Convener's Address

Third National Student Symposium on Physics - 2015

Good morning. Welcome to the third National Student Symposium on Physics. At the outset let me thank and congratulate the Panjab University, and specially the vice chancellor Prof. Grover for hosting the third National Student Symposium on Physics, in addition to hosting earlier the first and second NSSP in a row. The success of the last two Symposia, and the enthusiasm of the students for the present one, heralds a new era in the Undergraduate and Postgraduate Physics education in our country. It is a matter of great solace to IAPT that, our students are resonating well with the call of the 21st century for the innovation and research. This is more so when there is desperation in all spheres, because of the widely prevailing symptoms of degeneration in higher education in India. We cannot take it lightly, or wish it away, as the data emerging in the several international studies unequivocally point it out. Indian universities and other higher teaching institutions like IITs and IISERs etc. are not able to occupy a single spot in the list of top two hundred universities in the world, when countries like Malaysia and Saudi Arabia do. It has entered into the folklore of our country, being repeated in various forums routinely, in the last couple of years. Recent study by the journal Nature reveals more startling facts that in 2013, the scholarly citation impact of India is nearly 30% lower than the world average. The number of patent applications filed per million of the people in 2013 is the lowest, being only 17 compared to 541, 910, 2268 and 3716 for China, USA, Germany and Japan respectively. What is most perplexing is that India spends $171,000/- per researcher, more than many advanced western countries like Britain, Canada, Spain and Hungary given by $155,000/-, $157,000/-, $154,000/- and $122,000/- respectively.

Notwithstanding the fact that India has achieved excellence in some areas like space science, agriculture, nuclear science and pharmaceutical etc., one often wonders how the picture could be so dismal when compared with our contributions to basic sciences in the pre-independence era in 1920s and 1930s when the country had hardly a dozen of universities. Looking further back to the ancient period, India's contribution is simply breathtaking. While all civilizations endeavoured relentlessly to discover the way to write big numbers, it is only India which succeeded by inventing 'zero' and Decimal Place Value system. All branches of knowledge like science, mathematics and commerce etc., and in fact, the entire human civilization developed and flourished with it as the

cornerstone of its foundation. It is amazing that in Europe, Roman system of writing numbers was followed up to as late as 17th Century in which one has to go on inventing newer symbols like I, V, X, L, C etc. with the increase of the largeness of the number, limiting its practical use up to couple of thousands. Rig Veda is supposed to have been written 5000 years back when the rest of the world was hardly literate.

What could be the possible causes for present state of decline? Out of many reasons the most important one is the long foreign rules of our country. India is the only country in the world which has been ruled by foreigners for about a thousand years. What incalculable and invisible harm it does to the native population is the erosion of the faith, self-confidence and self-esteem in themselves. It is easier to fight with an empire but difficult to fight with the legacy left by it. Although India got independence 68 years back, we are still fighting in various spheres to get back the faith in ourselves. The sooner we get the better it is. This process can be accelerated by our relentless conscious effort. The present symposium meant to instill spirit of innovation and creativity in our young students, is a step in that direction. Swami Vivekananda has said "Difference between a man and man is owing to the existence or non-existence of faith in oneself. It is the faith, and faith, and only faith in yourself which is the secret of all great achievements."

Wishing you a very successful symposium and enjoyable stay in this beautiful City of Chandigarh. Thanking you.

L. Satpathy

Convener

3rd IAPT National Student Symposium on Physics
(17–19 September 2015)

Organised by

Indian Association of Physics Teachers
and
Department of Physics, Panjab University, Chandigarh

In order to foster a culture of innovation and creativity among young students, IAPT has instituted the Annual National Student Symposium on Physics (NSSP). The first and second in the series were held in the years 2013 and 2014 in collaboration with Department of Physics, Panjab University, Chandigarh. The Symposium provides a national forum to young students to present their new ideas and innovative work at an early state. The third in the series, NPSS-2015 was held during17-19 September, 2015.

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Titles / Abstracts of Invited talks

Prof. D.P. Roy
HBSCE, Mumbai
BASIC CONSTITUENTS OF MATTER AND THEIR INTERACTIONS

Prof. D.P. Roy
HBSCE, Mumbai
WHY LHC?

Prof. Sudipta Mukherji
IOP, Bhubaneswar
RENORMALISATION IN QUANTUM MECHANICS

Prof. Prasanta K. Panigrahi
IISER, Kolkata
QUANTUM MECHANICS IN ACTION

Abstract: We start with the basic principles of quantum mechanics, which are finding applications in the area of quantum computation, and explain how quantum mechanics allows one to carry out faithful teleportation, better than 'Star Trek'! Principles of quantum mechanics can be used in a host of applications, where utmost security is desired, such as in 'Quantum Key distribution, 'Quantum Cheques' etc. Use of quantum mechanics in carrying out accurate measurements of change in length and other observable. Basic understanding of matrices is assumed.

Presentations

Synthesis and Characterization of Innovative Multilayer, Multi Metal Oxide Thin Films by Modified Silar Deposition Method

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Abstract: Multilayer, multi-metal oxide ($CuNiO_4$) thin films are deposited on glass substrate by modified SILAR deposition method. The chemicals copper chloride and Nickel acetate act as a cationic precursor solution and KOH as a anionic precursor solution. The SILAR is mainly based on the immersion of the substrate into separate cationic and anionic precursor solution and rinsing between each immersion with water to avoid precipitation. Effect of preparative parameters such as concentration, time, pH etc were studied and optimized to get uniform films. These thin films are found to be very useful in many applications like solar cells, sensors, temperature controller satellite etc. These films were characterized by X–ray diffraction and SEM techniques. The X–ray diffraction (XRD) data was used to determine of crystal structure. X-ray diffraction study reveals that the films are amorphous and optical study estimated the band gap value 2.56 eV.

1. INTRODUCTION

Many chemical deposited metal oxide thin films including manganese oxide, cobalt oxide, tin oxide, and copper nickel oxide, etc. have been applied in supercapacitors [1]. The thin film deposition method involving the growth from solution is called chemical methods. Copper oxides exist in two stable forms, the cuprous oxides (Cu_2O) and the cupric oxides (CuO). These two oxides have very different colors, crystal structures, and physical properties. Simple chemistry tells that these differences are mainly due to the fact that Cu in Cu_2O is in the Cu+ state. Cu_2O is a red-colored cubic semiconductor. Nickel oxide has molecular formula NiO. Its molar mass is 74.6928 g/mol. Its density is 6.67g/mol. It is soluble in ammonium hydroxide.

Thin semiconductor films of $CuNiO_2$ are applicable in the various applications [2-5]. Our attempt is to prepare theCuNiO$_2$ thin films by the Successive Ionic Layer Adsorption and Reaction method (SILAR), which is very easy, inexpensive and relatively low temperature deposition method [6]. The thickness and other preparative parameters can be easily controlled by this method.

Thin film plays a vital role in the present day technology development. The different methods of thin film deposition offer a major key to the fabrication of micro and nanoscale devices [2]. The deposition of thin films by vacuum evaporation, spray pyrolysis, electrodeposition, anodization, electroless deposition, chemical bath depositions (CBD), successive ionic layer deposition (SILAR) etc. are well known methods [7]. Among these deposition methods, SILAR is simple, inexpensive and convenient for large area deposition.

2. EXPERIMENTAL

2.1 Substrate Cleaning

Before any substrate can be used, it must be adequately cleaned. The proper cleaning technique depends on the nature of the substrate, the nature of the contaminants and the degree of cleanness required. Cleaning involves the breaking of adsorption bonds between the substrate and the contaminants without damaging the substrate surface itself. The following procedure has been adopted for cleaning of the micro-slide (glass) substrates [8],

1. The micro-slide was washed with double distilled water,

2. Boiled in 0.5 M chromic acid for 1 h and kept in it for 24 hours,

3. Washed with double distilled water and

Ultrasonically cleaned with double distilled water for 10 min and used prior to the deposition.
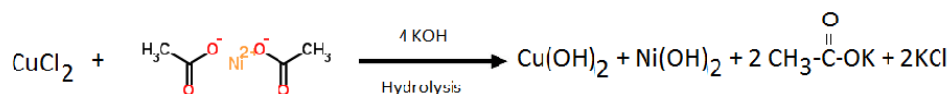
2.2 Preparation of Solution

The copper chloride, Nickel Acetate, and KOH is used for the solution preparation. The required amount of chemicals were weighed accurately and dissolved in double distilled water. All solutions of approximate concentration were prepared prior to the deposition.

2.3 Deposition of CuNiO$_2$ thin films

For the deposition of CuNiO$_2$ thin film 0.1 M of CuCl$_2$and 0.1 M of nickel acetate were used as cationic precursor solution and 0.1 M KOH was used as the anionic precursor solution. The well cleaned glass/stainless steel substrate was immersed in a cationic precursor solution for 10s for the adsorption of Copper Nickel species on the substrate surface. The substrate was rinsed in double distilled water for 5s to remove loosely bound species. Then the substrate was immersed in anionic precursor solution (KOH) for 10s to form layer of CuNiO$_2$material. Rinsing the substrate again in double distilled water in 10s to separate out excess and non-reacted species. Thus one SILAR cycle of CuNiO$_2$ deposition was completed. Then 80, 90, 100 and 110 cycles were repeated and different film thickness were obtained.

2.4 Reaction mechanism

The CuNiO$_2$ films were prepared by immersing substrate in separately cationic and anionic precursors with rinsing between every immersion. The growth kinetics of thin film deposition process is ion by ion growth mechanism, which involve the ion by ion deposition on substrate. The mechanism of CuNiO$_2$ is given as below.

$$CuCl_2 + H_3C{-}COO^-{-}Ni^{2+}{-}OOC{-}CH_3 \xrightarrow[\text{Hydrolysis}]{4\,KOH} Cu(OH)_2 + Ni(OH)_2 + 2\,CH_3{-}\overset{O}{\underset{\|}{C}}{-}OK + 2KCl$$

Oxidation happened when heat supplied to Copper and Nickel hydroxide

3. RESULTS AND DISCUSSION

3.1 X-ray diffraction (XRD) studies

Fig. 1 displays XRD pattern for $CuNiO_2$ thin film. $CuNiO_2$ spinel structure. It shows the amorphous nature. The small peak intensities in XRD pattern are attributed to the existence of fine grains.
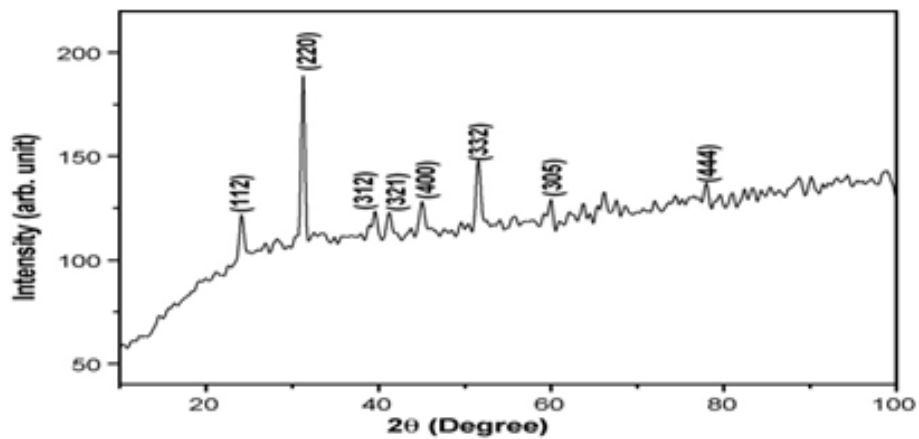

Figure 1: XRD pattern of $CuNiO_2$

3.2 Surface morphological studies

Fig.2 displays the scanning electron microscopy (SEM) images of randomly distributed corn nanoflakes ofCuNiO$_2$. The images are taken at four different magnifications of x 2,000, 5,000, 10,000 and 500 as shown in following figs..The average size of each rose varies between 1-50μm in diameter. There are randomly oriented nanoflakes for each rose; this may be because of faster nucleation rates during deposition.
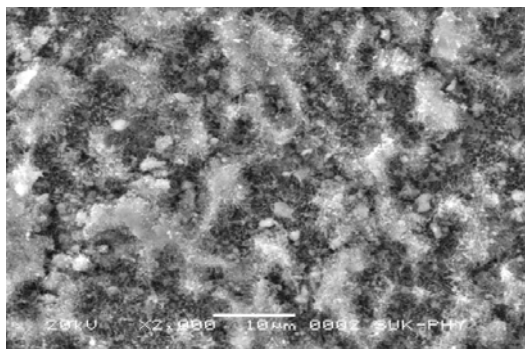
Figure 2: The SEM image of CuNiO$_2$ thin film.

