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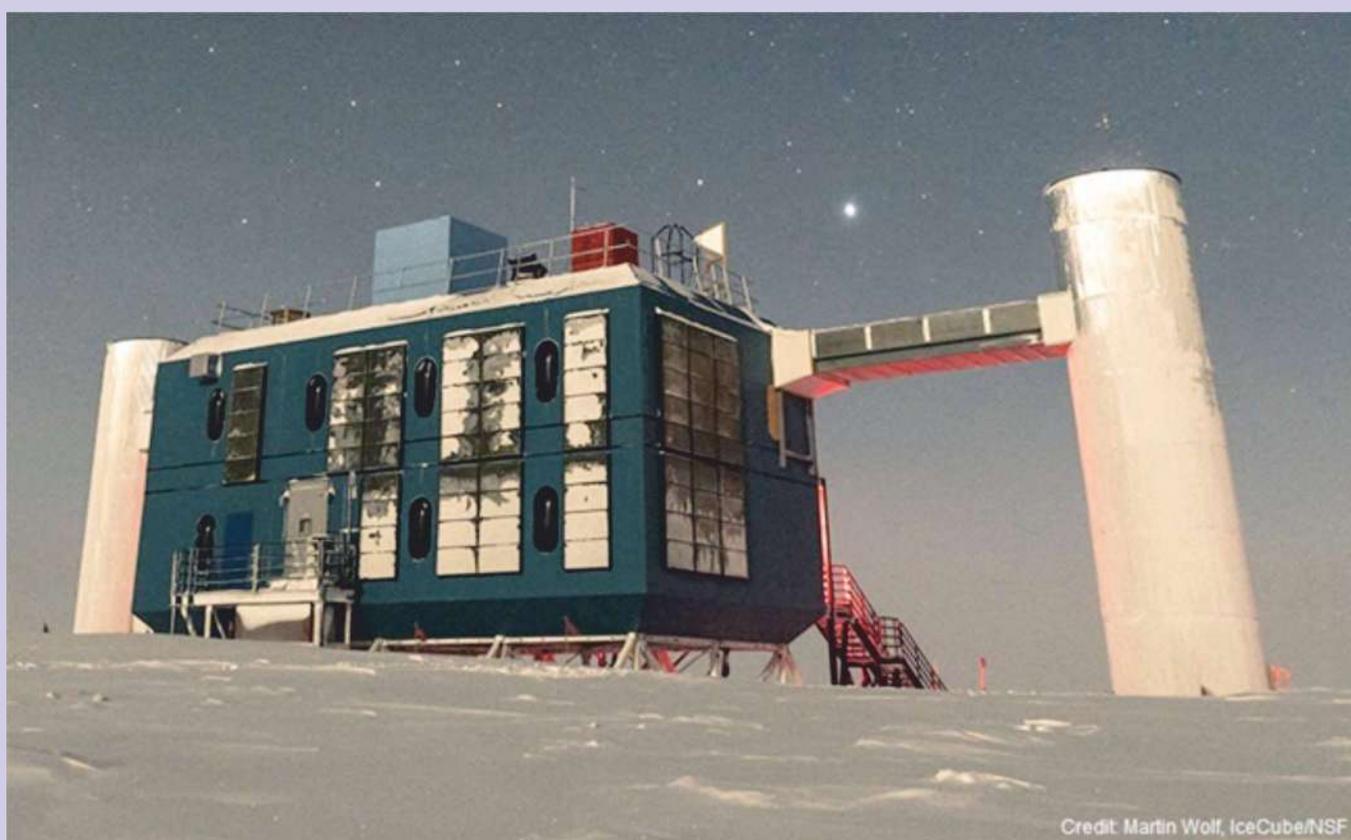
# THE INDIAN ASSOCIATION OF PHYSICS TEACHERS

## A MONTHLY JOURNAL OF EDUCATION IN PHYSICS & RELATED AREAS

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Credit: Martin Wolf, IceCube/NSF

Recent technological advances have enabled the development of increasingly advanced telescope and astrophysical instruments. This includes the IceCube telescope, which was originally built to detect and examine high-energy neutrinos in the universe. Using their high-energy neutrino telescope, the IceCube Collaboration recently set the most restrictive constraints on relativistic magnetic monopoles to date. The results of their study emphasize the potential of neutrino telescopes to search for exotic particles.

The picture (above) shows IceCube laboratory at the South Pole. IceCube's 5160 optical sensors are buried under the ice between 1.5 and 2.5 km, instrumenting a total volume of 1 km<sup>3</sup>. The direction and energy of the particles that cross the detector are reconstructed from the signals they produce in the optical sensors, and this information is sent through satellite link to the IceCube participating institutions for further analysis.

(<https://phys.org/news/2022-03-icecube-collaboration-restrictive-constraints-relic.html>)

# The Story Of Cosmology Through Post Stamps 16

## THE MECHANICAL UNIVERSE

## NEWTON & MATHEMATICAL MODEL (17<sup>th</sup> CENTURY)

In his three books of the Principia, which constitute an introduction to modern astronomy, Newton presented his laws, in form of mathematical model which provide an explanation of planetary motion, precession equinoxes, tides and motion of the moon.

**Postally used cover with pre-printed stamp-**  
Illustrate Kepler's Law of planetary motion, which greatly influenced and provided the foundation Newton's theory of Universal Law of Gravity.



Combining his work on centrifugal force and Kepler's third law of Planetary motion Newton deduce Famous Inverse Square Law of Gravity



**Newton; Quantitive definition of Force and Dispersion of light**



Motion of planets around the sun in ellipse supported by *law of gravity*

*Theory of orbital motion* and free fall



**Leibniz (1716)** a German polymath also invented Calculus independently, which was a great contribution in mathematically modelling the universe



**Edmond Halley** helped and encouraged Newton to publish the great book "Mathematical Principle of Natural Philosophy. (1687). He also used Newton's theory of gravitation to predict the orbit of Comet.



In 1668 newton produced first **Reflecting Telescope** which gave clear image without chromatic aberration

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*The Bulletin is the official organ of the IAPT. It is a monthly journal devoted to upgrading physics education at all levels through dissemination of didactical information on physics and related areas. Further, the Bulletin also highlights information about the activities of IAPT.*

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## PANDEMIC AND LABORATORY TRAINING

Our country is now passing through the post third-wave phase of the corona pandemic. We have begun to take stock of the impact of the virus in various sectors including the educational arena. No doubt it has brought out number of disheartening aspects to the fore. If we focus our attention particularly towards those who were at the last stages of their school days one could recognize that some irreparable damages they have suffered from the academic point of view. Some very important aspects of teaching-learning not only went missing, it is perhaps not possible to compensate those since the school life of this section of students is coming to an end. They were deprived of some valuable training that could help them in their next level of education in a big way. And this list includes among so many things the laboratory training or the practical classes for different subjects that have taken a heavy beating due to pandemic.

The students who had to spend their two final school years and possibly the first two semesters in their UG classes during 2020 and in 2021 virtually could not get any exposure to laboratory work. So they could not do the laboratory experiments that involve, arranging the equipments, making circuits, taking measurements, gathering data, drawing graphs, making calculations and in the process arriving at some scientific conclusions that provides the essence of science. The emergence of this scenario brings in some special responsibilities for IAPT and its members. We now need to plan to conduct more workshops taking this section of students from the classrooms to the laboratories and possibly should include the students who are just entering the UG level. In these workshops the students would work with their own hands and would perform simple experiments may be with rudimentary equipment. Our members now can approach the schools or UG colleges, plan experimental workshops with the faculty members there. They can set up some simple experiments with the available equipments, in physics laboratories of the institutions. A well-planned lab-based workshop, may be for two to three days, is expected to provide this section of students with the some flavour of the experimental component of physics and help them to enrich themselves, that went lagging because of the pandemic scenario. With some critical planning we can really play a meaningful role for this section of students who will be the future scientific manpower of the country.

