constitution to this day.

Dr A. K. Rajarajan. Currently serving as a scientist in BARC, is researching on superconductivity and Magnetism using the neutron beam facility. He has keen interest in Children's education and involves in developing experimental tool for education. Dr. Rajarajan is the Vice Chairman of NMSF.

Dr D. A. R. Babu. retired from Health Safety and Environment Group of BARC. His area of interest is Radiation Physics, Nuclear radiation detectors and instrumentation. He has developed various types of instruments for entire Nuclear Fuel Cycle. He

joined NMSF in 2015 and has been an active member since then. Dr. Babu is the Secretary of NMSF.

Dr K. P. Muthe: Currently serving as a scientist in BARC. His research interest include Superconductivity, Material development for optically stimulated dosimeters, gas sensors, thermoelectricity and organic Solar cells. Dr. Muthe is an active member of NMSF.

Dr.Shashibhal Pandey. Associate Prof. and Vice Principal of Smt. Chandibai Himathmal Mansukhani College in Mumbai. Being a molecular biologist and biochemist, he has research interests in Regulation of gene expression and effect of neuromodulators and XAP genetic control.

Shri M. P. Bellary. After a fruitful career in the Chemical Engineering Group of BARC, Mr. Bellay joined NMSF to propagate science. Mr. Bellary involves in educating chemistry to young children. Currently is the treasurer of NMSF.

Dr V. Dalvi. Currently a faculty in Institute of Chemical Technology, Dr. Dalvi's research interests are in Thermodynamics, Solar thermal energy, Equation of states, molecular modelling and Generation of biogas. Dr. Dalvi contributes to science education as a resource person in science Olympiads.

Shri Tejas Shah is associated with Fr. Agnel Multipurpose school, Navi Mumbai and involved in academic planning of the courses. He is keenly interested in teaching young children especially practical education.

Maharashtra Nature Park: An Oasis for Birds in Concrete Desert of Mumbai

Would you believe me if I told you that there is a forest in the middle of Mumbai where one can find as many as 125 species of birds, 83 types of butterflies and countless other insects, reptiles and mammals? You must! That's Maharashtra Nature Park (MNP) for you. Located in Dharavi, it is a human-made forest developed on a dumping ground. The Birdman of India, Dr Salim Ali, was the first to plant a sapling back in 1983. Many volunteers and enthusiasts followed his footsteps, and MNP is a result of these collective efforts. The government officially opened MNP to the public in 1994.

Importance of Birds

The number of birds and their variety in the surrounding are measures of a healthy ecology. You will find birds in forests, deserts, cities and grasslands, and almost all over the world. They play a critical role in pollination, agriculture and insect control. To maintain the balance in the natural food chain, birds are essential.

To date, 125 species of birds have been recorded at MNP. While some are migratory birds, others are resident birds. Migratory birds are the species that move to a different region of the world annually for food, breeding and other reasons. In contrast, the resident birds do not switch their regions and spend their entire life in just one place. Moreover, the MNP sees birds that are typically found in dense forests, wetland regions (mangroves and river deltas) and some are among the rare-to-find birds in the Mumbai region.

See charts 1 and 2, which show pictures of the birds from MNP.

Chart 1 shows common birds and chart 2 shows rare birds from MNP.

Chart 1: Some common birds found in Maharashtra Nature Park

1. Greater Coucal	2. Red Wattled Lapwing	3. Indian Pond Heron	4. Indian Golden Oriole
			
			
5. Oriental Magpie Robin	6. Black Kite	7. Purple Rumped Sunbird	8. Cattle Egret
9. White Throated Kingfisher	10. Shikra	11. Copper-smith Barbet	12. Asian Koel
			