3.3 Optical absorption studies

The optical absorption spectrum in the range of 350-900 nm for the CuNiO$_2$ film was carried out on to the glass substrate without scattering and reflection taking into account. Inset of Fig.3.4 shows the optical absorption of CuNiO$_2$ film. The absorption edge was found at nm due to optical band gap absorption. The optical band gap for CuNiO$_2$ film is calculated on the basis of optical absorption using the following equation,

$$\alpha = \frac{A(h\nu - Eg)^n}{h\nu}$$

Where α is absorption coefficient, Eg is band gap, A is constant and n is equal to 1/2 for direct transition. The plot of $(\alpha h\nu)^2$ versus hν of CuNiO$_2$ film is shown in fig. The band gap energy, Eg is obtained by extrapolating the linear portion of the plot $(\alpha h\nu)^2$ versus hν to the energy axis at α=0. From the graph for CuNiO$_2$ thin film, band gap value is 2.56 eV.
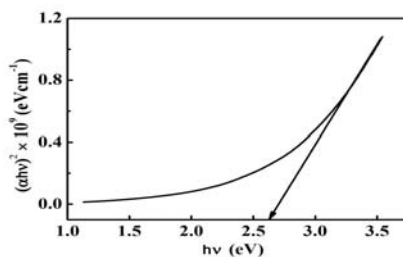

Figure 3: Shows Optical Characteristics of CuNiO$_2$ thin film

ACKNOWLEDGEMENT

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A Visual Observation of Geminids-2014

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Abstract: Every year in mid-December (13-14 Dec) the Geminids meteor shower appears to come from radiant in the constellation 'Gemini' hence the name. It occurs when Earth crosses the path of the asteroid '3200 Phaethon'. Geminids is considered to be most intense meteor shower. On 13-14 December 2014, observations were taken from Paud, near Pune, having geographical coordinates 18.52420°N, 73.6158°E. In the present work, its Zenithal Hourly Rate (ZHR) was calculated and was compared with the ZHR of Geminids for the last 10 years. Using the data of ZHR, orbital period of 3200 Phaethon was approximated.

1. INTRODUCTION

The purpose of visual meteor observation is principally to obtain data which involves looking for patterns to help understand meteor behaviour and to predict what might be seen in the future .Our College undertakes sessions for meteor shower observations since last 10 years and the data recorded by the students is submitted to the International Meteor Organization. In the present work, observations of Geminids meteor shower-2014 were taken and the ZHR was calculated. Moreover it was compared with the ZHR of Geminids of last 10 years and the orbital period of the parent body of Geminids meteor shower was estimated.

Meteors occur when tiny particles of dust enter the Earth's atmosphere at high speed and burn up by friction with the air molecules at specific heights above the surface. The streak of light in the night sky so produced is called a meteor. The word meteor is of Greek origin and means 'in the air'. The dust particles are called meteoroids, while particles large enough to survive the fiery passage through the Earth's atmosphere to reach the surface still partly intact are called meteorites.

Meteoroids enter the Earth's atmosphere with velocities between 11 to 72 km/s[1]. Due to collisions at such high velocities, electrons are stripped off the atoms. When these electrons recombine with ions, they emit light which causes the observable phenomenon of a meteor-a streak of light.

A meteor exceeding the brightness of Jupiter at its brightest (magnitude -3) is called a fireball and a large fireball particularly accompanied by sparks and explosive noise, are called as bolides.

Meteor showers observed from the surface appear to come from a particular point in the sky which is called as radiant.

2. METEOR SHOWERS:

Meteor shower is a celestial event in which a number of meteors are observed to radiate or originate, from one point in the sky. Meteor showers are commonly named after the constellations in which the radiant appears to fall on the celestial sphere; examples are Geminids (Gemini), Perseids (Perseus), Orionids (Orion).

3. CLASSIFICATION OF METEOR SHOWER

3.1 Sporadic Meteor Shower

There are some meteors that arrive from random locations in the sky or those which cannot be associated with any active radiant are usually classified as sporadic meteors. Sporadic meteors appear throughout every night of the year. The sporadic meteor activity is much less observed than that of the showers because of its generally low hourly rate.

3.2 Non-Sporadic Meteor Shower

Showers like Geminids, Orionids, Leonids recur annually from a certain radiant hence they are non-sporadic meteor showers. Larger number of meteors appears in this type of meteor shower as compared to sporadic meteor showers. Non-sporadic meteor showers can be further divided into two sections.

3.2.1   Annual Meteor Showers

The annual shower would occur if the debris of comet were spread out more or less evenly throughout the whole of its orbit. This is referred to as a meteoroid stream. As a comet approaches the sun, the frozen ices of the nucleus' surface sublimate to gas, liberating the dust inclusions in the icy matrix.

3.2.2 Periodic Meteor Showers

When meteor showers are periodic and not annual it is probable that the cometary residues occur mainly in relatively small region of the orbit then they form meteoroid swarm rather than stream moving around the sun. It is only when Earth passes through the swarm that meteor shower occurs.
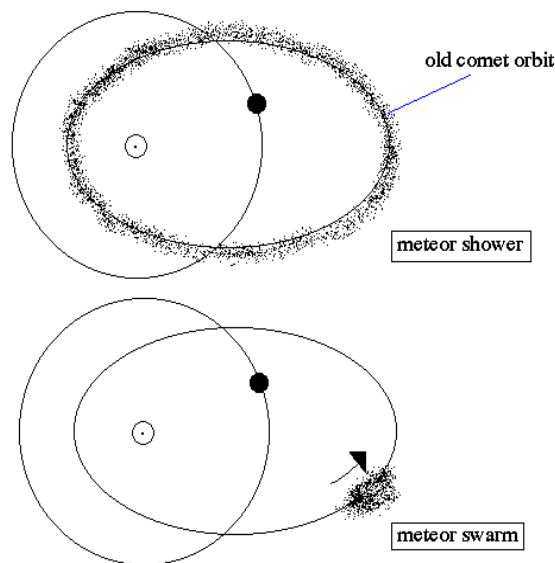
Figure 1: meteoroid stream and meteoroid swarm [2]

4. GEMINIDS

The first indication of the Geminids meteor shower [3] was published by Quetelet, who mentioned high meteor activity in December 1830 in Germany. The early observations do not provide the sufficient details of the shower. Most authors cite Greg (1872) as the discoverer of Asteroid (3200) Phaethon which is a 5 km diameter body dynamically associated with the Geminids meteoroid stream. Most meteoroid streams have cometary parents from which mass loss is driven by the sublimation of near-surface ice. The Geminids meteor shower is unique in a number of ways. Unlike most showers, it is not associated with cometary debris. Instead, the sand-sized granules that hit the atmosphere during the Geminids were left behind by an asteroid.

5. 3200 PHAETHON-PARENT BODY OF GEMINIDS METEOR SHOWER

Phaethon's orbit is skewed relative to the Earth's. As a result, Earth's orbit will intersect the asteroid's debris tail for only a few short centuries. First noticed in the 1860s, this meteor shower will cease around the year 2100. Humanity only has one brief century left to enjoy this consistently dense yearly meteor shower. The orbit of 3200 Phaethon is unusual among the known meteor showers with its small perihelion distance of 16 solar diameters which is 0.14 AU. The properties of 3200 Phaethon are that of an asteroid while its behavior resembles a comet [5].

6. VISUAL OBSERVATION

The purpose of visual observation is principally to obtain data which can be used to compare past meteor reports. It mostly involves looking for patterns to help understand meteor behavior and to predict what might be seen in the future. An easy way to observe meteors visually is what we call the 'counting method'.

The observer notes the meteors seen on a tape recorder or just a piece of paper. He gives the estimated magnitude of the meteor and whether or not it belonged to the observed shower (e.g. Perseid or non-Perseid). This method is applicable for major shower maxima

like the Quadrantids, Perseids, and Geminids. One has to decide which observing method, plotting or counting, is most favorable.

6.1 Method Of Observation

Meteor counting method was utilized for taking the observations. In which initially triangles were virtually made in the sky with the known stars at the vertices. The triangles were distributed among the volunteers and the number of meteors observed, along with the effective time period of observation, was recorded. With the help of the recorded data, ZHR of Geminids was calculated.

On 13-14 December, the weather conditions in Pune were not favorable for the observations. There was 88% cloud cover along with moderate rain and hence the meteors with high magnitude were not observed. As a consequence, the value of ZHR obtained was 27, which was very less. The probable reason would be the presence of waning gibbous moon in the sky at the time of observation. The database for Geminids-2014 on the official site of International Meteor Organization was analyzed and the value of ZHR was utilized to compare with the ZHR of Geminids of last 10 years [4].

7. ZENITHAL HOURLY RATE (ZHR)

The standard quantity measuring meteor shower activity is the Zenithal Hourly Rate (ZHR). It is the number of meteors a single observer would see in one hour under a clear, dark sky if the radiant were at the zenith. The rate decreases the closer to radiant is to the horizon.

7.1 Formula For ZHR

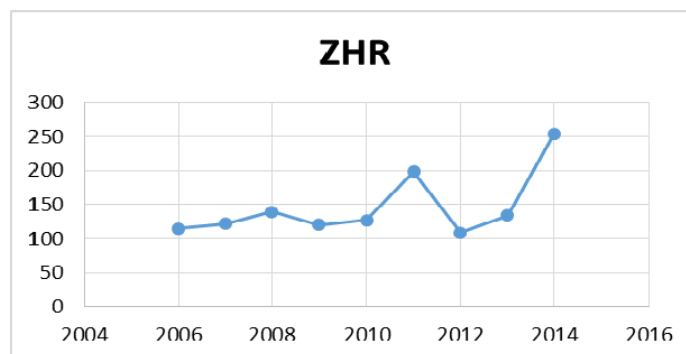$$ZHR = HR \cdot F \cdot r^{6.5 - lm} / \sin(hR) \tag{1}$$

Where,
HR=Number of meteors per effective time interval,
F=1/1-k where 'k' is the percentage of the observer's field of view which is obstructed.
sin(hR) represents the correction factor for altitude of the radiant above the horizon.

8. RESULTS

In order to study the variations in the value of ZHR, data of ZHR for the last 10 years was collected from the official site of International Meteor Organization. Analyzing the data graphically, we inferred that ZHR increases after every 3 years which suggests that 3200 Phaethon might cross the Earth's orbit after 3 years due to which the orbital period of 3200 Phaethon could be approximated to 3 years.

ACKNOWLEDGEMENTS

We would like to thank, Dr. Ms. R.V. Dabhade, Co-coordinator Astro Club, Fergusson College. Prathmesh Pawar (M.Sc. II) for providing the site for observation. Yogesh Pandey (B.Sc. III), Ziad Modak (B.Sc. III) and all the Astro Club members for arranging the sessions of Geminids meteor showers.

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Low-Temperature Susceptibility of Rock, Volcanic Ash and Sediment Samples

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Abstract: Low-temperature (up to -190˚C) magnetic susceptibility measurements can be used to find the composition of a material or even in some cases substances present in trace amounts in the material. Some rock, volcanic ashes and sediment samples are taken and their susceptibility is measured in the temperature range of -190˚C to 10˚C. The ideal graphs of some magnetic minerals are used as reference and compared to the resulting graphs of the samples. Most of them contain mainly Titanomagnetites while some have pure Magnetite, whereas one sample was found to have Hematite. The graphs of ashes had a lot of noise due to low ferromagnetic concentration. A shift is observed in the graphs which suggest presence of impurities. Low-temperature susceptibility data when combined with high-temperature data can be very useful in other applications such as finding out Curie temperature, looking for trace amounts of minerals, etc.

1. INTRODUCTION

Magnetic susceptibility is a magnetic property of a material defined by the extent to which the material can be magnetized in relation to an applied magnetic field. It is a function of temperature. In this experiment, the variation of susceptibility of rock, volcanic ash and sediment samples with lower ranges of temperature is studied. Many substances or minerals show peculiarities in this temperature range. They have a certain trend in graph (χ-T) which can be used as a classification or identification tool. The presence of a certain mineral in abundance causes the graph to follow the particular trend of that mineral. On the other hand, if no mineral is present in high amounts or if its magnetic properties are not strong enough, the graph shows no identifiable trend.

Various minerals show particular characteristic or anomaly in their graph within this range of temperature. Therefore, this range is taken.