**Bhupati Chakrabarti**  
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Former GS, IAPT, [chakrabhu@gmail.com](mailto:chakrabhu@gmail.com)

## PHYSICS NEWS

### **The experimental demonstration of topological dissipation in photonic resonators**

So far, physicists have primarily studied topological phases in conservatively coupled systems. These are systems with dynamics that do not dissipate and a phase space that does not shrink over time. Researchers have recently introduced and experimentally demonstrated topological phases in a dissipatively coupled system. In addition to demonstrating topological phases in a dissipative system, the researchers realized an experimental platform that could improve the study of topological physics. More specifically, they used time-multiplexed resonator networks to create a large-scale, flexible platform to study topological photonics. This essentially means that each of the paths connecting the resonators can leak some photons and cause them to leave the network, depending on how the light in the connection interferes with the light in the resonators.

The results achieved could lay the groundwork for further theoretical studies and experiments focusing on topological phases in dissipative systems. In addition, the dissipatively coupled topological phase demonstrated by the researchers could also be relevant to other areas of physics, including condensed matter physics, photonics, and the study of ultracold atoms

**Read more at :** <https://phys.org/news/2022-03-experimental-topological-dissipation-photonic-resonators.html>

**Original paper :** Nature Physics (2022). DOI: 10.1038/s41567-021-01492-w

### **A fully optical attoclock to image tunnelling wavepackets**

Attoclocks are instruments that can measure time intervals on the attosecond scale by measuring the time it takes for electrons to tunnel out of atoms. Researchers have recently developed a new, all-optical attoclock. This clock could be used to collect time-resolved measurements in condensed-matter systems, which has never been achieved so far. This new method specifically looks at the radiation released by electrons during the tunnelling process and its subsequent dynamics.

In their experiments, researchers found that by measuring the polarization of the terahertz radiation emitted by the electron they could access its dynamics at the attosecond scale. This was an unexpected result, as terahertz and attosecond time scales differ by nine orders of magnitude. The researchers have already successfully used their attoclock prototype to measure something that had never been detected using the traditional attoclock, namely a slight asymmetry in the ionization process. In the future, they feel that it could also be used to collect time-resolved measurements in systems where electrons cannot be detected, such as solids.

**Read more at :** <https://phys.org/news/2022-03-fully-optical-attoclock-image-tunnelling.html>

**Original paper :** Nature Physics(2022). DOI: 10.1038/s41567-022-01505-2

### **Could massive gravitons be viable dark matter candidates?**

Today, many research teams worldwide are trying to detect dark matter, an invisible substance that is believed to account for most of the matter in the universe. Theory suggests that massive gravitons were produced during collisions between ordinary particles in the hot and dense environment of the early Universe, in the few instants following the Big Bang. While theories predict their existence, these particles have so far never been directly detected.

Researchers carried out a theoretical study exploring the possibility that massive gravitons could be good dark matter candidates. In the future, the results gathered by this team of researchers could inspire new studies and calculations exploring the production of massive gravitons in the universe.

**Read more at :** <https://phys.org/news/2022-03-massive-gravitons-viable-dark-candidates.html>

**Original paper :** Physical Review Letters (2022). DOI: 10.1103/PhysRevLett.128.081806

**Pankaj Bhardwaj**  
Friedrich Alexander University  
Erlangen & Nuremberg, Germany

# THEORY OF TRANSMISSION GRATING AND MATLAB PLOTS

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## ABSTRACT:

Theory of Transmission Grating is given based on the convolution. The formulae and plotted with MATLAB codes. It is pointed out that the grating spectra is ideally sample points of the single slit (Fraunhofer) diffraction pattern.

## 1. INTRODUCTION:

The study of transmission grating spectra plays a central role in wave optics under the title of both interference and diffraction. The experiment with transmission grating is important in the determination of wavelengths of Mercury vapor light, with standardization of the grating (number of lines per cm) with the Sodium vapor light, which is considered as monochromatic light. Now a days, HeNe laser or semi-conductor laser can be used with great care. To describe the theory of the spectra formation with transmission grating, convolution method can be elegantly used. Convolution and convolution theorem are widely used in almost all branches of physics such as communication (linear response), solving inhomogeneous differential equation, image formation, and many more.

## 2. Convolution:

Convolution  $h(x)$  of two functions  $f(x)$  and  $g(x)$  is defined [1] as

$$h(x) = f(x) * g(x) = \int_{-\infty}^{\infty} f(x')g(x - x')dx' \quad (1)$$

One function is fixed and the other function is reversed and translated and moved over the fixed function and the double ordinates are multiplied for the region of overlap for a given  $x$  and then this is done for all shifts  $x$  and the new function  $h(x)$  is the convolution of the two functions. Using the property of delta function, we can easily show that [2]

$$f(x')\delta(x - x')dx' = f(x) \quad (2)$$

Thus, a function convolved with delta function, it is reproduced or replicated. This is interesting. This result can be generalized:

$$f(x) * \delta(x \pm nl) = f(x \pm nl), \quad (3) \text{ where } n$$

is an integer. This is the key-point in the theory.

A transmission grating can be expressed as the convolution of an aperture (slit) with large number  $N$  delta functions at spacing (interval)  $d$  [3]:

Grating = Aperture (slit) \* [Large number  $N$  delta functions of spacing  $d$  [4]:

$$\text{Grating} = \text{rect}\left(\frac{x}{a}\right) * \sum_0^{N-1} \delta(x - nd). \quad (4)$$

The aperture is a slit of width  $a < d$ .

$$\text{rect}\left(\frac{x}{a}\right) = \begin{cases} 1 & |x| \leq \frac{a}{2} \\ 0 & x > \frac{a}{2} \end{cases} \quad (5)$$

represents transmittance of the slit [3, 4].

### 3. FRAUNHOFER DIFFRACTION:

The amplitude distribution ( $f_x$ ) of Fraunhofer diffraction is the Fourier transform  $\mathcal{F}$  of aperture's transmittance function [3, 4]. Thus

$$U(f_x) = \mathcal{F}\left(\text{rect}\left(\frac{x}{a}\right)\right) = \int_{-\frac{a}{2}}^{\frac{a}{2}} 1 e^{i2\pi f_x x} dx = a \text{sinc}(\pi f_x a). \quad (6)$$

Where [4]  $\text{sinc}(t) = \frac{\sin(t)}{t}$ .

The Fourier transform  $\mathcal{F}$  of delta functions are given by [1, 4, 7]

$$\mathcal{F}(\delta(x - nd)) = e^{i2\pi n f_x d}. \quad (7)$$

### 4. CONVOLUTION THEOREM:

According to the Convolution theorem, the Fourier transform of convolution of two functions is the product of the Fourier transforms of the functions. The amplitude of the Fraunhofer diffraction of the grating is given by

$$(f_x) = a \text{sinc}(\pi f_x a) [1 + e^{i2\pi f_x d} + \dots + e^{i2\pi(N-1)f_x d}]. \quad (8)$$

The sum of exponential terms forms a geometric progression and its sum is

$$\frac{\sin(N\pi f_x d)}{\sin(\pi f_x d)}$$

The amplitude distribution of a transmission grating is [6]

$$U(f_x) = a \text{sinc}(\pi f_x a) \frac{\sin(N\pi f_x d)}{\sin(\pi f_x d)}. \quad (9)$$

$$I(x) = |U(f_x)|^2 = |a \text{sinc}(\pi f_x a)|^2 \left| \frac{\sin(N\pi f_x d)}{\sin(\pi f_x d)} \right|^2. \quad (10)$$

The first term is the Fraunhofer diffraction term and the second term is the interference term due to  $N$  such slits. So interference and diffraction go hand in hand. It is usually said that the single slit pattern envelopes the interference pattern.