			
13. Ashy Drongo	14. Gray Heron	15. Rose Ringed Parakeet	16. Common Myna

Chart 2: Some migratory and some rare birds of Maharashtra Nature Park

17. Wood Sandpiper	*18. Greater Spotted Eagle*	*19. Common Snipe*
		
		
20. Orange Headed Thrush	*21. Black-Winged Stilt*	*22. Little Ringed Plover*

Some Special Cases

Let us learn more about some of the birds shown above. I have included four birds from the above list, first is a type of Eagle! Yes, an eagle in the boundaries of Mumbai. Eagles are generally at the apex of the food chain. And the presence of a raptor (predator bird) shows an abundance of prey (small birds). It visits the wetlands of Mumbai in winters. The second bird, Coppersmith Barbet, is widespread, and most of us might have already seen or have heard its call at some point in time. It is common in many cities, but still, many people are unaware of it. The third bird is another migratory wetland bird, common worldwide but rarely seen around Mumbai -- Common Snipe. The fourth bird on the list, the Orange-headed thrush, is a timid and secretive forest bird that needs dense, moist forest as its habitat.

1. Greater Spotted Eagle

The Greater spotted eagle (see image 18) is a large migratory eagle. It is brownish-blackish in colour and has a wingspan that ranges from 157 to 179 centimeters. These eagles spend their summer in Europe, where they breed

and migrate to the Indian subcontinent and the Middle East during winter. They usually prey on small mammals and birds. A greater spotted eagle is a regular visitor of the Indian wetlands. Bird watchers have reported seeing them at MNP during winter and early spring. According to the International Union for Conservation of Nature (IUCN), this species is vulnerable to extinction (can be endangered), meaning at risk of death in the absence of proper actions to preserve it. Up until the year 2000, there were only 4000 breeding pairs of this species. Habitat degradation or loss and human-made environmental disturbances caused during the mating season can threaten their existence.

2. Coppersmith Barbet

Called the city bird of Mumbai, coppersmith barbet (see image 11) is a small resident bird around the size of a house sparrow. They are found in all parts of the Indian subcontinent, except for the Thar Desert, some parts of Pakistan and the higher Himalayas. While most of their body is green in colour, their belly has a white pattern. They also have visible red and yellow spots on the head and neck. Their unique calls of *"tuk tuk tuk"* can often be heard by people. They are mainly frugivorous (eat fruits) but feed on small insects sometimes. They are commonly visible at the MNP on banyan and fig trees, eating their berries or carving holes inside trees to build their nests. Because they are widely found on banyan trees, they are called *Vatah*, derived from *Vat Vriksha*, the Sanskrit name for banyan tree.

3. Common Snipe

Another visitor at the MNP, the common snipe, is a wetland bird. They are medium-sized bird commonly found wading through the mud or wetlands in search of food. They have a brown and white pattern all over their body, and their tail is orange in colour. It is rarely seen around Mumbai.

Its presence indicates the diverse ecology of the MNP. The common snipe are migratory birds. While they spend summer in Northern Europe and Asia, where they breed, they migrate to countries near the equator in the winter. Their long beak throws light on their diet, which primarily consists of worms and insects from under the mud. Globally, their population is stable. The

presence of mangroves and mudflats at the MNP plays a crucial role in the arrival of such wading birds.

4. Orange-Headed Thrush

The orange-headed thrush (see image 20) is found in the Indian subcontinent and Southeast Asia's dense forests. As its name suggests, it is orange in colour, with greyish-bluish wings. This bird species found in India has white stripes on the head and is slightly bigger than house sparrows in size. It is a resident bird. It is omnivorous, and its diet involves mainly fruits, insects and earthworms. They are shy and secretive and are mostly seen alone or in pairs. They are also known for singing songs that are pleasing to the ears. The pied cuckoo lays eggs in its nest. For the forest's health and for this bird to survive, the forest has to be moist and evergreen.

Importance of Habitats

In all the examples we saw above, the common factor was the need for habitat. Like those written above, species of birds depend on some specific types of habitats, sometimes that places like the MNP provide. And sites of nature such as this can very well be inside the boundaries of a big city. As mentioned earlier, bird enthusiasts have seen more than 125 different species of birds in the small area of 37 acres that houses the MNP. That leaves one wondering how a similar but more extensive and well-protected space would impact our ecosystem. Habitats provide shelter, food and nesting sites to our birds. The population of birds is directly dependent on the availability and health of habitats. Several bird species are already on a decline due to the loss of their habitats. We must think of how we can minimize this threat for them.