MAJOR SECTIONS

1) **About certain minerals:** Titanomagnetites, $Fe_{3-x}Ti_xO_4$ where x is between 0and 1, show varying trend as Titanium content varies. Figure (a) shows trends of different titanomagnetites from x=0.6 to x=0, i.e. TM60 to TM0. TM60 is Ulvöspinel (Fe_2TiO_4) and TM0 is Magnetite (Fe_3O_4). [1]

Magnetite shows an anomaly at 120 K which is known as Verwey Transition. The Fe^{2+} and one of the Fe^{3+} are interchangeable. At T_v(=120K), they no longer remain interchangeable and separate out. [2] This causes a sudden decrease in its electrical conductivity and a slight change in its crystallography. This also affects the susceptibility of Magnetite (as shown in Figure (b)). [3]

Hematite (Fe_2O_3) is anti-ferromagnetic with slight canting above ~253 K. Below this temperature, it is perfectly anti-ferromagnetic. This is known as Morin Transition. The effects are seen in its susceptibility (as shown in Figure (c)). [4]
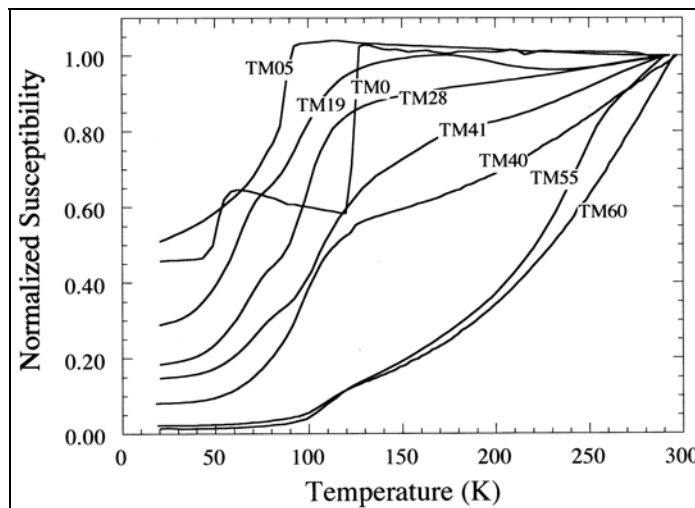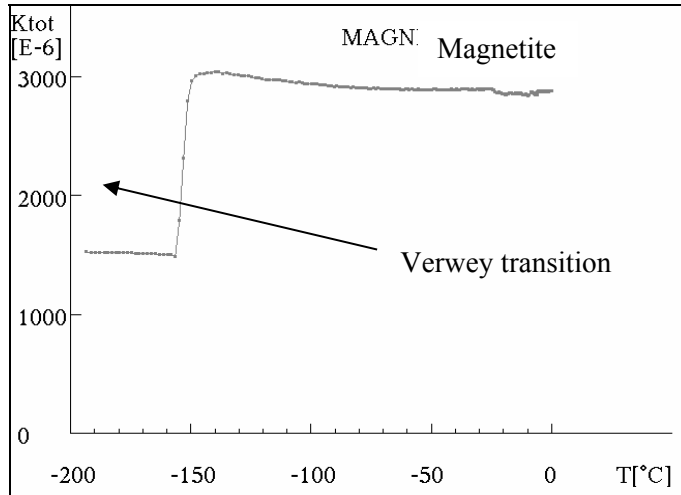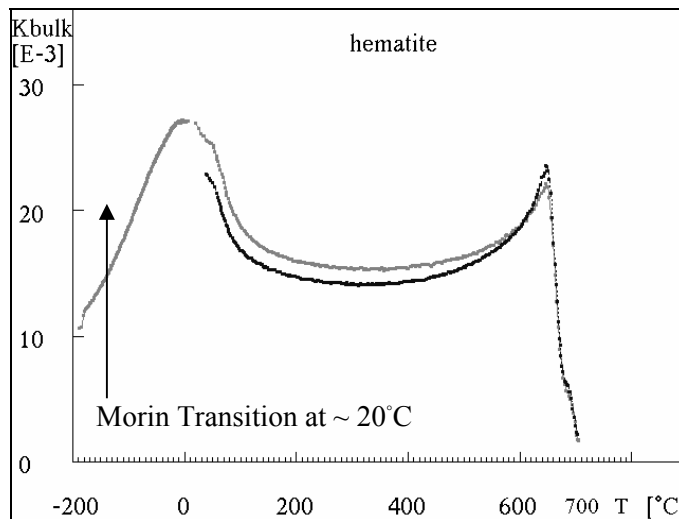

Figure (a) [5]

Figure (b) [3]

Figure (c)[6]

MS2WFP. It has its own software (GeoLabSoft). The samples brought to -190°C by

a) **Experimental Method:** The instrument used for acquiring data is the Bartington's using liquid N_2. After this, the instrument is set to record susceptibility after every $2°C$ increase in temperature till the sample reaches $10°C$. This data is used to make graphs which are then studied.

b) **Result:** For rock core samples,

Most of them have mainly titanomagnetites of different compositions with some having Magnetite and Hematite. These graphs are found to be shifted towards right which may be because of impurities. A couple of samples were found to be unidentifiable as there trend was very different.
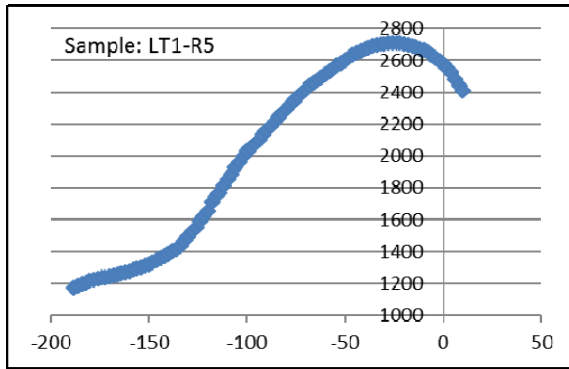
Graphs of some samples are
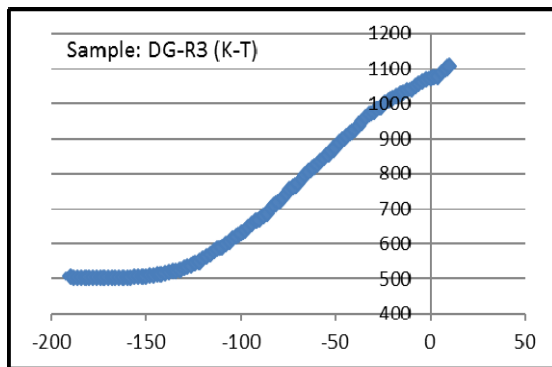
The graph here resembles that of TM55. The small change in the ideal graph at approximately $-23°C$ is observed here at $-26°C$.
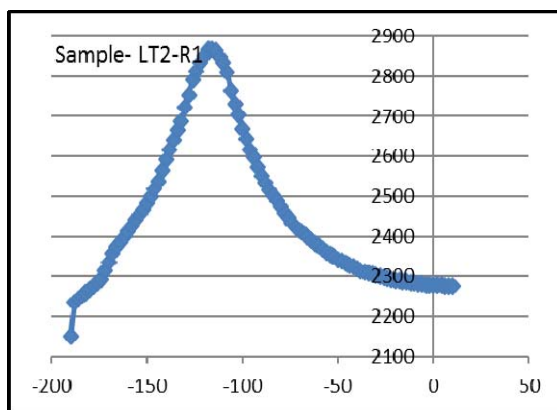
This graph clearly shows Verwey transition- characteristic of Magnetite. The peak is at $-116°C$. Ideally, it is present at $-150°C$ but here it has shifted towards right.

Here, the graph has a peak at -26˚C. This is similar to Morin transition which is ideally at -20˚C. Therefore, it is safe to assume that the graph shows presence of Hematite.
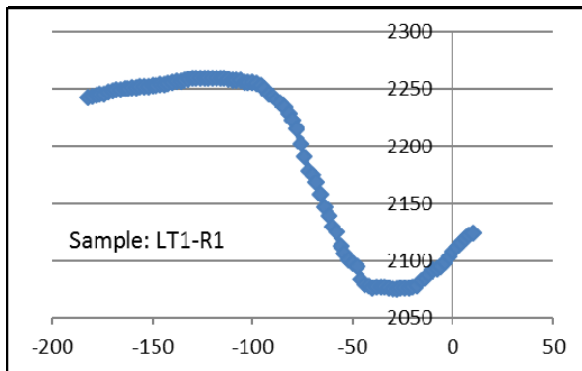
This sample may have intermediate composition.

For volcanic ash samples,

As it is very clear, there is a lot of noise present. This has made it difficult to identify the trend of the graph and therefore its composition. For example,

For Sediment samples, These samples also have a high content of different Titanomagnetites.
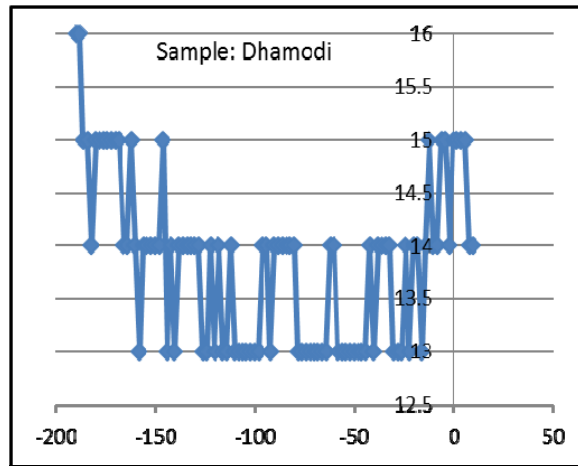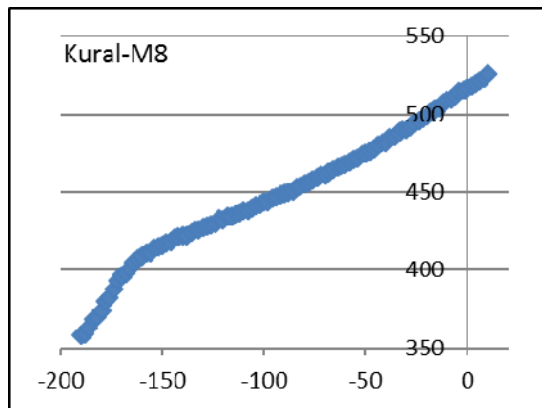
The graph is like that of TM60. In this low-temperature graph, there is a bump at -174˚C; otherwise the graph is smooth enough.

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Gesture Controlled Car using Accelerometer

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Abstract: In this project we have made a car whose movement can be controlled with hand gestures. We have made use of an accelerometer to achieve this functionality. The readings of the accelerometer were taken for different orientations and they were further given as an input to a PIC. This enabled the use of the accelerometer for gesture control.

1. INTRODUCTION

Accelerometers are components that can sense a change in motion and with the help of an appropriate electronic circuit attached to it, we can use these devices in a wide number of motion sensing applications.

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

The ADXL335 uses a single structure for sensing the X, Y, and Z axes. As a result, the three axes' sense directions are highly orthogonal and have little cross-axis sensitivity.

FEATURES: 3-axis sensing, small, low profile package 4 mm × 4 mm × 1.45 mm LFCSP, low power : 350 µA (typical), single-supply operation: 1.8 V to 3.6 V, 10,000 g shock survival, excellent temperature stability.

2. MAJOR SECTIONS

2.1 Components Used

Accelerometer ADXL335- to sense the change in orientation.

HT12E Encoder- to encode the digital data to be given to the RF transmitter module.

433MHz RF Module (Transmitter+Receiver)- to send and receive the data wirelessly.

HT12D Decoder- to decode the digital data received by the RF receiver Module.

74HC154N 4-line to 16-line Decoder- to select mutually exclusive output lines as per the 4-bit data.

PIC16F688- to convert analog output from ADXL to digital form.

PIC16F84A- to drive the servo motor.