### 5. SPATIAL FREQUENCY:

The factor  $f_x$  plays the role of reciprocal of length in the same way as  $\nu$  in harmonics, viz.,  $2\pi\nu t$ .  $\nu$  is temporal frequency, with the dimension of reciprocal of time (Hertz).  $f_x$  has the dimension of length<sup>-1</sup> [4].

$$f_x = \frac{X}{\lambda Z} = \frac{\sin\theta}{\lambda} \quad (10)$$

Where  $\sin\theta \approx \frac{X}{Z}$  is the angle of diffraction.

$X$  is the distance from the origin on the Fraunhofer plane which is at a distance of  $Z$  from the grating, illuminated by light of wavelength  $\lambda$ . The Fraunhofer plane is the spatial frequency plane with respect to the diffracting aperture plane. The plot of *amplitude* and intensity distributions of diffraction term are shown in Fig.2 and Fig. 3 respectively.

It is interesting to note that in an auditorium, the columns of chairs have various spatial frequencies as shown in Fig. 1. This arrangement is angularly distributed.

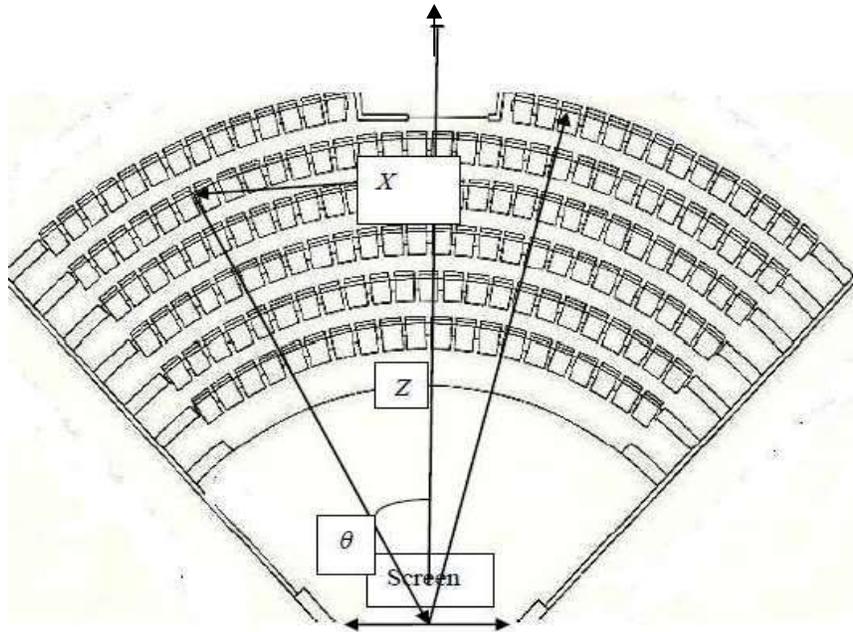


Fig. 1 Special frequency =  $\frac{\sin\theta}{\lambda} = \frac{X}{\lambda Z}$ .

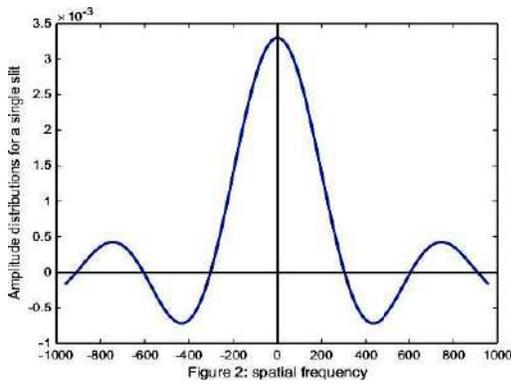


Figure 2: spatial frequency

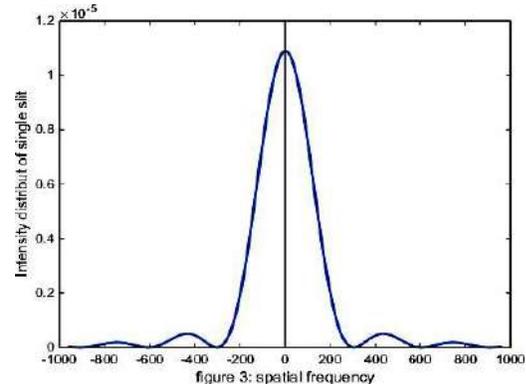


figure 3: spatial frequency

Fig. 2 and Fig. 3 are the amplitude and intensity distribution for single wavelength due to the Fraunhofer diffraction at a single slit.

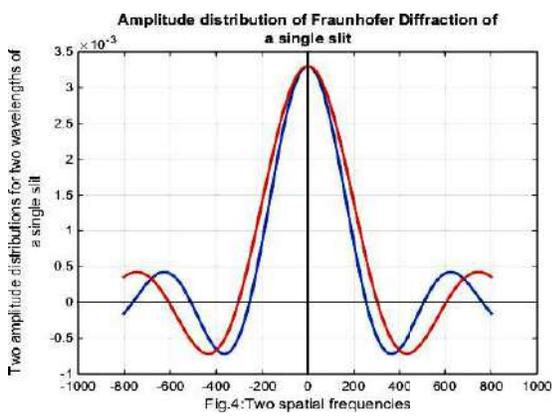


Fig.4:Two spatial frequencies

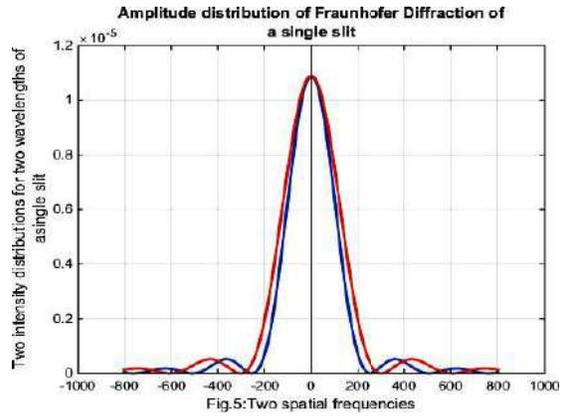


Fig.5:Two spatial frequencies

Fig. 4 and Fig. 5 show the spatial frequency distributions of two wavelengths due to a single slit; longer wavelength is inside the smaller wavelength as spatial frequency is reciprocally related to wavelength.

In Eq. (9) the interference term consists of two sine functions in the numerator and denominator. The numerator oscillates rapidly due to large value of N. The denominator is zero whenever  $\pi f_x d = \pm n\pi$ , or

$$f_x = \pm \frac{n}{d} \tag{11}$$

At these points the numerator is also zero because

$$N\pi f_x d = Nn\pi \text{ and } \text{sinc}(N\pi f_x d) = 0. \tag{12}$$

The term becomes 0/0 and is indeterminate. But using L'Hospital's rule it can be shown to be N. Within N there are (N-1) minima (zero) and (N-2) maxima. The numerator  $\text{sinc}(N\pi f_x d)$  is zero when  $N\pi f_x d = \pm m\pi$ . Hence,

$$f_x = \pm \frac{m}{N}, \quad m = \frac{1}{N}, \frac{2}{N}, \dots, \frac{N-1}{N}, \frac{N+1}{N}, \frac{N+2}{N}, \dots \quad (\text{minima}). \tag{13}$$

$$f_x = \frac{N}{N}, \frac{2N}{N}, \frac{3N}{N}, \dots \text{ Are omitted as they contribute to principal maxima.}$$

There are (N-2) secondary maxima.