The Man-Made Challenge

Is the MNP safe and secured from human challenges to birds? The image above shows hundreds of gulls that visit the Mithi river's mangroves, which is adjacent to MNP. One can see a flyover right behind them. It was recently built. Many bird watchers, visiting the park for years, have reported a decline in the number of migratory birds in the park after the bridge was opened. In an activity like this, mudflats get destroyed due to the concrete,

depriving the wading birds of their food. Waste and garbage dumped in water bodies can also pose a severe threat to the health of birds. For example, the consumption of plastic by birds or other creatures can have serious consequences.

Need of Conservation and Protection of Habitat

If any bird or animal species go extinct, then it impacts the entire food chain. Subsequently, other creatures that are dependent on a particular species will also decline in numbers. For example, when the number of vultures in India decreased by 95% since 1990 (it happened because of a particular drug used for cattle), it had several impacts not only on ecology but also on humans. Vultures used to eat dead animals, domestic and wild. Since vultures were dying, those animal carcasses polluted water bodies, which triggered diseases like cholera.

Furthermore, it led to an increase in the numbers of feral dogs, which led to the rise in dog bites and rabies. To control these health hazards, India spent 1.7 lakh crore rupees. If the decline in 9 species of vultures could cause this much damage, one can only imagine the impact of the decrease in the numbers of other birds and animals.

Habitats are not only important for birds, animals and reptiles but humans too. For example, mangroves of wetlands act as sponges for the seawater. In the absence of mangroves, seawater can enter the city territories and cause floods. Water and air pollution is another significant threat facing the well-being of humankind. Therefore, as individuals and inhabitants of this world, we must all act together to protect our habitats and those of other species.

Some other biodiversity at Maharashtra Nature Park

Indian Rock Python	*Checkered Keelback (Water Snake)*	*Red Pierrot Butterfly*
		
		
Blue Tiger Butterfly,	*Mangrove Tiger Butterfly*	*Dense Forest of MNP*

References

- Official Website of Maharashtra Nature Park: https://maharashtranaturepark.org/
- Ebird link for the count of birds in Maharashtra Nature Park: https://ebird.org/hotspot/L1332848

Sushant Pawar

Homi Bhabha Centre for Science Education, TIFR

Great discoveries without sophisticated equipment

Discoveries of science have always revolutionized sciences and the civilization. The efforts of the great minds behind these discoveries are laudable, but these scientists had to go through very hard times of rigorous observations and analysis to arrive at their destinations. Students of science, specially, the school students are always fascinated by the stories of great minds like Einstein, C.V. Raman, Bhaskaracharya et. al. But have you ever wondered the process that they went through to reach the heights that we now know? Their path to the end of their quest is like going into a jungle, where no one has gone before, with only a small lamp of knowledge which can show path up to next 2 or 3 steps only, and the direction of the final destination unknown. I am sure there must have been many such explorers who did not succeed and history has no record of them, but their failures sometimes are source of guidance to the next in line, to "where not to venture". But success comes to those who observe their steps keenly and plan their next few steps accordingly.

Let us see some great journeys of those who ventured out in this jungle not very sure what the destination was but surely knew how to take "calculated" steps, deeply observing their steps and the surroundings that nature had to offer. They only had a small lamp of their experience gained from their own movements.

The great discoveries of science have come not from the most sophisticated equipment of those times. One such discovery was speed of light (C) which opened up the world of quantum mechanics and relativity theory. But the story of speed of light is very long and tedious. Without the knowledge of C, both these great fields of knowledge would not have opened up. How C is an entry

point of modern physics, from classical physics, will be taken up in future issue.