2.2 Output Voltage of ADXL335 for different orientations

Position	X-axis Voltage	Y-axis Voltage
Forward	0.567	0.529
Reverse	0.573	0.629
Left	0.608	0.576
Right	0.514	0.575

Table 1. Output Voltages of ADXL335 for different orientations

2.3 Block Diagram

Yash Deorukhkar and Ketan Pimputkar
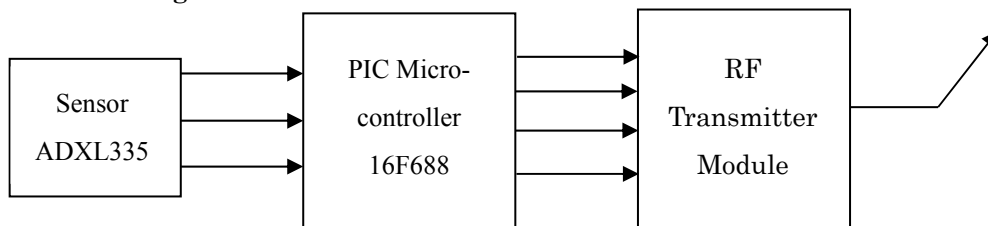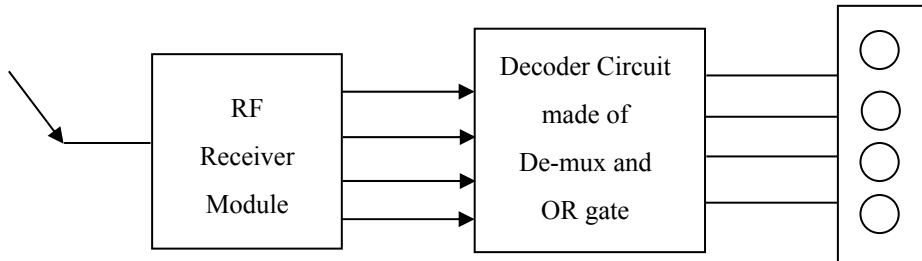
2.4 Circuit Diagram
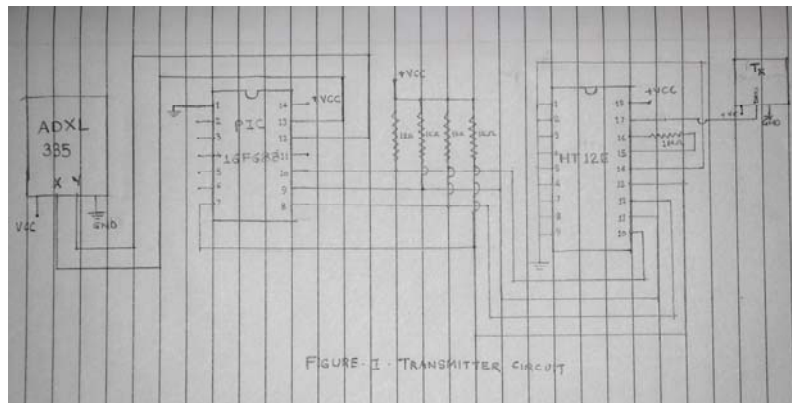
FIGURE-I · TRANSMITTER CIRCUIT
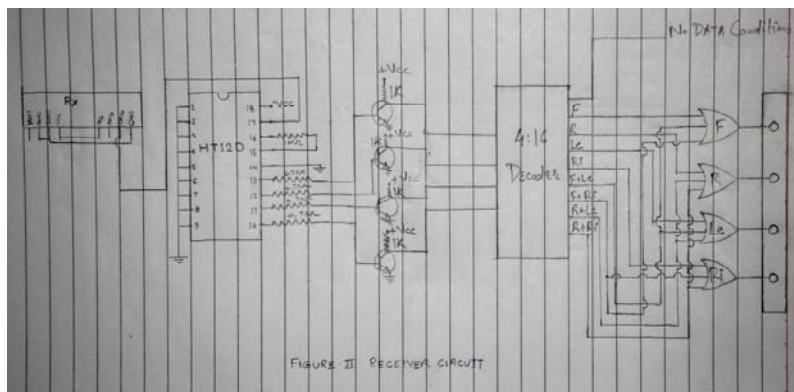
FIGURE II RECEIVER CIRCUIT

2.5 Applications

Motion sensing has a wide range of applications such as:

1. Home appliances such as opening and closing windows.
2. In mobile phones a few applications work on gesture such as certain games.
3. In research labs that deal with a lot of radioactive material this can be of great help.
4. In making robotic arms.
5. In cameras for image stabilisation.

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Determination of Hubble 's constant

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Abstract: In the present work, Hubble's law is verified and the value of Hubble's constant is determined. Cepheid Variable and Type Ia Supernovae are used as standard candles for calculating distances to galaxies. To measure the velocity, the amount of redshift observed is used.

1. INTRODUCTION

According to Hubble's law, the distant galaxies are moving apart from our galaxy, and at the same time from each other. The velocity of this recession is directly proportional to the distance between galaxies. Mathematically, this relation can be expressed as:

$$V = H_{\circ} D$$

Where, V=Velocity of recession, H=Hubble's constant, D=distance between galaxies.

To find the value of Hubble's constant, one need to measure the distances and velocities of galaxies and plot a graph of velocity vs distance, the slope of this graph gives the value of Hubble's constant. NASA's Extragalactic Database (NED) has been referred to obtain the required data, i.e. the measurements of distances to various galaxies and their velocities (redshifts). NED's database is used to obtain Cepheid distances to the galaxies within the range 0-70 MPc and their respective redshifts. Whereas, *Freedman, W.L, et al, the Astrophysical Journal, 553:47È72, 2001 May 20* , was referred to obtain distances to the galaxies within the range 50-500 MPc, in which Type Ia Supernovae are used as standard candles.

2. METHODOLOGY

2.1 Measuring distance

To measure distances standard candles are used. Standard candles are objects with known standard absolute brightness.

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2.1.1   Using Cepheid variables

Cepheid variable stars have a linear relation between their absolute magnitudes and their distances. The relation is shown in the Fig 1.

The Cepheid distances to the galaxies can be found in NASA's Extragalactic Database (NED) along with the corresponding redshifts of the galaxies.
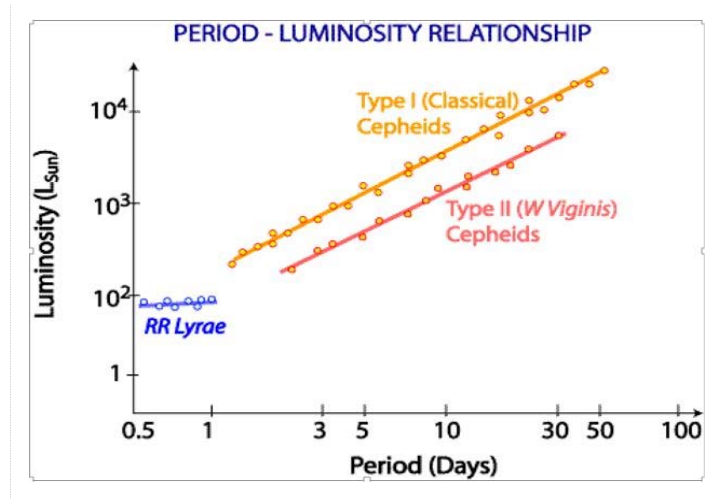
Figure 1: Period-Luminosity relation of Cepheid variables.

2.1.2   Using Type 1a Supernovae

Type Ia supernovae are all caused by exploding white dwarfs which have companion stars. The gravitational pull of the white dwarf causes it to take matter from its companion star. Eventually it reaches a high enough mass (about 1.44 solar masses) that it cannot support itself against gravitational collapse and explodes. All type Ia supernovae reach nearly the same brightness at the peak of their outburst. Type Ia supernovae can be used to measure distances from about 1 Mpc to over 1000 Mpc.

2.2 Measuring velocities

The redshift is symbolized by z. The definition of z is.-
 1 + z = Wavelength observed / Wavelength rest.

For example, taking the observed Balmer gamma line of a certain galaxy as 4780, we get:

$$1 + z = 4780 / 4340.5 = 1.1,$$

So, $z = 0.1$.

If the observed wavelength were less than the rest wavelength, z would be negative. That would tell us that we have a blueshift, and the galaxy is approaching us. But it turns out that only almost every galaxy in the sky has a redshift in its spectrum.

To convert from redshift z to velocity v measured in kilometres per second, the formula is

$$v = c z,$$

Where c is the speed of light, $c = 300,000$ km/sec.

3. RESULTS AND CONCLUSIONS

The following Graphs were plotted and the value of Hubble's constant determined is:

The values of Hubble's constant determined are:

1. $H_o = 72.22$ Km/sec/MPc (By using Cepheid distances)

2. $H_o = 74.22$ Km/sec/MPc (By using Type 1a Supernovae for distance measurements)
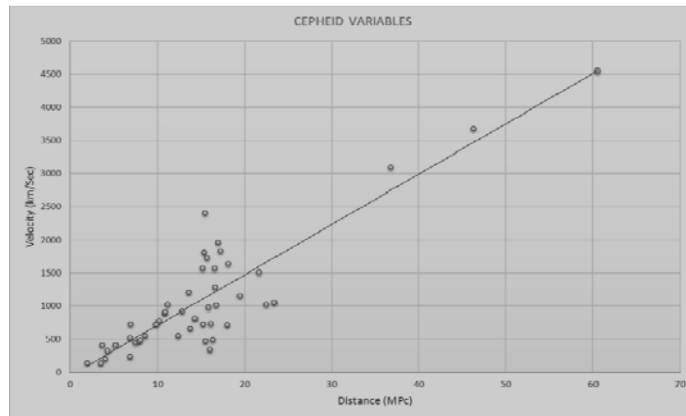
Figure 2: Velocity vs Cepheid distances.
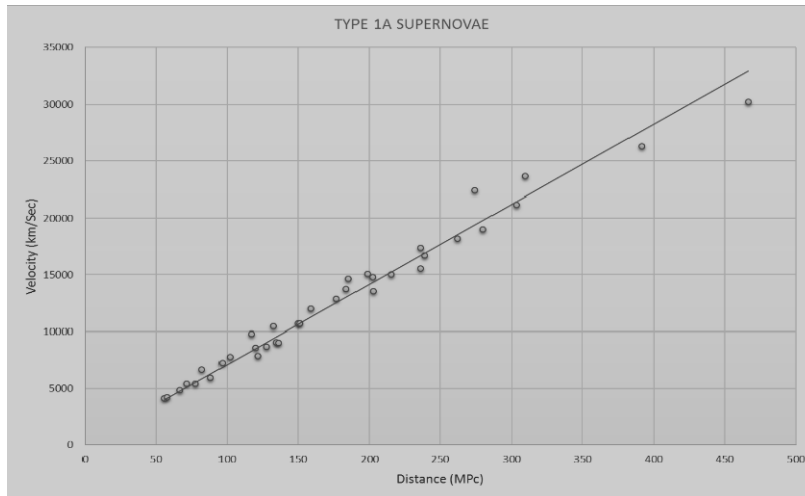
Figure 3: Velocity vs Type 1a Supernovae distances

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An Amateur Radio Telescope Using a Satellite TV Dish Antenna

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Abstract: In the present work, an amateur radio telescope has been designed and built using the components of a satellite TV dish antenna. The parabolic dish works as a reflector and the Low Noise Block works as a receiver of the radio waves. The output of the receiver is recorded using a satellite finder meter. This radio telescope works in the frequency range of 10 GHz – 12 GHz. This whole array of instruments was intended to take radio observations of the Sun, but it can also detect radiation from the human body, geostationary satellites and Compact Fluorescent Lamps (CFL). This amateur radio telescope is designed using materials that are available off the shelf so that school and college students can easily assemble and use it at a low cost. This should expose them to the wide field of radio astronomy.

1. INTRODUCTION

Radio astronomy is the branch of astronomy in which the universe is observed in the frequency range of 3 KHz to 300 GHz. A number of different sources emit radio waves, like the Sun, and also totally new classes of objects like radio galaxies, quasars and pulsars were later discovered [1]. Radio astronomy is less famous amongst the general public than its optical counterpart. In the present work, an amateur radio telescope has been designed and built that can be used to popularize radio astronomy. School and college students can easily build it at a low cost and use it.

2. FABRICATION

This radio telescope was designed using the components of a satellite TV antenna. All the materials needed for fabrication are easily available in the local market at a low cost.

2.1 Materials Used

2.1.1 Parabolic Reflector Dish

The parabolic dish was used here for reflecting the radio waves emitted by the source. When used in a satellite TV setup, it reflects the radiation transmitted by the geostationary communication satellites.

The diameter of the dish used in this setup was 60 cm. Larger dishes available in the market can be used as well. The angular resolution of the dish used is given by, [2]

$$\theta = 1.22 \, \lambda/D \tag{1}$$

Where, θ = Angular resolution in arc degrees,

λ = Wavelength of incident radiation in meters,

D = Diameter of the reflecting surface in meter

The relation between wavelength and frequency of electromagnetic radiation is, [2]

$$\lambda = c/\nu \tag{2}$$

Where, c = speed of light = 3 x 10^8 m/s

ν = frequency of radiation in hertz.

The wavelength corresponding to the frequency of 12 GHz, from Eq. (2), was calculated to be 2.5 cm. Using this value of wavelength in Eq. (1), we get the angular resolution of the telescope as 2.91 arc degrees.