Fig. 6 shows this plot using MATLAB [8, 9]. It is clear that the plot shows rapid oscillations. When N is too large integer, secondary maxima and minima rapidly decrease and becomes dominant when

$$\lim_{f_x d \rightarrow n} \frac{\text{sinc}(N\pi f_x d)}{\text{sinc}(\pi f_x d)} \rightarrow N$$

Thus, at point  $f_x = \pm \frac{n}{d}$ , the amplitude distribution is  $N \text{ sinc}(\pi f_x a)$ .

Intensity distribution  $I(f_x) = N^2 (\text{sinc}(\pi f_x a))^2$  at points  $f_x = \pm \frac{n}{d}$ .

$$\lim_{f_x d \rightarrow mN} \frac{\text{sinc}(N\pi f_x d)}{\text{sinc}(\pi f_x d)} = \lim_{f_x d \rightarrow mN} \frac{\text{sinc}(N^2 m\pi)}{\text{sinc}(\pi mN)} \rightarrow N.$$

$$\text{sinc} \theta = nN\lambda \quad n = \pm 0, \pm 1, \pm 2, \dots \tag{14}$$

Where  $N = \frac{1}{d}$  is the number of grating elements per unit length (per inch or per cm).

This is usually referred as the Gratings formula.

This is usually referred as the Gratings formula.

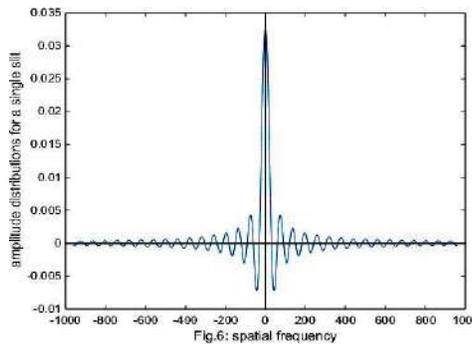


Fig. 6. At every positive or negative integer, given by Eq. (14), the spike with rapid oscillations of fast decreasing amplitude occur.

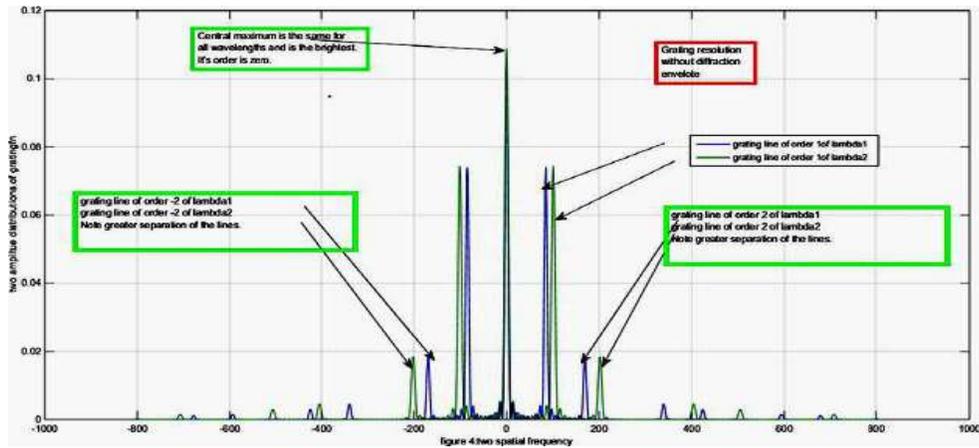


Fig. 6. The grating spectra of two neighboring wavelengths (like the doublet of Sodium vapor) are enveloped by the single slit Fraunhofer pattern. The separation increases with  $n$  (Eq. (14)).

**6. CONCLUSIONS:** The theory of formation of grating spectra is described using the method of convolution and related properties. The grating spectra are the periodic samples of the Fraunhofer diffraction, which is at the background of the spectra. Concept of spatial frequency is used which plays the role of temporal frequency in harmonic functions. The theory is further strengthened by using tools in MATLAB, which is a powerful software for plots of varied types for scientists and engineers.

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**SCIENCE-DAY**

Remember the Day.....Honour the Day.....Salute  
the Day

It is Science Day.....It is Science Day.....It is  
Science Day

Science is Simple  
Science is Special  
Science is Solution

Remember the Day..... Honour the  
Day.....Salute the Day  
It is Science Day.....It is Science Day.....It is  
Science Day

Know the Science  
Understand the Science  
Spread the Science  
Apply the Science

Remember the Day.....Honour the Day .....Salute  
the Day

It is Science Day.....It is Science Day.....It is  
Science Day

Science can bring Heaven  
Science can stop Corruption  
Science can spread Humanity

Remember the Day.....Honour the  
Day.....Salute the Day  
It is Science Day.....It is Science Day.....It  
is Science Day

Science can Reveal importance of the Earth  
Science can Show everything of Solar-System  
Science can take us Journey in to Milky Way  
Science can Unravel Secrets of Universe

Remember the Day..... Honour the  
Day.....Salute the Day  
It is Science Day.....It is Science Day.....It  
is Science Day

**JOIN.....JAMES WEB SPACE TELESCOPE.....JOURNEY**

I was destined to SHOW clear deeper picture and  
reveal secrets of Solar-system Galaxies Universe  
before 1996

I was planned and named after NASA s Director  
james web in 1996

I was completed with Hi-Fi Technology by NASA  
ESA CSA in 2016

I was Tested Perfected Launched in to SPACE on  
25 Dec 2021

I am revolving in own halo orbit at Lagrange Point  
L2 always facing opposite SUN at distance 1.5  
million Km from Earth 25.1.22 onwards

I am 6.5 m wide 132m long with area 26m<sup>2</sup> CAN  
collect light from Orange to MidIR for S ka bands

I am 6200Kg with Sun-Sheild 20.15 m<sup>2</sup> working

with Power 2KW with COST of 10 Billion dollars

I can collect Deepest Oldest Light of Age 100  
million year old after big-bang

i can scan kuiper belt objects with Resolution of  
0.03 arcsecond

I can help to study first stars first galaxies

I can help to study planet and star formation

I can help to study life cycle of galaxies

I can help to study Origin of Planetary-system in  
universe

I am I am I am none other than James-web-  
space-telescope

I will be available to all next 20 years until 2042

so join j-w-s-t journy enjoy planets stars  
galaxies universe

**TRACK.....TELESCOPES.....TOUR**

We were destined to help humans to scan Earth Solar-System Galaxies Universe since Civilization began

We were provided Basic organs like Mirrors lenses prisms by father of Optics Al-hasan In 1015

We got first look with lenses with help of lippershey in 1608

We got name and fame could Show Jupiter Milkyway closely clearly by Galileo in 1609

We were modified by various scientists like Kepler Huygen Herschal up to 1667

We were first made with mirrors having high resolution magnification to scan universe by Newton in 1668

We were modified for 230 years with better mirrors lenses prisms to take photograph spectrograph of planets stars galaxies universe up to 1896

We were made giant and grounded as yerkes observatory to scan universe which was enjoyed greats like Hubble Chandra Karl-sagan etc. in 1887

We were allowed to use 7 lights as radio ir visible uv xrays gamma rays cosmic rays and 4 positions underground ground airborne space with improved technology to scan universe upto 1929