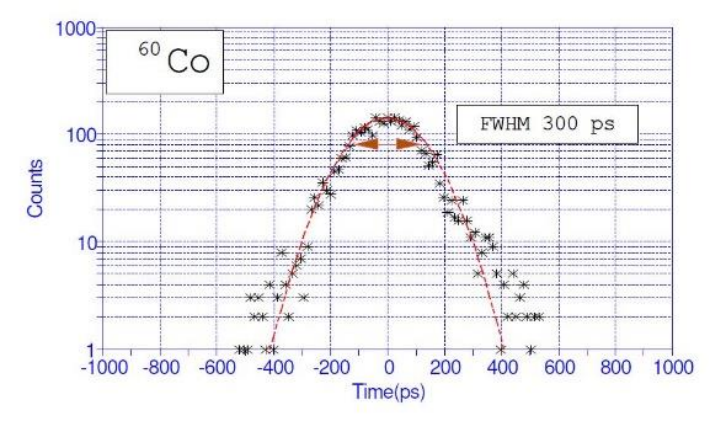
Speed of light is currently equal to 299,792.458 km/s. But how and was this measured? When was it measured for the first time? How did they measure it?

In order to measure the velocity of any object it is essential to measure the distance the object travels and the time it takes to travel that distance. But in the case of speed of light, in one second it travels almost 3×10^8 m. The circumference of earth is 0.4×10^8 m which means that light will travel around seven times the circumference of earth. Or light takes only 3.3×10^{-12} s for 1 mm. Which means that if we lay a cable, which runs along the equator and makes 7 rounds around the equator of earth, then light will travel that distance in one second? Even with today's technology and resources it is very difficult to accomplish such a feat. Can we measure very small times? Yes, in last few decades this has been made possible that one can measure 1 ps (10^{-12} s).

The different times that light takes to travel are listed in table below.

No	distance	time
	3×10^8 m	1 s
2	300 m	1μs
3	30 cm	1 ns
4	3 cm	.1 ns = 100 ps
5	1 cm	0.033 ns = 33 ps
6	3 mm	10 ps

A radioactive source ^{60}Co gives out two γ (photons) radiations, with a time gap between them in the range of 10^{-15} s and hence can be assumed to be simultaneous. If there are two separate detectors A and B, detector A detecting the first photon and B detecting the second photon, then the time difference between these detections will be practically zero. The spectrum for those who are curious to see the working, is given in figure.



However, if the second detector is moved away by 3 cm the time required for the first photon to travel is zero ps but second photon will be detected after 100 ps, easily measurable today. The photo on the left is a representative of experiment carried out at TIFR.

However, the point of this article is that how was the speed of light measured in 1672, when no pico-second, or even milli-second, measurement instruments existed.

When was the speed of light measured for the first time? It was in 1672. The first pendulum clock was invented by Christiaan Huygens (as per the historical facts available currently) was in 1656. The most common clocks were the sand clocks which measured in hours rather than minutes or seconds. Hence in those days they had no choice but to measure large distances if one was interested in speed of light. In fact, the distances over which reliable measurements could be made, gave a feeling that the travel of light was “instantaneous”. Hence, not only scientists did not know what was the speed of light, they were not even sure if it was a finite measurable number. Any scientist will be motivated to measure a physical quantity only if he/she knew it was measurable.

The history of this measurement is very interesting and motivating to see how scientific discoveries are not slaves of modern and sophisticated equipment. The actually story of this measurement will be described in the next issue. To be continued……

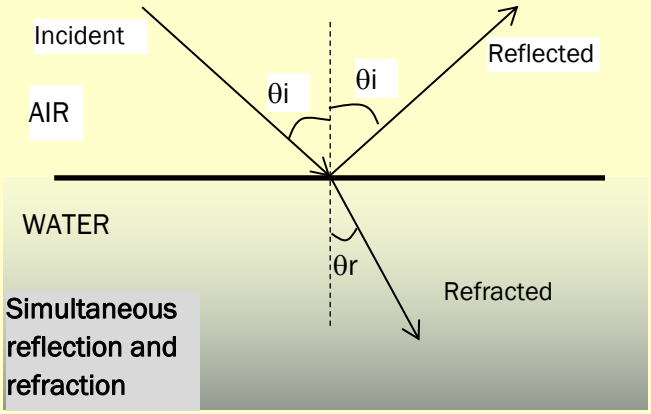
By. Dr. P.K. Joshi (HBCSE-TIFR)

Lingering Doubts???...