2.1.2 Low Noise Block (LNB)

The LNB was mounted on the arm of the dish such that it sat its focus. The LNB acts as the receiver of the radio waves. It contains a band pass filter which passes only the radio waves of frequencies 10 GHz to 12 GHz. These waves are then amplified by the internal low noise amplifier and the noise is rejected. The amplified signals are then downconverted to the frequencies 950 MHz to 2150 MHz which are used by the set-top box to generate audio and video signals.

2.1.3 Satellite Finder Meter (SFM)

The SFM is an instrument used by satellite TV engineers as an aid to point the dish precisely towards the communication satellite. This instrument was used in this setup for observing the intensity of radiations detected by the telescope. It has an arbitrary intensity scale and a knob to control the gain of the internal amplifier. The SFM needs a power supply of 18 V DC to work and it receives the radio waves from the output of the LNB.

2.1.4 Set-top Box

The set-top box acts as the decoder of the radio waves, downconverted by the LNB, to generate TV signals. Here, the set-top box was used to supply the required DC voltages to the LNB and the SFM. An external power supply can be used as an alternative to the set-top box.

2.2 Fabrication Method
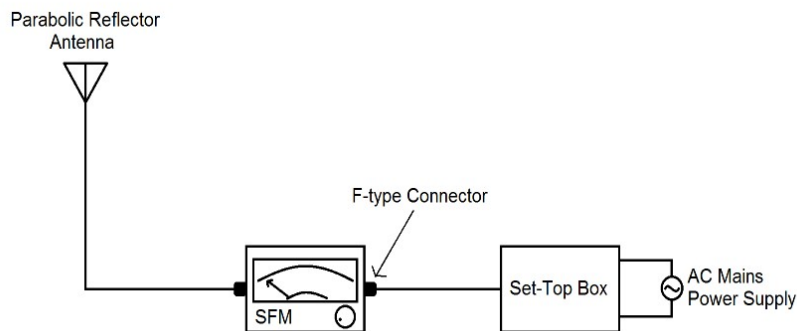
Figure 1: Schematic diagram for connection of components.

All the components were connected using coaxial cables and F-type connectors. The parabolic reflector dish was mounted on a telescope mount so that it became easy to point the dish towards a source. The LNB was mounted on the arm of the dish such that it sat at the focus of the dish. The satellite finder meter was connected between the LNB and the set-top box as shown in Figure 1.

All of the components were connected to each other using coaxial cables and F-type connectors. As the LNB passes signals in the frequency band 10 GHz to 12 GHz of the electromagnetic spectrum, this radio telescope works in the same band of frequencies. These frequencies fall in the Ku band of the electromagnetic spectrum. [3]

3. OBSERVATIONAL TECHNIQUE

The Sun is a broadband emitter [4] and hence this telescope can be used to observe the Sun. After connecting the components as shown in the schematic, the dish was pointed towards the blank sky and the set-top box was connected to the AC mains supply. The set-top box acts like an AC to DC converter and supplies a voltage of 18 volts to the LNB and the SFM. The gain of the satellite finder meter was adjusted so that it showed a constant reading of 4 on its scale. The meter started buzzing at a certain frequency indicating that radio waves were received. The dish was then slowly moved, from the blank sky, in the direction towards the Sun and then away from it in the azimuth direction. The readings from the SFM and the azimuth of the sky were recorded. This same procedure can be used to observe any other source.

4. RESULTS AND CONCLUSIONS
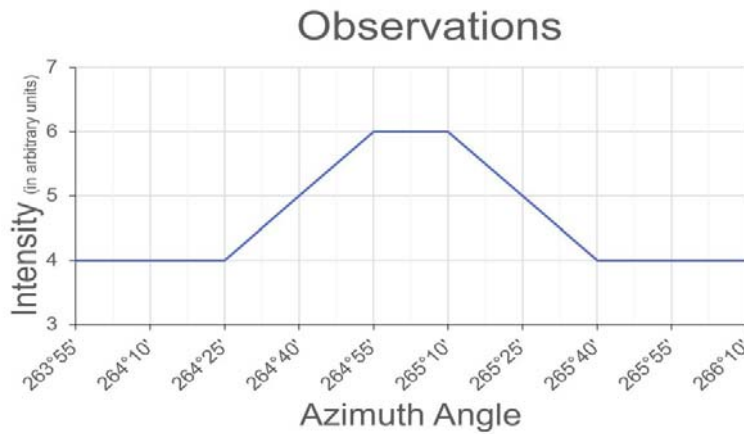
Figure 2. The graph of intensity against the azimuth angle for the Sun

The graph shown in Figure 2 was obtained when the telescope was used to take observations of the Sun, using the given observational technique, on 27th August, 2015 at 15:30 IST. This graph shows that more radio waves are received when the dish is pointed towards the Sun confirming that the Sun is emitting in the Ku band. The graph, ideally, should be the shape of a normal distribution. This is not the case in practice because the instruments used are not of high sensitivity. The SFM contains a buzzer which generates sound waves of varying frequencies, proportional to the intensity of radio waves. If the graph of these frequencies was plotted against the azimuth angle, we could have got a similar graph.

This amateur radio telescope works in the frequency range of 10 GHz to 12 GHz and hence can detect the radio waves from many different sources like the Sun, geostationary satellites, Compact Fluorescent Lamps, boiling water and even the human body. Since, this radio telescope can be easily assembled and operated by college students, this should help them to get exposed to the wide field of radio astronomy.

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Diffraction Pattern, reveals the Inner Beauty

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Abstract: Quiz is a mind tickler. Finding out something practically by applying what one has studied in theory is thrilling! But, I (Sahana) had to learn Diffraction thoroughly, to reveal the mystery. *Optochem*, a company at Delhi parceled a slide saying it is "----------" (not to let out the cat of the bag). To our surprise, when illuminated with a laser we saw a pattern different from expected. Immediately, we (Sahana K S and the teacher) studied the intensity pattern thoroughly and found that the slide was not what was claimed to be. A sense of satisfaction motivated us to share it with others and make it a tool for **activity based learning for students**.

1. INTRODUCTION

The question can be posed to peers as follows-

With the optical black box given to you, obtain a pattern by directing laser light perpendicular to the slide-with-slits. From the intensity pattern

    a) find the sum of the width of the transparency and the opacity, *a+b*.

    b) calculate the maximum order n_{max} of the device.

    c) find the number of slits *N* by at least by three different methods.

    d) derive the expression for the angular width of the primary maxima.

    e) determine the angular width of the central maxima.

    f) what are the factors on which the width of the primary maxima depend?

    g) find the missing orders if any.

    h) find the width of the transparency *a* and opacity *b* separately.

    i) discuss the variation of the intensity pattern.

2. THEORY

Intensity of the pattern is given by

$$I = A^2 \frac{Sin^2\alpha}{\alpha^2}\left(\frac{SinN\beta}{Sin\beta}\right)^2 \tag{1}$$

where

$$\alpha = \frac{\pi}{\lambda} a \, Sin \, \theta \qquad\qquad (2)$$

$$\beta = \frac{\pi}{\lambda} (a + b) \, Sin \, \theta \qquad\qquad (3)$$

a and b are the width of the transparency and opacity respectively and N is the number of slits.[1]. The condition for the maxima, $(a + b) \, Sin \, \theta = \pm n\lambda$..

3. METHODOLOGY

Diagram:

laser

LaseLaser   slit   **lide in an optical box**   **Travelling**

with a LDR mounted

Fig 1

LDR   μA

5V
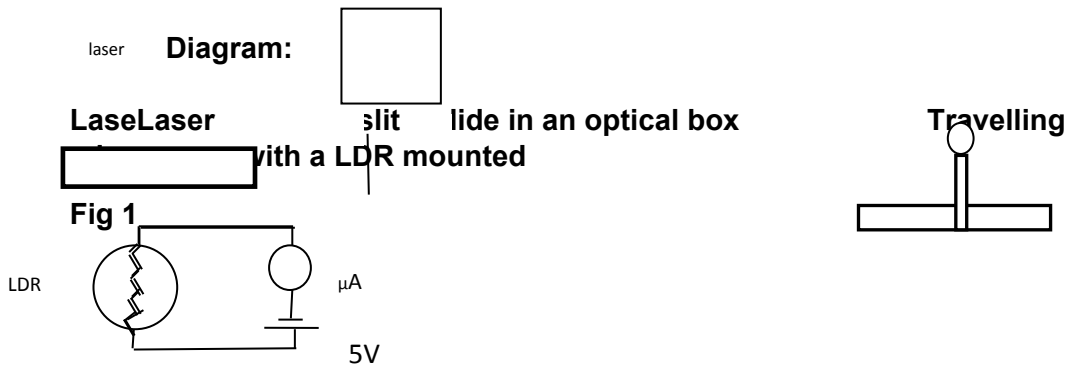
Figure 1: Laser, Slit and Travelling microscope with LDR mounted aligned coaxially (above); LDR ammeter and 5V source in a circuit (below).

The laser $(\lambda = 632 x 10^{-9} m)$, slide covered in a box with diametrically opposite holes and LDR mounted on travelling microscope ™ was mounted coaxially. The ™ was moved perpendicular to the axis and the current recorded per half *mm*. Current is proportional to the intensity of the light incident on the LDR. Plot of current *versus* distance was studied.
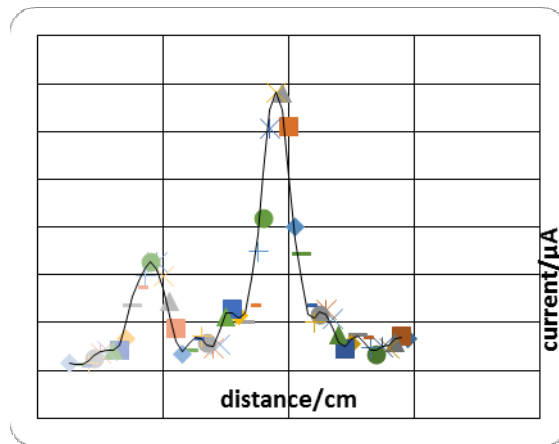
Figure 2: Graph of Current *versus* distance of the LDR

1.1 Observations

1. Central maximum is at 10.60 *cm*.
2. First primary maxima is at 9.60 *cm*
3. Secondary maxima is at 10.25 *cm* and 10.00 *cm*
4. There are 2 secondary maxima between the central and the first maxima.
5. There are 3 minima between the central and first maxima.
6. The minima are at 10.30 *cm*, 10.10 *cm* and 9.85 cm on the left and 10.90 *cm*, 11.15 *cm* and 11.*35* cm on the right of the central maxima.

   That is, the pattern is flanked on either side of the central maxima but the readings are not taken extensively.
7. The intensity of the central maxima is 342 μ*A* , the first primary maxima is 163.6 μ*A*
8. The intensity of the secondary maxima is only 114 μ*A* and 83.4 μ*A*

1.2 Calculation

From the intensity graph,

1. the distance from the centre of the pattern to the first order maxima is

$$x_{max1} = 0.96 \, cm \tag{4}$$

The condition for the maxima, $(a + b)\sin\theta = \pm n\lambda$

$$a + b = \frac{\lambda D}{x_{maxa}} \tag{5}$$

where D (= 4.16 m) is the distance of the screen from the device,

Therefore, $a + b = \frac{\lambda D}{x_{maxa}} = \frac{632 \times 10^{-9} \times 4.16}{9.76 \times 10^{-3}} = 2.7 \times 10^{-4} m$ (6)

The **width** of the opacity and transparency is $a + b = 2.7 \times 10^{-4} m$

2. **Maximum order** of the maxima is when $Sin\, \theta = 1$

$$(a + b) = \pm n_{max}\lambda \tag{7}$$

$$n_{max} = \frac{(a+b)}{\lambda} = \frac{2.7 \times 10^{-4}}{632 \times 10^{-9}} = 427 \tag{8}$$

As n_{max} is a large number it cannot be observed in the pattern.

3. **Condition for minima is** $I = 0$

$$Sin\beta \neq 0 \text{ and } SinN\beta = 0 \quad N\beta = \pm m\,\pi \tag{9}$$

Or $\frac{\pi}{\lambda}N(a + b)Sin\,\theta = \pm m\,\pi$

where $m = 1, 2, \ldots N - 1, N + 1, \ldots\ldots\ldots, (2N - 1), (2N + 1), \ldots\ldots$

$m = 0, 1, 2 \ldots\ldots$refer to the primary minima.