We were allowed to use radio waves on ground by Janskey of Bell Company in 1930

We were allowed to be airborne as Stratoscope in 1957

We were put into space to scan Universe as Satellite SPUTNIK in 1957

We were put in to space e to scan universe as Satellite-Telescope in 1968

We were put into space to study universe as Space-Station-Salutel in 1971

We were allowed in underground to trap cosmic

particles as bust in 1977

We were allowed travel Inter-Stellar-Space as Space-Probe VOYGER1 In 1977

We were developed placed underground ground in atmosphere and put into space as Satelite Space-Stations Space-Probes to scan Universe closely clearly up to 1990

We were given high power put into space as HST by NASA ESA CSA in 1990

We were made most powerful on ground as KECK in 1996

We were allowed to travel 1.5 million Km and remain in space to scan universe as JWST in 2021/22

We are 10s 10000s on ground 100s airborne 10000s as Satellite 10s as Space-Stations 100s Space-Observatories 100s as Space-probes using different lights providing secrets of planets stars galaxies universe to all

We will be more in number more convenient more smart to help all in future up to 2050

We are ..... We are ..... We are.....Telescopes.....

We are ....We are.....We are .....Science-scopes.....

We are ....We are..... We are.....Universes-horoscopes.....

with daya dua dava hoping for daily door darshan

**Shams Sir**

Lvdc Azd Ngr Raichur

9900677978

## Webinar on Solar PV- Cells for Green & Clean Energy Generation

**Schedule:** 11:00AM-1:30P Mon 19/02/2022

**Sponsored by:** DBT Star College Scheme and IAPT (RC-02)

**Activity Incharge:** Dr Gurpreet Singh  
Participating Departments: Chemistry and Physics

**Registration:** 69

**Coordinator:** Dr. Kulwinder Singh Mann



With an aim to inculcate research interest in undergraduate science students towards the

green and clean energy generation by Solar PV-Cells, organized a webinar on 19th February 2022 under the DBT Star college scheme. The resource person, Dr. Sudesh S Bhagwat, Member, Academic Council, Department of Physics, Dr. Homi Bhabha State University, Mumbai explained from basics to an advanced level about Solar PV-Cells. The webinar was arranged on Google-Meet and YouTube-Live. Dr Kulwinder Singh Mann, Assistant Professor and DBT Coordinator inaugurated the event. He gave a brief introduction about the Star College Scheme. Principal Dr Rajeev Kumar Sharma welcomed the expert and participants. Dr. Bhagwat explained some innovative methods to improve the efficiency of solar cells. He also suggested some minor research projects with Solar Cells those UG-Science students can perform to improve their understanding of the working principle of the cells. Students and faculty members actively participated in the interactive session. During the healthy discussion, Dr Bhagwat clarified many myths and doubts about Solar Energy. He encouraged B.Sc. students to pursue a research career in Material Science after completing their M.Sc. He offered himself to provide hands-on practical training for the fabrication process of the Solar PV cells. The event concluded with a vote of thanks to the resource person and participants by Dr. Gurpreet Singh.

**Kulwinder Singh Mann**  
**Coordinator**

### Solar Cell Efficiency

- Theoretical limit of Si Solar cell is 33%.
  - Photons with energy of less than Si Band gap is not absorbed. This accounts for 18% loss
  - Photons with energy more than the Si Band gap will be re-emitted as heat. This accounts for 49% loss.
- Currently the efficiency of Si solar cell is > 21%.

## Multidisciplinary National Conference on Recent Advances in Science & Technology for Sustainable Development

**Schedule:** 05/03/2022

**Sponsored by:** SEARB-DST & DBT

**Conveners:** Dr Gurpreet Singh; Ms. Meetu S. Wadhwa;  
Dr Kriti Gupta; Dr Amar Santosh Singh

**Participating Departments:** Physics, Chemistry,  
Botany, Zoology

**Registration:** 180

**Coordinator:** Dr. Kulwinder Singh Mann

The Chief Guest on the occasion was Prof. Raghavendra P. Tiwari Vice Chancellor, Central University of Punjab, Bathinda and other distinguished guests Prof. S K Mehta Vice Chancellor, University of Ladakh and Prof. G S Chauhan CSIR- Emeritus Scientist, Himachal Pradesh University, Shimla, Prof. Jagbir Singh, Department of Zoology Punjabi University, Patiala, Dr. Narinder Singh, Department of Chemistry IIT Ropar, Punjab and Prof. Atul Khanna, Department of Physics Guru Nanak Dev University, Amritsar, participants and the researchers from various institutes of nearby states, were accorded a warm welcome by the Principal Dr. Rajeev Kumar Sharma.

In the inaugural address Prof. Mehta, delivered a talk on “Effects of Global Warming on Cold Deserts.” He apprised the gathering about the climatic conditions of cold deserts like Ladakh and other similar areas and elaborated on the effects of global warming and the green house technique in the Ladakh Region. He drew the attention of the audience to solutions like Artificial Glaciers and Ice Stupas to tackle the problem.



The key-note address was delivered by Prof. G S Chauhan

(CSIR- Emeritus Scientist, Himachal Pradesh University, Shimla). He spoke on “Advancing the e2 concept: Quest for Sustainable Development.” He focused on the notion that green growth is possible when environment and economy simultaneously grow. He enlightened the audience about the rapid degradation of quality of water and its contamination and emphasized on recycling of the waste and utilization of the bio-waste cellulose.



First Technical Session was chaired by Prof. S.K. Mehta and the lecture was delivered by Prof. Jagbir Singh (Department of Zoology Punjabi University, Patiala) on “Gender and Climate Change Adaptation”. He talked about the many challenges related to Punjab due to climate changes, water depletion, droughts, food production, environment and many more. He also talked about marginalization of women and at the same time the major role that women can play in sensitizing families on utilizing resources effectively and intelligently.

Second Technical session was chaired by Prof. Jagbir Singh and Dr. Narinder Singh delivered a talk on chemosensor and pollutants, colorimetric sensor to detect various ions in water, deterioration of food and dreadful diseases like cancer.

In Third Technical session Prof. Atul Khanna, delivered a lecture on “Synthesis and Characterization of Oxide Materials for Application in Luminescent and Energy Storage Devices”. He further elaborated about the neutron diffraction study of the oxide materials.

Poster presentation witnessed the creativity of the participants. Around 75 poster-presentations were displayed. More than 150 registrations were received

including that of 34 faculty members, 24 research scholars and students from various institutes.



The valedictory function was presided over by Prof. Raghavendra P. Tiwari. He expressed pleasure over the initiative of the college to organize the Multi-Disciplinary national conference. He talked also about the New National Education Policy for higher educational institutions and the democratization of learning system. The stage was conducted by Dr. Neha Jindal and Ms. Harpreet Kaur Brar. The prizes and certificates were awarded to the participants during the valedictory session.

Dr. Gurpreet Singh proposed the vote of tanks.

**Kulwinder Singh Mann**  
Coordinator

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## REPORT

### Observation of National Science Day

The teachers and students of Nigamnagar N. S. High School, Adra, Purulia, West Bengal observed the National Science Day on 28<sup>th</sup> February 2022 at the Seminar Hall of the School under the guidance of RC15. Around 100 students and 10 teachers of the school participated in the event. A portrait of Sir C. V. Raman, drawn by a student was displayed along with a decent flex.