RAINBOW

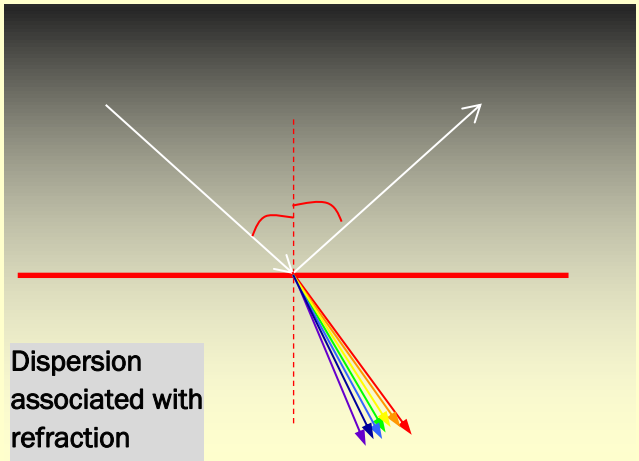
One of the wonders of the nature is the formation of rainbow (Indra-dhanush) formed in the clear sky just after the rain. The sky covered with arch of colours warms everyone's heart with wonder of nature. The joy doubles when one also observed a second inverted rainbow. It is difficult to observe this because normally it is very faint…


Rainbow in a field



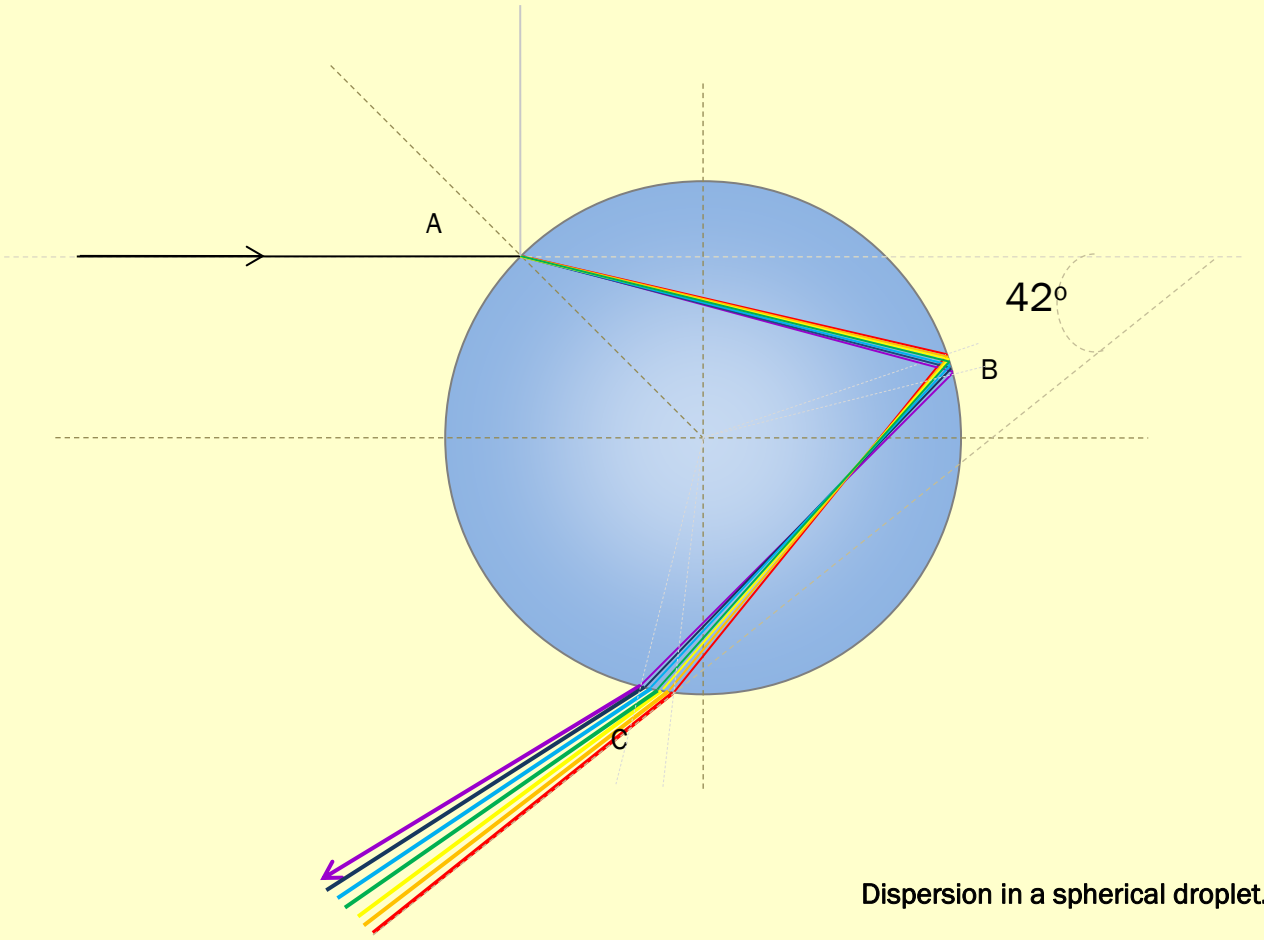
Simultaneous reflection and refraction

Refraction, bending of light at the boundary of media, happens because light travels at different speeds in different media. Refraction is always accompanied by reflection also. When the surface is transparent, the reflected portion of the light is much weaker than the refracted portion. The angle of reflection is equal to the angle of incidence (θ_i). The angle of refraction is given by Snell's law $n_i \sin\theta_i = n_r \sin\theta_r$. In this formula n_i is the refractive index of the medium from which the light is incident and n_r is refractive index of the medium in to


Dispersion associated with refraction

which it refracts. $\theta_r$is the angle of refraction (see figure).

In a dense medium, the different colours of light travel at different speeds and because of this they bend to different angles. This is called dispersion. So, during the process of refraction, white light is also dispersed.



Dispersion in a spherical droplet.

Optics has a rule which says, measure all angles with respect to the perpendicular line at the point of scattering. When the white light enters a small drop of water, at every boundary it undergoes a refraction and reflection. The path of light that produces rainbow is shown in the figure. The angle of incidence at point A is 45° and the angle of refraction, is $31.9^{\circ} - 32.1^{\circ}$ for violet to red (here shown exaggerated to two degrees). At point B, most of the light refracts out of the drop (not shown here) and a small portion reflects back in to the drop. This ray of light again undergoes a refraction when it comes out of the drop at point C.

The conditions that must be present in the atmosphere for formation of rainbow are (i) Sky must be clear (ii) small rain droplets must be present continuously (iii) Sun rays should be present from behind the observer. iii) The angle formed by incoming sunlight and the reflected light to the observer, from the rain drop, should be less than 42° (figure shows rainbow produced by splashing water observed in a river viewed from above at mid-day). The intensity of dispersed light and incident will be maximum when the angle between two lies between 40° to 42° (at 40° violet appears and 42° red appears and remaining colours in between).