$m = N, 2N, \ldots$ refer to the maxima.[2]

Thus, there are $N - 1$ minima between two consecutive maxima (10)

and there are $N - 2$ secondary maxima between $N - 1$ minima. …....8

In this pattern, total no. of minima between two consecutive maxima is 3.

Thus, $N - 1 = 3$

and, $N = 4$ (11)

4. From the pattern, **total number of secondary maxima** between two consecutive primary maxima is 2

Thus, $N - 2 = 2$

and, $N = 4$ (12)

5. Angular width of the nth order maxima is

$$2d\theta_n = \frac{2\lambda}{N(a+b)Cos\theta_n}$$ (13)

From the pattern, the distance from the centre to the first minima is

$$x_{min1} = 0.25 x 10^{-2} m$$

$$2d\theta_0 = \frac{2x_{min1}}{D} = \frac{2 x 0.25 x 10^{-2}}{4.16} = 1.2 x 10^{-3} radian.$$ (14)

For the central maxima,

$$\theta_0 = 0, \ cos\theta_0 = 1$$

$$2d\theta_0 = \frac{2\lambda}{N(a+b)Cos\theta_0} = \frac{2\lambda}{N(a+b)}$$

Hence,

$$N = \frac{2\lambda}{2d\theta_0(a+b)} = \frac{2 x 632 x 10^{-9}}{1.2 x 10^{-3} x 2.7 x 10^{-4} m} = 3.90 \approx 4$$ (15)

 N should be an integer.

6. **Missing orders** as observed in the pattern are 3rd and 6th.

$$\frac{a+b}{a} = \frac{n}{m}$$

$n = 3$ and $m = 2$ (16)

Hence, $a = 2b$ (17)

Missing orders were visible in the pattern on a white screen prominently. The intensity of the third, sixth, ninth..... is extremely small compared to the neighbouring maxima. In general, the intensity of the maxima was gradually decreasing from the centre outwards.

Since from Eq. (6) $a + b = 2.7 \times 10^{-4} m$

$$3b = 2.7 \times 10^{-4} m$$

$$b = 0.9 \times 10^{-4} m \qquad (18)$$

Hence,

$$a = 1.8 \times 10^{-4} m \qquad (19)$$

The slide is removed from the black box and the slit width is measured using a travelling microscope to verify the values of the transparency a and the opacity b. The number of slits was counted to be 4

1.2 Verification: a and b as measured with a travelling microscope is 0.009 ± 0.001 cm and 0.021 ± 0.001 cm.

1.3 Results

a) The sum of the width of the transparency and the opacity, $a+b = 2.7 \times 10^{-4} m$.

b) The maximum order that can be obtained by the given slits is $n_{max} = 427$

c) The number of slits N by counting the number of minima between two consecutive primary maxima is 4.

d) The number of slits N by counting the number of secondary maxima between two consecutive primary maxima is 4.

e) Angular width of the central maxima is 1.2×10^{-3} rad.

f) The cosine of the angular width of the primary maxima depends on the number of slits, the width of the transparency and opacity, wavelength of the incident light.

g) 3rd and 6th are the missing orders observed but readings are not taken.

h) The width of the transparency is $a = 1.8x\ 10^{-4}m$ and opacity is $b = 0.9\ x\ 10^{-4}m$.

i) The variation of the intensity pattern is shown in the graph.

The values of a, b and N were verified.

1.4 Inference

This slide is a **Quadruplet slit** with spacing *b* half of the width of the transparency *a*. The intensity pattern is a combination of interference and diffraction. The minimas are *not* zero because of the Guassian distribution of the Laser beam [3]. The whole exercise is a good learning-teaching tool for both teachers and the students.

ACKNOWLEDGEMENT

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ATM Security System

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Abstract: In this paper a security system is designed to prevent ATM crime. When an ATM robbery takes place or the robbers try's to dislocate the ATM, the LDR circuit gets activated which is placed inside the ATM, as because the LASER source placed at the base of the ATM gets disrupted. The LDR senses the difference in the light intensity and it sends a signal to a microcontroller which in turn activates a siren and a GSM module sends SMS alert to the nearest Police Station. And the location of the machine can also be tracked. This system will prevent the ATM crime.

1. INTRODUCTION

Automated Teller Machine is a mechanical device that has roots embedded in the accounts and records of a banking institution. Today ATM has become an irreplaceable communication due to its fast, convenience and human resource saving advantages. Since ATMs do not need human involvement round the clock so they become an easy target to attack in certain locations. According to a forecast by Retail Banking Research it is estimated that more than 3 million ATMs would be in use by 2016 worldwide. As the number of ATMs in use increases, the security threats also increases and developing a crime prevention measures is a top priority for financial institutions as well as for ATM manufacturers.

This paper suggest a method of providing security to financial institutions whoever uses ATM services. By using GSM technology, LDR (Light Dependent Resistor), and a Microcontroller. By keeping a LASER source at the base of an ATM.

2. METHODOLOGY

A LASER source will be installed at the base of the ATM (separately from the machine). The LASER from the source will be allowed to incident continuously on LDR and the LDR will function normally with a fixed value of resistance.

When any illegal attempt is made to shift the ATM, the normal activity of the LDR circuit will be disrupted as the LASER from the source will be discontinued. The circuit containing ADC, Microcontroller, buzzer, GSM Module and LDR is designed in such a way that in the absence of LASER, it produces security alert and sends SMS to the nearby police station, police control room and the Regional Head Office of the Financial Institute.

When no light falls on the LDR sensor, it sends an analog signal to the ADC (Analog IC) which converts the analog signal to digital signal and sends it to the microcontroller. When the microcontroller receives a valid signal, it activates the buzzer (or siren), and at the same time SMSs will be send to the nearest police station, Police Control Room and the Financial Institution's Regional Head Office. We can also track down the ATM because of the GSM Module.
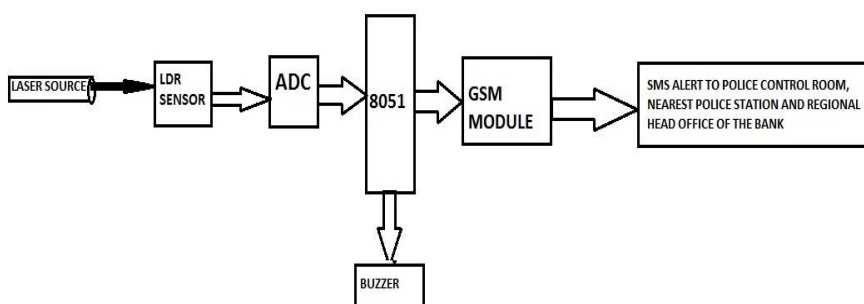
Figure 1: Block diagram of the working function of the proposed system.

3. HARWARE MODULES

A) LDR: An LDR (Light dependent resistor), as its name suggests, offers resistance in response to the ambient light. The resistance decreases as the intensity of incident light increases, and vice versa. In the absence of light, LDR exhibits a resistance of the order of mega ohms which decreases to a few hundred ohms in the presence of light. It can act as a sensor, since a varying voltage drop can be obtained in accordance with the varying light. It is made up of cadmium sulphide (CdS). An LDR has a zigzag cadmium sulphide track. It is a bilateral device, i.e., conducts in both directions in same fashion.

B) Analog to Digital Converter (ADC): Analog to digital converters find huge application as an intermediate device to convert the signals from analog to digital form. These digital signals are used for further processing by the digital processors. Various sensors like temperature, pressure, force etc. convert the physical characteristics into electrical signals that are analog in nature.

C) Microcontroller: A microcontroller is an integrated circuit or a chip with a processor and other support devices like program memory, data memory, I/O ports, serial communication interface etc. integrated together.

D) Buzzer: A buzzer or beeper is an audio signaling device, which may be mechanical, electro- mechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. A joy buzzer is an example of a purely mechanical buzzer. Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz. Often these units were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made. A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

E) GSM Module: This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Applications like SMS Control, data transfer, remote control and logging can be developed easily. The modem can either be connected to PC serial port directly or to any microcontroller through MAX232. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. In GPRS mode we can also connect to any remote FTP server and upload files for data logging. One more benefit of using GSM Module is that we can track its location as we can track our mobile phones.

F) Power Source: The whole set up requires power, in case the main power source gets detached the system will not work. To deal with it we have to make a mini inverter connected with a 9V - 12V battery and fit it inside the machine and connect the whole set up with it (except the LASER).

4. SOFTWARE IMPLEMENTATION

For the software implementation, we need two software packages. First one is the KEIL µVision 4.0 and second one is the Flash magic simulator. The KEIL µVision Debugger accurately simulates on-chip peripherals. Simulation helps to understand hardware configurations and avoids time wasted on setup problems. With simulation, we can write and test applications before target hardware is available. The system program written in embedded C using KEIL IDE software will be stored in Microcontroller.

KEIL development tools for the Microcontroller Architecture support every level of software developer from the professional applications engineer to the student for learning about embedded software development. The KEIL Development Tools are designed to solve the complex problems facing embedded software developers. Flash magic is used to dump the code to microcontroller from PC. Flash Magic is a free, powerful, feature-rich Windows application that allows easy programming of Philips FLASH Microcontrollers. The Flash Memory In-System Programmer is a tool that runs under Windows 95/98/NT4/2K. It allows in-circuit programming of FLASH memories via a serial RS232 link. Computer side software called Flash Magic is executed that accepts the Intel HEX format file generated from compiler KEIL to be sent to target microcontroller. It detects the hardware connected to the serial port.

5. FIGURES

Figure 2: LDR   Figure 3: ADC   Figure 4: Microcontroller

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Figure 5: GSM Module   Figure 6: Buzzer

5. CONCLUSION

It is well known that, these days most of the ATMs have been attacked by the robberies. From the first ATM being installed in the world till now, ATM has gradually become a target of crimes. While with the constantly evolving of reported ATM crime ATM industry has begun to pay attention to the safety of ATM. This paper demonstrates how an automation of ATM crime prevention can be implemented using GSM technology, microcontroller, LDR Sensor, buzzer with KEIL micro vision 4.0 in ATM Machines center. By implementing this project we can easily prevent the crime up to a certain extend.

This project can be developed further to make a robbery proof ATM by taking the necessary steps.

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Thermoluminescence Characteristics of Nanocrystalline Materials

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Abstract: I did research on the topic "**Thermoluminescence Characteristics of Nanocrystalline Materials**" ($CaSO_4$:Ce ; $CaSO_4$:Sm; $CaSO_4$:Dy; $CaSO_4$:Sm,Dy and $CaSO_4$:Ce,Dy. For that Purpose I first synthesized different samples of five nanocrystalline materials. Nanocrystalline materials were prepared by chemical co-precipitation method. Different samples of same host material were formed by varying the amount of dopant. Mainly, the concentration of the dopant was varied as 0.05mol%, 0.1 mol%, 0.2 mol%, 0.35mol%, 0.5 mol% in the samples. These set of samples were exposed to 300Gy of gamma radiation and the optimum concentration was found from Glow curve study. The optimized samples were exposed to different doses i.e. 30, 60, 100, 200, 350 and 500 Gy of gamma radiation in the gamma irradiation chamber. Radiation creates electronic excited states in crystalline materials. In some materials, these states are trapped, or arrested, for extended periods of time by localized defects, or imperfections. Heating the material enables the trapped states to rapidly decay into lower-energy states, causing the emission of photons in the process. To study the thermoluminescence characteristics of the nanocrystalline materials, the different samples (which were exposed to different radiation doses) were studied using a TLD reader (Thermoluminescence Dosimeter) by taking small quantity (5mg) of the samples each time. The study was done by heating the sample in TLD. Accordingly, the glow curves of these samples were plotted. Comparative studies were thus done and the role of thermoluminescence in radiation dosimetry was understood.

1. INTRODUCTION

The aim of this research project is to understand the basic phenomenon of thermoluminescence by checking the level of performance of TL dosimeters in order to be used for better service delivery for dosimetry. In this project, I developed nanocrystalline TLDs specifically Calcium Sulphate doped with Cerium, Samarium,

Dysprosium and mixture of Samarium-Dysprosium and mixture of Cerium-Dysprosium. My main objective of the project is:

To Improve characteristics of TL material,

To understand TL Mechanism,

Response of nanomaterials over thermoluminescence.