The program was presided over by Mr. Sukumar Chakraborty, the Headmaster of the School. The event

started with an opening song sung by a student followed by a brief opening speech of Mr. Chakraborty mentioning the importance and purpose of the program. After that two students jointly talked about the life and work of the great scientist. Mr. Avijit Khanra, Mr. Prasanta Banerjee, Mr. K. P. Mudi, Mr. Biresh Chandra Layek one by one elaborated to the students on Raman effect, the need for developing scientific and logical thinking for sustainable technological and social development and role of students community in this regard. Two students presented a few science experiments with explanations..



The entire program conducted by Mr. Biresh Chandra Layek, an assistant teacher in Physics of the School. Dr. Subhash Chandra Samanta, former GS of IAPT actively

supported and continuously guided to organize the program.

**Biresh Chandra Layek**  
Convener

## REPORT

### Science Teachers Workshop

Udaypalli Sikshaniketan High School hosted 3day prestigious District level Science Teachers workshop 1St Feb - 3Rd Feb,2022 on **Generation of project ideas for school students based on low cost Science teaching aids** organized by Science Centre, Midnapore. This workshop was supported and catalyzed by National Council for Science and Technology, Govt. of India. Shri Suchand Pan ,Secretary, Science Centre Co-PI of the project discussed the objectives of this workshop .The workshop was an instant success and after this workshop Udaypalli Sikshaniketan High School Udaypalli,Kanchannagar,Burdwan,713102.(WB) celebrated National Science Day on 28th Feb,2022 encouraged by Prof. Subhas Chandra Samanta , Ex-General Secretary of IAPT and Sri Suchand Kr. Pan. The observation of National Science Day was divided into three parts

1) Valuable lectures delivered by;

a) Prof. Avijit Chakroborty, Dept. of Physics, BU, In inaugural session he discussed about the significance of National Science Day, the life of C V Raman and Raman Effect in details. He also discussed about different types of sounds produced by musical instruments, he explained about the colour of sky and sea water etc.

b) Prof. Montu Saha discussed the life of the great mathematician Srinivas Ramanujan which greatly encouraged the students.

c) Dr. Amit S Agarwal, Dept. of Chemistry, Arambag College explored the usage and implication of Chemistry in daily lives.

He discussed

i) Food Preservation-

Food preservation protects food from decaying and spoiling by bacteria and other microorganism's. Salt, sugar, oils and Sodium benzoate are common in our household.

ii) The chemistry of an Onion-

Ever wondered why we shed tears while chopping an onion.

This happens because of the underlying chemistry concepts. As soon as we slice an onion, sulfenic acid is formed from amino acid sulfoxides. Sulfenic acid is responsible for the volatile gas propanethiol S-oxide, which stimulates the production of tears in the eyes.

iii)Kitchen, the most laboratory-



Cooking itself is really just chemistry, Heating, Freezing, Mixing and blending are all processes used in the laboratory and the kitchen when we cook food, a myriad of different physical and chemical processes simultaneously take place to transform the ingredients involved.

2) Science model exhibition performed by School students.

a) Ashima Chottopadhyay House –

1) Deduction of formula of Angle sum of any polygon by induction method (model)

2) Area of Circle (model)

3) Air pressure (model)

b) Srinivas Ramanujan House

1) Experiment on Pascal's law(model)

2) Air pressure(model)

c) Haragobindo Khurana House-

1) Sex determination in Human(model)

d) Meghnad Saha House -

- 1) Cause and effect of scattering of light(model)
- 2) Light travels in a straight line(model)
- 3) Observation of patterns in the number system.

The 3rd part was a science quiz competition.

**Gopal Ghosal**  
**Head Master**

## REPORT

### Celebration of National Science Day

A one-day workshop was organised in the ATL lab of our School, Vidyasagar Shishu Niketan, Midnapore, in collaboration with IAPT, Midnapore College CSC on 12th March, 2022 in physical mode on the occasion of National Science Day.

The Vice Principal, Mrs. Saptarni Dutta chaired the inaugural function and welcomed the audience. Dr. Biswajit Sen, Associate Professor of VTT, Former International Visiting Scientist at Univerzita Palackeho Volomouci, National University of La Plata, IIUM, University of Malaya, Czech academy of Science, threw light on the significance of the National Science Day.

Mr. Suchand Pan, Former Head Master of Midnapore Collegiate School (Boys) and Secretary, Science Centre, Midnapore, motivated the students towards experiments through an illuminating speech and beautiful demonstration of a good number of science experiments.

Dr. Subhash Chandra Samanta, Khandelwal Centenary Committee, spoke on the life, philosophy and activities of Dr. DP Khandelwal, the founder of IAPT and IAPT-Midnapore College Centre for Scientific Culture. Dr. Khandelwal's birth centenary is being celebrated by IAPT. Dr. Samanta along with the physics teachers of the school, Mr. Motilal Jana, Mr. Deep Narayan Ghosh and

Mr. Sandip Ghorai demonstrated a good number of physics experiments developed in CSC Midnapore before a chosen group of 40 students. It is expected that each of them will learn and perform at least one of the experiments and prepare a video and ppt on it. All of them would demonstrate these experiments before not only the rest of the students of the school but also to those of the neighboring schools.

Finally, all these CSC experiments will be presented to an all India audience through an online platform. For this purpose experiments were distributed among the students such that each of them can perform one experiment either in ATL or at home.

Another aim of this workshop was to remind us about the importance of project work for the school level students. This programme made us aware of how Physics projects can be executed even at home, if required, using the instruments which could be easily fabricated using easily Materials available at home or in local market at low cost.

The workshop ended with the vote of thanks.

**Motilal Jana**  
**Physics Teacher**



## IAPT Examination: Both IOQ And NGPE

It has been quite disappointing that the prevailing pandemic has delayed the entire schedule of examination. All these examination are conducted just in March 22. There had been IAPT examination on each Sunday of March 22. The actual date of examination and the enrolment in respective subjects in IOQ 2021-22 is tabulated below.

Examination	Enrolment	Date	Exam held on Time
IOQJS 2021-22 (NSEJS)	11124	6.3.2022	2.30 PM to 6.00 PM
IOQP 2021-22 (NSEP)	21397	13.3.2022	9.00 AM to 12.30 Noon
IOQB 2021-22 (NSEB)	9755	13.3.2022	2.30 PM to 6.00 PM
IOQA 2021-22 (NSEA)	7970	20.3.2022	9.00 AM to 12.30 Noon
IOQC 2021-22 (NSEC)	18489	20.3.2022	2.30 PM to 6.00 PM

In all, there were 241 examination centres for IOQ 2021-22. According to Meta-I technologies the agency conducting this examination, there were around 80 centres to which question papers were made available on email while for all the rest 161 centres they sent the examination material by post/courier. More or less the examination is conducted smoothly at all the centres. The enrolment was done only in online mode.

National Graduate Physics Examination - 2022 has been conducted well at 225 centres with an enrolment of 6394 in the country. Every centre received the examination material in time by post/courier. Most of the states are well represented as far as the NGPE-2022 enrolment is considered. The enrolment of students was done both in on-line mode as well as in off-line mode.

I sincerely express my gratitude and thankfulness to all the centre in-charges and their college/institute administration who have actively cooperated in smooth conduct of IAPT examination.