Basically, the rainbow forms like a complete circle (which can be viewed from elevated heights or from aero plane while flying – see this nice video by Meteorological department of UK

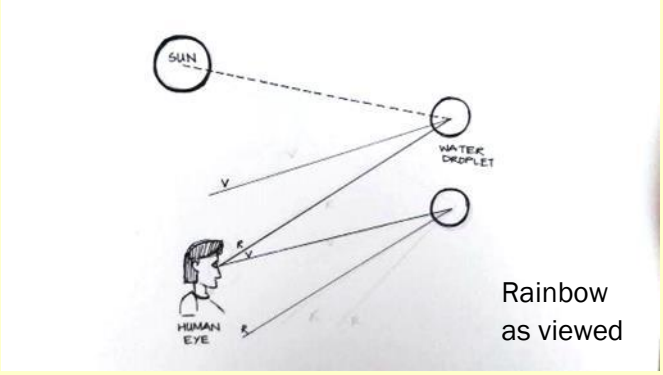
https://www.youtube.com/watch?v=PRSSC1tZxxs

or visit website

https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects/rainbows/full-circle-rainbow)

There are still doubts lingering. If the violet light comes on the top of the spectrum as shown in the droplet dispersion picture, why is it that we see red on the top of a rainbow? A rainbow is not located at a specific distance from the observer, but comes from an optical illusion caused by any water droplets viewed from a certain angle relative to a light source. So, every droplet can only reflect one of the colours in the direction of our eye. In reality, the rain drops at a higher altitude are in a position to reflect red light to your eye and the lower

ones reflect the violet. That is why we see red on the top. The rainbow is not an object and cannot be physically approached. Indeed, it is impossible for an observer to see the primary rainbow from water droplets at any angle other than the range of 40 – 42 degrees with respect to the light source.



Rainbow as viewed

Are there only seven colours in the rainbow? Certainly not! The sunlight has all the possible wavelengths in a continuous spectrum. So, rainbow also has all the colours. But our eye can only distinguish clearly seven colours.


Rainbow from a Compact Disc

There is another way of seeing the rainbow. Take a compact disc (CD or DVD) that you use for storing data, music or video. Observe the light that comes from the active side of the CD. If you observe carefully, you can see all the seven colours. The figure shows the rainbow created by a CD when LED light is shined. What is the reason for this rainbow without rain?! It is possible to disperse white light in more than one way?

People in the discussion of lingering doubts

Dr. D.A.R. Babu.

Mr. M. Bellary.

Dr. P.K. Joshi.

Dr. A.K. Rajarajan.

Dr. A.M. Bhagwat.

Illustration of "Rainbow as viewed" by Ms. Jahnavi Joshi.

Students' Corner ….

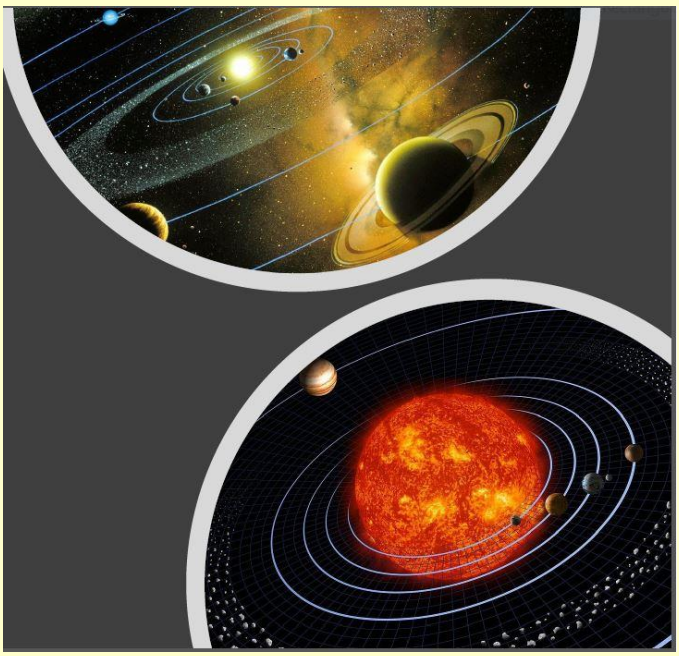
THE TIMELESS QUESTION: HOW OLD IS THE UNIVERSE AND THE SOLAR SYSTEM?