The term luminescence implies luminous emission which is not purely thermal in origin i.e. luminescence is 'cold light' light from other sources of energy, which takes place at normal and lower temperature. In luminescence, some energy sources kicks an electron of an atom of its ground state (lowest energy) into an exited state (highest energy) by supplying extra energy, then as this excited state is not stable ; electron jumps back to its ground state by giving out this energy in form of light. We can observe the luminescence phenomenon in nature like in glow worms, fireflies, and in certain sea bacteria and deep-sea animals. This phenomenon have been used in various fields by different scientist all over the world like, archaeology, geology, biomedical, engineering, chemistry, physics, and various industrial application for quality control, research and developments.[1]

Luminescence is the emission of optical radiation (infrared, visible or ultraviolet light) by matter. This phenomenon is to be distinguished from incandescence, which is the emission of radiation by a substance by virtue of its being at a high temperature (>5000oC) (Black body radiation). Luminescence can occur in a wide variety of matter and under many different circumstances. Thus, atoms, polymers, inorganic, organic or organo-metallic molecules, organic or inorganic crystals, and amorphous substances all emit luminescence under appropriate conditions. [2]

TL or more specifically Thermally Stimulated Luminescence (TSL) is stimulated thermally after initial irradiation given to a phosphor by some other means ($\propto$ - rays, β - rays, γ - rays, UV rays and X-rays). Thermally stimulated luminescence (TSL) is the phenomenon of emission of light from a solid which has been previously exposed to ionizing radiation under conditions of increasing temperature. Unlike other luminescence process such as electroluminescence, chemiluminescence, here heat is not an exciting agent, but it acts only as a stimulant.

Hence it is better known as TSL. Excitation is achieved by any conventional sources like ionizing radiation, $\propto$ -rays, β-rays, γ- rays and UV rays and X-rays. TSL is exhibited by a host of materials, glasses, ceramics, plastics and some organic solids. Insulating solids doped with suitable chemical impurities, termed as activator, are the most sensitive TL materials and these materials are used here. [3]

2. EXPERIMENTAL WORK

The Nanocrystalline materials CaSO4:Ce , CaSO4:Sm, CaSO4:Dy, CaSO4:Sm,Dy and CaSO4:Ce,Dy were prepared by chemical co-precipitation method. High crystalline, small particle size, high specific surface areas are usually found for materials obtained using this technique. Ethanol medium is used in the preparation of the nanocrystalline materials. Ethanol prevents agglomeration of particles in the solution and facilitates the formation of nanoparticles. [4]

One normal solutions of both Calcium Acetate {Ca(C2H3O2)2} and Ammonium Sulphate {(NH4)2SO4} was prepared in double distilled water in different cleaned beakers. The solution of Calcium Acetate is made in ethanol medium. Then CeCl3 was added to Calcium Acetate Solution thus made and is thoroughly mixed using magnetic stirrer.

The Ammonium Sulphate solution was poured into a burette and mounted above the beaker. The cork of the burette was opened a little so that Ammonium Sulphate fell in drop by drop and the reaction took place by mixing the two solutions with stirring. Following reaction was considered:

$$Ca(CH3COO)2 + (NH4)2SO4 + CeCl3 \xrightarrow{\text{Ethanol medium}} CaSO4:Ce(ppt) + 2CH3COONH4$$
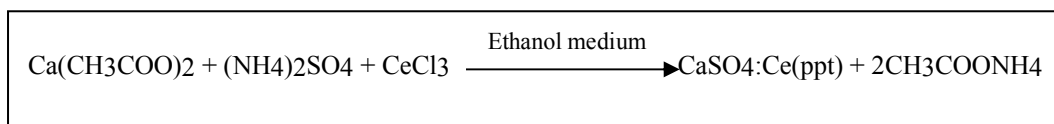
As indicated by the reaction two products are formed. Out of the two products thus formed, nanocrystalline CaSO4:Ce was precipitated out while CH3COONH4 gets dissolved in water. The process was allowed to continue till the resulting precipitated

compound was completely formed stoichiometrically. The precipitate was filtered out and washed several times with distilled water using centrifuge machine. Nanocrystalline powder sample thus obtained was dried by heating it at 80 ^{O}C for 6-7 hours. Further we anneal the given sample by heating it at 650 ^{O}C for 2 hours in a furnace. And then the sample is quenched by placing the boat directly on a metal plate. Thus the required sample was formed. Hence we have five nanocrystalline materials doped with different quantities of Ce. Thus 5 samples of each CaSO4:Ce, CaSO4:Sm, CaSO4:Dy, CaSO4:Sm,Dy and CaSO4:Ce,Dy (in total 25 samples) were made.

3. RESULTS AND DISCUSSIONS

Mainly I did the following studies:
      1. Finding the optimised concentration.
      2. Parallel analysis of Glow Curves.
      3. Response Curve Analysis

3.1 Finding the optimised concentration

The optimised concentration for a nanomaterial is the concentration for which the nanomaterial absorbs the most radiation. This can be found by irradiating the samples with different concentrations of dopant and then doing the TL studies. The concentration for which we get the highest intensity is the Optimised Concentration. 5 mg of different samples of Nanocrystalline materials were taken and irradiated with gamma rays using Gamma Chamber 1200. The dosage given is 300 Gray. The graphs were plotted from the data provided by the TLD reader. From the graphs thus plotted the maximum intensity curve were observed and thus the Optimised concentration was found. It can be readily seen that the intensity increases with increase in the concentration of the dopant up to certain limits, and then it decreases. This effect is called quenching. Quenching refers to any process which decreases the fluorescence intensity of a given substance. A variety of processes can result in quenching, such as energy transfer from one state to another, complex-formation and collisional quenching.
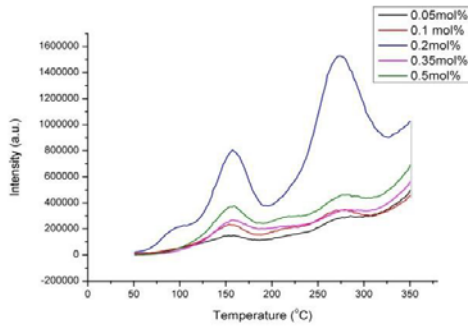
For CaSO4:Ce
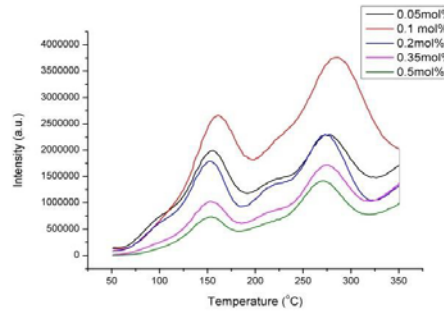
For CaSO4:Sm
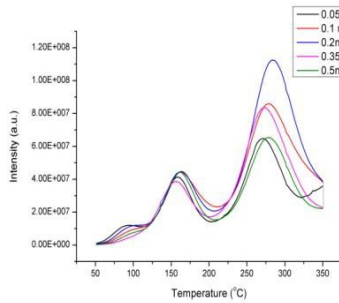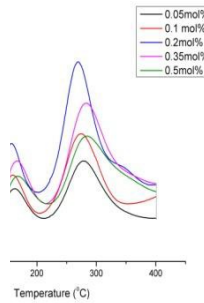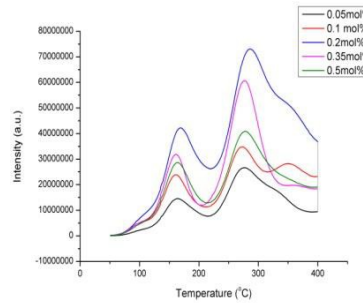
For CaSO4:Dy   For CaSO4:Sm,Dy   For CaSO4:Ce,Dy

The optimised concentration for different samples is as follows:

CaSO4:Ce	0.2 mol%	CaSO4:Sm	0.1 mol%
CaSO4:Dy	0.2 mol%	CaSO4:Sm,Dy	0.2 mol%
CaSO4:Ce,Dy	0.2 mol%		

3.2 Glow Curve Analysis

In case of all nanomaterials, we measured thermoluminescence by heating 5 mg of sample having optimised concentration constantly at rate of 5°C/second from 50°C to

400°C each time using TLD Reader. There are 2 peaks in the glow curve of each differently irradiated sample. The peaks vary in the intensity as well as in terms of position of most prominent peak of all. The graphs are plotted as temperature vs Intensity. We have taken the temperature along X axis and the intensity is considered along the Y axis. The graph represents the glow curves for the Nanocrystalline material irradiated with 30 Gray, 60 Gray, 100 Gray, 200 Gray, 350 Gray and 500 Gray. It can be seen that as the radiation dose is increased the intensity also increases. Thermoluminescence phosphors generally exhibit glow curves with two or more peaks when the charge carriers are released. The glow curve is characteristic of the different trap levels that lie in the band gap of the material. All the trap levels are not at same level. As they are at different levels, the different energy photons are thus released causing physical parameters that also include trap depth. Thus the position of the electron traps the formation of two or more peaks. Moreover the traps are characterized by certain in the forbidden gap and also the trap depth cause the formation of two major peaks.
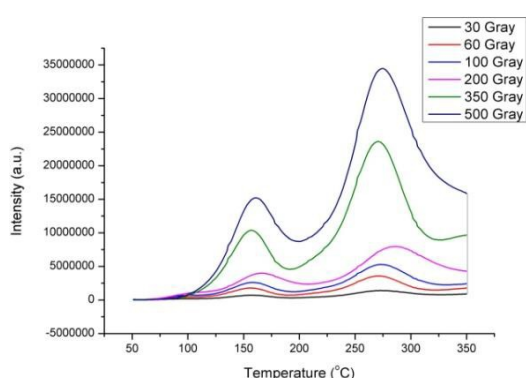
For CaSO4:Ce   For CaSO4:Sm
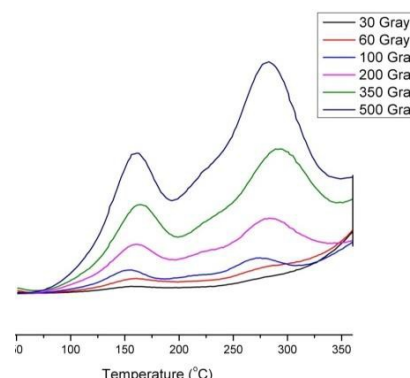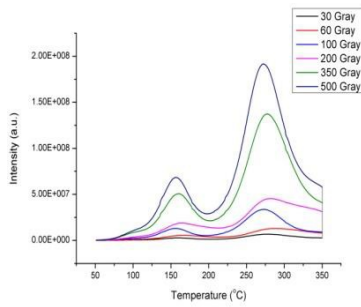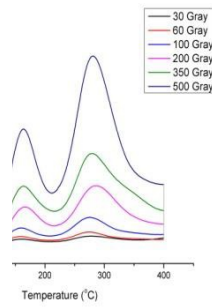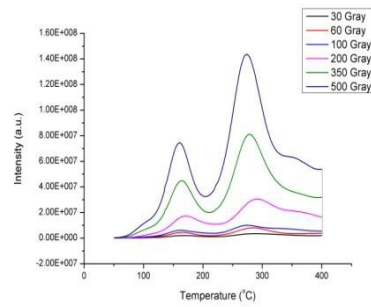
For CaSO4:Dy   For CaSO4:Sm,Dy   For CaSO4:Ce,Dy

3.3 Response Curve Analysis
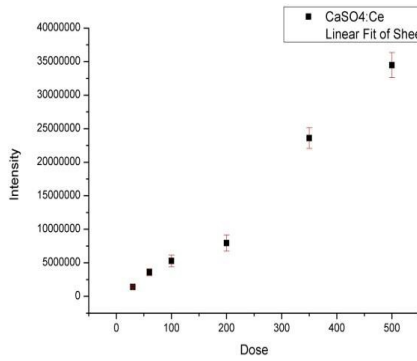
For CaSO4:Ce
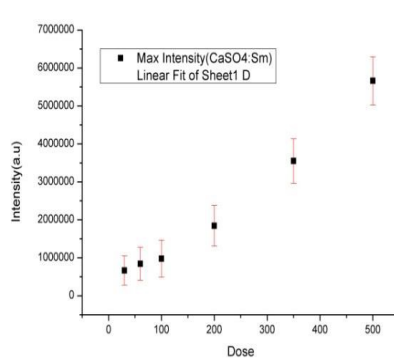
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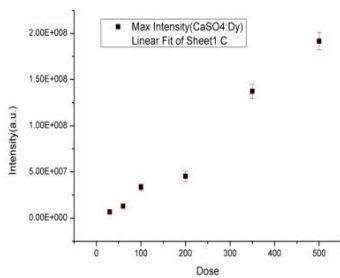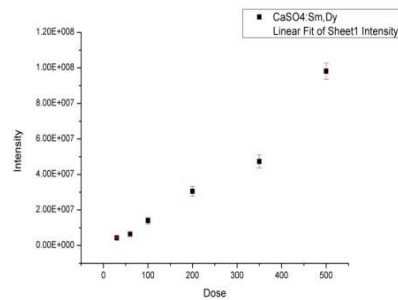
For CaSO4:Dy

Fr CaSO4:Sm,Dy
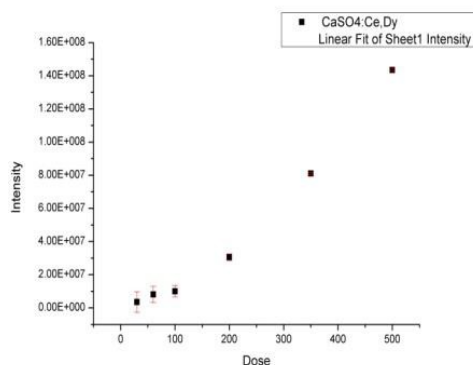
For CaSO4:Ce,Dy

TL response is linear for all as seen from the TL response curves. Thus these materials will give promising result as a dosimeter. Further high dose (500 Gy onwards) study can be done.