**B. P. Tyagi**



**G-2190 NATIONAL PG COLLEGE LUCKNOW (UP)**

## The Smart Hub: A Humble Beginning

The humble hamlet of Dharahara Kala has a population of less than 200 at any given time. It has a primary school and is the proud home of the late Jamuna Prasad Singh, who completed his MA and Law from Calcutta University in 1927 but left a lucrative practice to become a social worker and freedom fighter. It is located in the backwaters of Saran district, Bihar. Due to the initiative of Dr Praveen Pathak (Scientific Officer, HBCSE, Mumbai) and Prof Vijay Singh (ex-President IAPT) the **SMART HUB** was launched here on Feb 27 2022, the eve of National Science Day

The **SMART HUB** is a humble low cost hands-on initiative Science Lab using smart phones and devices and readily available hardware. Smart phones are ubiquitous and now students in towns and several in villages (including Dharahara Kala) carry these for their “on-line education” The labs in schools have long been in a state of neglect and the Covid-19 crisis has made it worse. We thought of a judicious way to address this lamentable state of affairs. Using free software (Phyphox) and readily available material Dr Pathak actually made students perform a variety of high school experiments. In a 90 minute session students (i) measured the value of  $g$  (Mechanics); (ii) studied the Doppler effect (Sound); (iii) measured the fall in the intensity of light with distance (Optics); (iv) measured the intensity of the Earth's magnetic field (Magnetism); and in an innovative way measured the angular velocity of the fan by attaching a small magnet to it (Interdisciplinary). Dr Praveen Pathak

asked the student to use their smart phones in a “smart” way. Old Smart phones can be donated for this purpose and the material should cost about Rs. 1000/ and no more than Rs. 5000/ for a working Lab.



A student interacting with Dr Praveen Pathak

The event was held under the auspices of IAPT and organised by the Jamuna trust. 60 students participated and half of them were girls. They appreciated the presentation. As one of them said it empowered them and enabled them to discover firsthand, what they learn in textbooks. Shri Ambika Rai an ex-Principal of the local high school and an IAPT member was the Chief Guest. Prof. Vijay Singh introduced Dr Praveen Pathak. Shri Jay Prakash Singh of the Jamuna Trust proposed the vote of thanks.

**Vijay Singh**



Students assembled outside the shed where the SMART HUB will be housed

## IAPT National Competition on Essay Writing in Physics (NCEWP - 2022)

*Writing makes one perfect, essay writing more so....*

NCEWP is one of the three national competitions being held by IAPT every year. The competition is open to participants in two categories viz., students and teachers (including Science Communicators).

**Category A** - *students* of Higher Secondary /Jr. College, UG and PG levels;

**Category B** - *teachers* of Higher Secondary/Jr. College, UG and PG institutions, also Science Communicators working in recognized institutions.

**Essay topic for both the categories is:**

**“PHYSICS BEHIND THE CLIMATE CHANGE”**

Climate change is a significant time variation in weather patterns occurring over long periods ranging from decades to millions of years. Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions.

The idea is to explore the Physics behind the Climate change and ferret out interesting science themes. As a keen scientist you need to share your observations, exploration and investigation. Your essay may be written considering the following points:

- (i) Scope of study: your city/town- relevant map with latitude and longitude; area and population.
- (ii) You may obtain the data for rainfall, temperature variation (minimum and maximum) during winter and summer seasons for the last ten years from your local Meteorological office. You may have graphical representation of these parameters. This will give an idea of the climate change in your region.
- (iii) You may report:
  - (a) Natural causes of Climate change
  - (b) Man made causes of Climate change
  - (c) The Physics of Climate change
  - (d) Effect of Climate change on Economy
  - (e) Effect of Climate change on Social Factors

(f) Some remedial solution

(iv) Conclusion

### **General Instructions:**

The essay will be limited to 08 pages including figures/tables etc. type-written in the Times New Roman 11-point fonts, with 1.15 spacing. A format is given below:

### **IAPT National Competition on Essay Writing in Physics: 2022 (NCEWP–2022)**

**Topic: –“PHYSICS BEHIND THE CLIMATE  
CHANGE”**

Tick Category:     A                                     B

**Author's Details** (with Affiliation & Signature):-

Total No. of Words:-

Key Words (Maximum Five)

### **Important Changes in the IAPT Essay Competition NCEWP-2022**

**All the RC's will conduct the regional level essay competition digitally. Students at all the levels i.e. Higher Secondary/UG/PG can submit their essays through e-mails to President/Secretary/EC member of the respective regional council. Only two entries per institution may be submitted in a category.**

**(1) Students will send their entries duly forwarded through respective school/college/institute to the appropriate Regional Council (RC) with all contact details clearly. The RC's will have the initial scrutiny at their level. They will select 2 best essays from each level. Thus each RC will submit 6 best entries to the national competition. RCs may award certificate etc., for their participants. Even the RCs may issue a certification of Participation to those whose Essays are sent to the National Competition.**

(2) For the regional competition, students may write their Essays in Hindi or their regional languages. If such entries are forwarded for the National Competition, then the concerned RCs will translate the Essay in English (with the help of Google translator etc.) Only English Version will be submitted for National Level Competition.

(3) Similarly, Teachers & Science Communicators will send their entries through e-mails duly forwarded directly to the Coordinator/Member. **Retired teachers can self-attest their entry. All entries (in English only) will be scrutinized. All entries will be subjected to the online plagiarism test. All entries will be assessed by three evaluators.**

**The last date for essay submission is 25<sup>th</sup> July, 2022.**

Final entries for the national competition must be submitted in PDF format by e-mail to any one of the following:

1. Prof. S. K. Joshi, Coordinator, NCEWP, Mail id:- [joshisantoshk@yahoo.com](mailto:joshisantoshk@yahoo.com)
2. Dr. Himanshu Pandey, Member, NCEWP, Mail id:- [himanshukrpandey@gmail.com](mailto:himanshukrpandey@gmail.com)

Dr. Shivanand Masti, Member, NCEWP, Mail id:- [shivanandmasti@yahoo.co.in](mailto:shivanandmasti@yahoo.co.in)

**S. K. JOSHI**  
Coordinator, NCEWP-2022

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APPEAL

## Appeal For Treatment Of Sh. Vinod Kumar Prajapati

VINOD JI, Office-in-charge IAPT, Kanpur Registered Office, is known to all of us for his genial disposition, helpful nature and sincerity to his work. He has been associated with IAPT from early days and has worked under the guidance of Dr. D.P. Khandelwal and Dr. R.N. Kapoor.

Lately, he has been diagnosed, after a series of tests, with mouth cancer and is under treatment and Chemotherapy since 28<sup>th</sup> February 2022. This treatment will amount to an expenditure of Rs. 4 Lakh. This heavy expenditure is beyond his means and we as a fraternity must come forward to help him. Despite this kind of deliberating treatment, he is attending to the IAPT office duties with sincerity and full devotion. I humbly appeal to all the IAPT members to come forward and help him during this difficult time.

Following are the account details of IAPT Dehradun office in which you can make your contribution and we will make sure that the amount is transferred to Vinod Ji's account:

**Account Name: Indian Association of Physics Teachers**  
**Bank Name: Central Bank of India**  
**Bank Branch: DBS College Dehradun 248001**  
**Account Number: 3750324600**  
**IFSCCODE: CBIN0283283**

**P.K. Ahluwalia**  
President, IAPT

**Rekha Ghorpade**  
General Secretary, IAPT

**Members elected unopposed for the Executive Council of  
IAPT U.P. (R C - 4) for the term 01.01.2022 to 31.12.2024**

**President-** Dr. Devesh Kumar Tyagi, Assoc. Prof., D.A-V P.G. College, Muzaffarnagar.

**Vice President-** Dr. R. B. S. Rawat, Assoc. Prof., M S College, Saharanpur

**Secretary-** Dr. Akhilesh Tewari, Assoc. Prof., I I I T Pryagraj

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Dr. Luxmikant Sharma, Retd. Rama Inter College, Pilibhit

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Dr. Aparna Dixit, P S I T, Kanpur

**Ex-officio Members-**

Padamshri Prof. H. C. Verma, Vice President (General) IAPT, Retd. IIT Kanpur

Prof. A. K. Jain, Vice President (Central Zone), Retd. IIT Roorkee

Dr. R. K. Dwivedi (Immediate Past President RC-4), Director C.D.C.