Age may only be a number, but when it comes to the age of the universe, it is an important one. According to research, the universe is approximately 13.8 billion years old. Astronomers can determine the age of the universe using different methods. They are:

- By studying the oldest objects within the universe.
- Measuring the expansion of the universe.

The universe we live in is not flat and unchanging, but constantly expanding. If the expansion rate is known, scientists can work backwards to determine the universe's age. It is widely believed that our universe began with an explosion of space itself – the Big Bang. Starting from extremely high density and temperature, space expanded, the Universe cooled, and the simplest elements formed. Gravity gradually drew matter together to form the stars and then galaxies. Galaxies collected into groups, clusters and superclusters. Some stars died in supernova explosions, whose chemical remnants seeded new

generations of stars and enabled the formation of rocky planets. Now let's see how our solar system was formed.



• Our solar system consists of our star, the Sun, and the planets Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, dwarf planets such as Pluto, dozens of satellites and millions of asteroids, comets and meteoroids.

• The formation and evolution of the Solar system began about 4.5 billion years ago from a dense cloud of interstellar gas and dust. The cloud collapsed, possibly due to the shockwave of a nearby exploding star, called a supernova. When this dust cloud collapsed, it formed a solar nebula – a spinning, swirling disk of material.

• At the centre, gravity pulled more material in. The pressure in the core was so great that hydrogen atoms began to combine and form Helium. With that, our sun was born and it accumulated more than 99% of the available matter. Matter farther out in the disk was also clumping together. These clumps smashed into one another, forming larger objects. Some of them grew big enough for their gravity to shape them into spheres, becoming planets, dwarf planets and large moon. In other cases, planets did not form; the asteroid belt is made of bits and pieces of the early solar system that could never quite come together into a planet. Other smaller leftover pieces became asteroids, comets, meteoroids and small irregular moons.

NAME - RUCHA DHAMANASKAR STD: 7th

ST. MARY'S MULTIPURPOSE HIGH SCHOOL AND JUNIOR COLLEGE , VASHI

Activity question

Try It Yourself: From this issue, we are starting a series where we will ask readers to carry out a very simple experiment. You will have to try it out at home and tell us if you succeeded or not and why? In the next issue we will give our opinion and also share the responses sent in by the readers. When you send your response, please write who tried it out (all the participants, if more than 1), your class and if you are teacher or student.

This is the position of the a table tennis ball, when I placed it in the glass filled with some water. My elder sister asked me to place the ball exactly at the centre of the glass.

Like this  (as seen from above)

I tried my best!! – No success

Would you like to help me! Try it and send your experience and explanations in a short note to edureka.nmsf@gmail.com

By, Prakash K. Nawale, HBCSE-TIFR

DON'T MISS IT

Coming up in Next issue (October-December 2021)

1. How was the velocity of light measured for the first time
2. Student's corner
3. Teacher's page
4. Activity question AND MUCH MORE……

DO YOU HAVE ANY INTERESTING EDUCATIONAL STORY TO TELL? JUST SEND YOUR STORY TO US AT edureka.nmsf@gmail.com for putting in EduREKA.

FROM NMSF'S EVENTS CALENDAR-2021

Information regarding the next activity

Homi Bhabha Bal Vaidnyanik Competition Practical (HBBVC)

(To be held in Jan 2022)

Guidance Sessions for Students of Std. VI.

(A general introduction to practical science at VI std – IX std level)

Get practical experience of laboratory equipments, measurement devices and learn methods of carrying out scientific experiments – even at home. (An online event)

For enquiries, parents may contact:

Dr. D. A. R. Babu: 97699 69694; Shri M.P. Bellary: 90823 13349; **or**
Dr. A.M. Bhagwat: 93241 68510, (after 1800 hrs). **OR**
write a mail to nmsfscienceutsav@gmail.com

For more information, visit NMSF's website:

http://www.navimumbaisciencefoundation.org