CSJM University, Kanpur

Dr. Anil Kumar Singh (NGPE Coordinator), Ewing Christian College, Pryagraj

Dr. Sanjay Kr. Sharma (Secretary IAPT), Retd. Asso. Prof. D.B.S. College, Kanpur

Dr. D.C. Gupta (Treasurer IAPT), D.B.S. College, Kanpur

**Anurag Saxena  
Returning Officer**

Email: [anurag\\_knp123@yahoo.com](mailto:anurag_knp123@yahoo.com)

**NOTICE**

The Life Membership Fee of IAPT has been increased from Rs. 1500/- to Rs. 2000/- effective from 1 April 2022. The same was decided by Executive Committee and approved by the General Body during Indore Convention 2021.

**Sanjay Kr. Sharma  
Secretary**



# INDIAN ASSOCIATION OF PHYSICS TEACHERS

(Registered under Section XXI of Societies Act 1860, Regd. No. K 1448)

## Membership Form (PLEASE FILL IN CAPITAL LETTERS)

To,  
Secretary IAPT  
Regd. Office  
Kanpur-208017

Date.....

Dear Sir,  
I wish to join IAPT as a

- 1) Life Member    2) Annual Member    3) Student Member    4) Institutional Member    5) Library

I am remitting a fee of Rs.....through Cheque/DD/UTR No.....  
dt..... of.....Bank.

Name : .....

Qualification.....Sex.....Age.....

Official Address

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.....Town.....Pin.....

Mobile No.....Email ID .....

Mailing address (if different)

.....  
.....

.....Town.....Pin.....

Mobile No.....Email ID .....

Sincerely yours

### MEMBERSHIP & SUBSCRIPTION FEES

(i)	Life Membership	:	Rs. 2000/=	(US \$ 460)
(ii)	Annual :			
	Institutional	:	Rs. 10000/=	(US \$ 3000) [ Rs 25,000 for three years]
	Library	:	Rs. 500/=	(US \$ 150)
	Individual	:	Rs. 250/=	(US \$ 100)
	Student	:	Rs. 250/=	(2 Yrs.)
	Single Copy	:	Rs. 25/=	

**The bulletin is sent free to Life Members of IAPT.**

(Payment should be made by DD /Multi City Cheque in favour of Indian Association of Physics Teachers, payable at Kanpur)

#### Bank Detail for Online Transaction :

Name : Indian Association of Physics Teachers  
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IFSC Code : IDIB000K521  
Bank Name : Indian Bank  
Branch : Kakadeo, Kanpur

**Sanjay Kr. Sharma**

Secretary, IAPT

Regd. Office : Flat No. 206, Adarsh Complex,  
Awasthi Vikas-1 Keshavpuram, Kalyanpur, Kanpur-208017  
sksharma777@gmail.com, Mob. : 09415404969

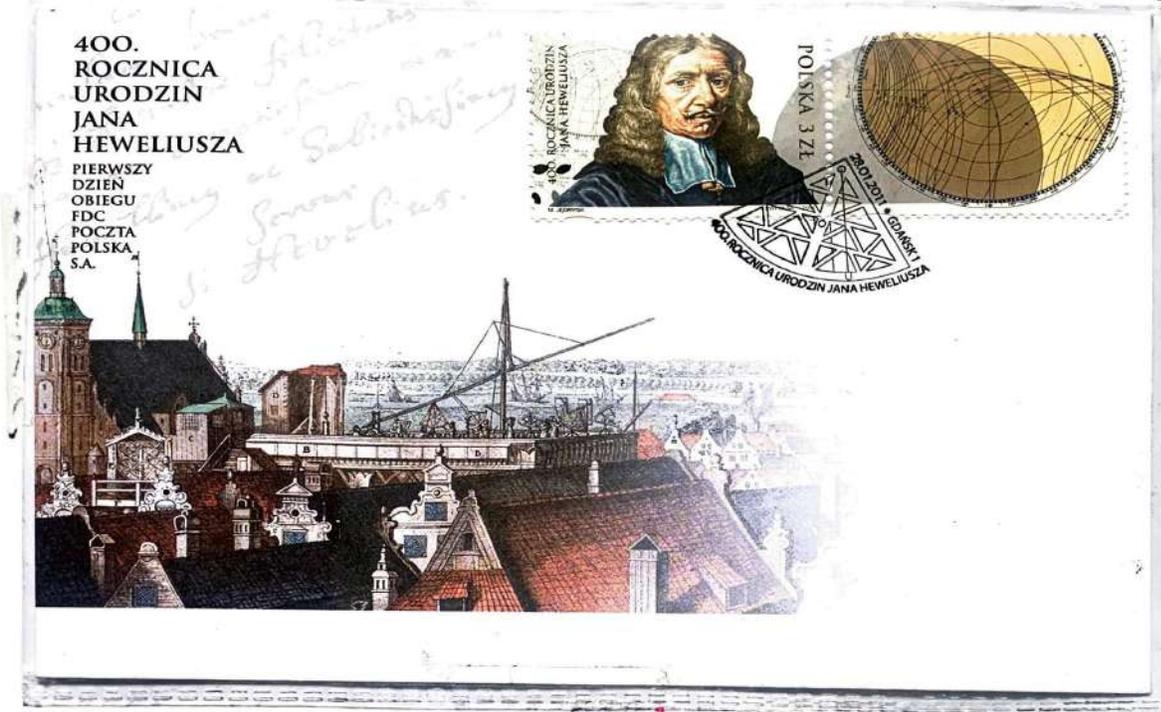
# The Story Of Cosmology Through Post Stamps-17

## MECHANICAL UNIVERSE

### AGE OF ENLIGHTENMENT (17<sup>TH</sup> CENTURY)

During this period of enlightenment astronomical theories and observations developed, building on the body of work forwarded by Copernicus, Kepler and Newton, astronomers refined telescopic observations, produces star catalogue, and worked toward explaining motion of heavenly bodies, Work on astronomy was popularise among an increasing literate population.

Johannes Hevelius (1611-1687). Mayor od Danzig, Poland, as astronomer he was founder of Lunar Topography (Selenographia) & discovered 10 new constellations. In 1641 he built a private observatory “Sternburg” inducting a large Keplerian Telescope (150 feet focal length) and discovered four comets and made observation of Sun Spots



**FDC with se-tenant pair** –depict portrait of Hevelius and a plate representing transit of mercury across the Sun (Mercuri in sole visus), **Cancellation** –depict brass sextant used by him. **Vignette on cover**– is taken from *Machine Cellesis* show his private observatory with 150 feet telescope



**Hevelius** working with 6 feet diameter brass sextant



**Hevelius** and his assistant engaged in observation of Sun Spot as projected on a screen

**Otto Von Guericke**- who believed in infinite void in cosmos as Stoic System



**Jesuit astronomer Leonardo Ximenes (1780)** founded observatory in Florence

**BULLETIN OF INDIAN ASSOCIATION OF PHYSICS TEACHERS**

FOUNDED BY (LATE) DR. D.P. KHANDELWAL

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*If underdelivered please return to :*

**Dr. Sanjay Kr. Sharma**

**Managing Editor**

Flat No. 206, Adarsh Complex,

Awasthi Vikas-1, Keshavpuram, Kalyanpur, Kanpur-208017