3.4 Conclusions

a) TL response is linear for all as seen from the TL response curves. Thus these Nanocrystalline materials will give promising result as a dosimeter. Further high dose (500 Gy onwards) study can be done.

b) From the glow curves, it can be concluded that with increase in concentration of dopant, sensitivity of the samples alters. The optimized concentration for different samples is as follows:

CaSO4:Ce	0.2 mol%	CaSO4:Sm	0.1 mol%
CaSO4:Dy	0.2 mol%	CaSO4:Sm,Dy	0.2 mol%
CaSO4:Ce,Dy	0.2 mol%		

c) By changing the doses the shape of glow curve does not change.

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Examining the Variation in Beta-Decay Rates of Tritium

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Abstract: This experiment examines the variation in beta decay rates of tritium to investigate the claims that the decay rate depends upon the distance between the Earth and the Sun [1]. The experiment consists of two photodiodes measuring the light output of a tritium lamp. The apparatus is kept at a constant temperature. Data recorded over a period of one year is stored on EEPROM memory. The data from three consecutive years (May 2012 - May 2015) is studied in this analysis. The results, while not very consistent, suggest that the measured decay rate corresponds to the average value near the equinoxes, with maximas in the winter months and minimas in the summer months. This may hint at correlation between the beta decay rates and the earth-sun distance. More experimentation is necessary to validate these claims, possibly using different detection apparatus at different locations.

1. INTRODUCTION

Beta decay rates show a small magnitude of variability depending upon external conditions: Beryllium-7, which decays by electron capture, shows variation of about 0.8% between conducting and insulating environments; a more prominent example is Rhenium-187, which decays to Osmium-187 with a half-life of 41.6×10^9 years but fully ionised Re-187 nuclei exhibit a half-life of only 32.9 years. These may be explained by the fact that decaying nuclei require electrons nearby, and if they are externally influenced, then the decay rate may vary. In case of Be-7, the internal and external electrons are virtually the same, and are influenced by the chemical environment.

It has been claimed [1] that the beta decay rates of Si-32 and Ra-226, amongst others, are influenced by the distance between the earth and the sun. This experiment attempts to investigate these claims.

The experiment was performed by Panteltje and the data is available for analysis online.[†]

2. EXPERIMENT

The experiment measures the light output of a tritium lamp. Two photodetectors are used to measure the light output and the data is stored on EEPROM memory. The apparatus is kept at a constant temperature to within a degree celsius, slightly above the expected maximum temperature. Data is collected for a period of one year and then released for analysis. The experiment has been repeated thrice by Panteltje and three sets of data are available, from 2012 to 2015.

3. DATA ANALYSIS

The analysis of the three sets of data is presented below. The procedure followed is to first test the validity of the data by fitting an exponential decay curve to the output of both the photodiodes to obtain the decay rate, as measured by the photodetectors. The values of the light output are then subtracted to obtain the residuals. Moving average of these residuals over a period of 60 days is plotted against time to observe any variations.

3.1 MAY 2012 -- MAY 2013

The initial light level increases for more than 20 days and the recorded decay rate isn't the same on both the photodetectors. The half-lives measured are 8.675 years and 9.832 years. Due to the large disagreement, this set isn't used for further analysis.

3.2 MAY 2013 -- MAY 2014

There is reasonable mutual agreement between the data from the photodetectors - the half-lives measured are 9.671 years and 9.691 years. However, this isn't in

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[†] The details of the experiment, along with data and images, are available here: http://panteltje.com/panteltje/tri_pic/

agreement with the accepted value for the half-life of tritium, which is 12.72 years. This may be because of non-linear response of the phosphors in the tritium tube or that of the photodetectors. This data is used for further analysis of the residuals:
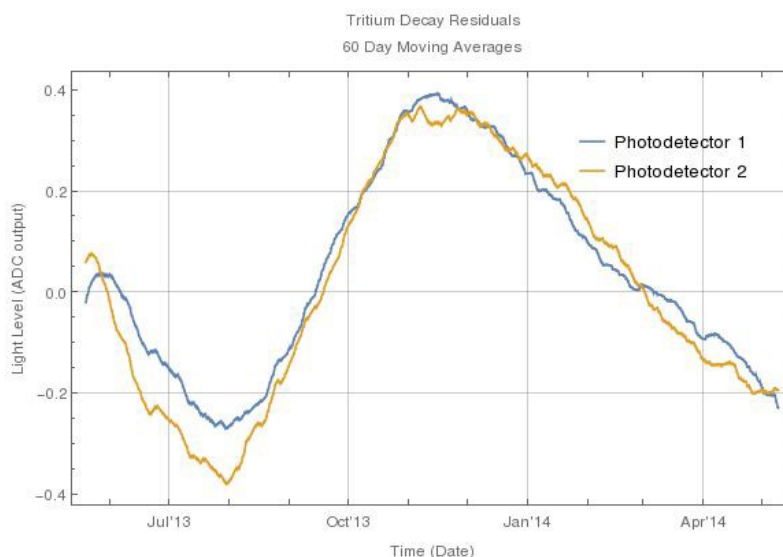
Variation is observed over the period of a year, with a maximum and a minimum around November-December and July-August respectively and nodes around the equinoxes. Local variations in the residual moving averages also appear to show some correlation.

3.3 MAY 2014 -- MAY 2015

The half-lives measured are 9.673 years and 9.659 years. The deviation from the accepted value appears to be intrinsic to the method of measurement. A similar variation is observed over the period of the year, with a maxima and a minima near November-December and July-August respectively with nodes a few days after the equinoxes.

However, significant discord is observed between the data from the photodetectors, which may suggest that the variations are entirely local effects. Also of interest are local variations observed in data from both the photodiodes which appear to show some correlation.
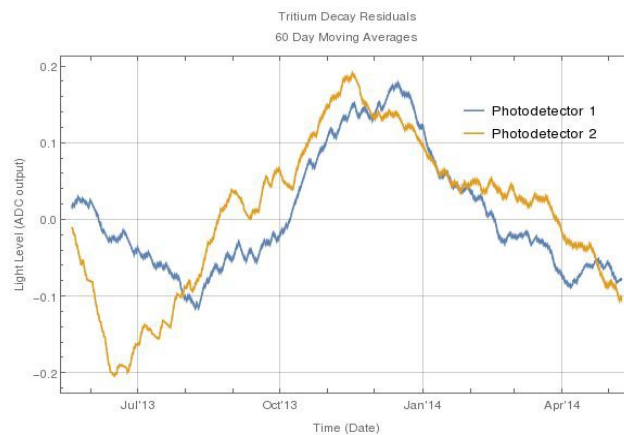
4. CONCLUSION

The results of the experiment are insufficient to argue that beta-decay rates could be influenced by the earth-sun distance. More experimentation is necessary to validate these claims. To eliminate local effects, the experiment could be performed at different places; the effects of solar activity, if any, could then be investigated. The quantisation noise from the 10-bit ADC is dominant in the data. Better ADCs can reduce this noise. The possibility that beta decay rates are influenced by solar activity isn't entirely refuted by this experiment. If such a correlation is experimentally established, it may be explained by interaction with the solar winds. [2]

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Abstracts of Oral Presentations

The Inprovement of Radiographic Visualisation Using Tissue Harmonic Imaging in Comparison with Standard Ultrasonic Imaging Mode

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This article reviews the conventional ultrasound machine in comparison with Tissue harmonic imaging (THI) which is a new grayscale imaging technique. It creates images that are derived solely from the higher frequency, second harmonic sound produced when the ultrasound pulse passes through tissue within the body. Tissue harmonics uses various techniques to eliminate the echoes arising from the main transmitted ultrasound beam ("the fundamental frequencies"), from which conventional images are made. Once the fundamental frequencies are eliminated, only the harmonic frequencies are left for image formation. Indeed, the quality of the harmonic image is primarily dependent on the complete elimination of all echoes derived from the transmitted frequencies. Tissue harmonic imaging offers several advantages over conventional pulseecho imaging, including improved contrast resolution, reduced noise and clutter, improved lateral resolution, reduced slice thickness.

Robust Spin Gapless Semiconducting Characteristics of Mn_2CoAl with Ga Disorder

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The effect of substitutional disorder of sp-element (Al) by Ga in inverse Heusler alloy Mn_2CoAl has been demonstrated using Full potential linearized augmented plane wave (FPLAPW) method. We have found that this stoichiometric Heusler alloy is robust spin gapless semiconductor even in the presence of 25% Ga disorder. Further no change in magnetic moment of Mn_2CoAl via Ga disorder has been observed. The robustness of spin gapless nature and magnetism makes the studied alloy easy to synthesis without worrying small amount of sp-element disorder.

A review of The 3 Tesla (3t) Mri Machineartifacts and How it Affects Image Quality

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The Whole-Body MRI machines or scanners that operate at high field strengths are becoming widely available, such as the newly3 Tesla (3T) MRI models machines which are launched in the recent years. This generation of 3T scanners offers exciting possibilities for radiological Diagnosis. The primary advantage of 3T scanning machines is to increase the signal-to-noise ratio, which can be used to cut magnetic resonance (MR) scan or to increase the resolution of image quality. The magnetic resonance imaging MRI which is performed with 3T usually have a higher chemical shift separation, which produces spectral peaks that are farther apart. This advantage of the 3T MRI scan can be used to eliminate the balance against an increase in chemical shift artifacts in the image quality. This results is often used for a better background suppression during MR angiography, and better vessel/tissue contrast. Nevertheless one of its drawbacks is that it decreases the contrast between gray and white matter. The image quality effect will also increase, when the magnetic field is increased from 1.5T to 3T. Thus, the MRI will have higher sensitivities but also more susceptibility artifacts. Because scanning at high field strengths can also cause problems with the specific absorption rate (SAR) limit. Which means excess of radio frequency in the body, due to the longer scan times.

LEDs: The Most Energy Efficient Lighting Device

Hansraj

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LEDs are the best known optoelectronic device which emits visible, invisible, coloured or white light by the electroluminescent. For a long time, the high cost of producing LEDs has been a roadblock to using wide spread use of it. LEDs are extremely energy efficient solid light bulbs. The directional limitation of LED bulbs can be overcome by using diffuser lenses and reflectors which are used to disperse the light more like an incandescent bulb. Here I like suggest to introduce a new material namely silicon carbide for production of LEDs. By using it the cost of LEDs can be reduced considerably.

A Simple Lamp from Waste Material (E-waste management)

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This paper describes a very simple circuit of a lamp made from waste material. In this lamp all materials used is waste material except the LED (Light Emitting Diode) and switch. This is very easy to construct. In this lamp I had used scrap cell phone battery or used cell phone battery, Diode, LEDs, switch, charging socket, wires etc .We can charge the battery up to 15 to20 minutes, Once its charged. It can glow up to 3 or 4 hours. If the condition of battery is good then it can glow for the whole night. It doesn't require any specific charger. It can be charged by mobile charger.

A Theoretical Explanation for The Einstein's Remark on Bending of Light due to Huge Mass

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An attempt has been made to explain the bending of light by taking into consideration the energy and angular momentum of em waves.

Classical System Underlying A Diffracting Quantum Billiard

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For a point scatterer placed slightly off the centre of a circular enclosure, rays are found which vividly exhibit the effect of diffraction. The Schr¨dinger equation was mapped in the complex plane by employing a fractional linear transformation which brings the point scatterer to the centre. But the mass of the particle becomes a function of space coordinates, bearing anisotropy. For the transformed problem, the corresponding classical Hamiltonian is written and solved with Snell's laws on the boundary. The solutions of the Hamilton's equations thus found constitute, in fact, the ray-manifold underying the diffraction at the level of the wave-description.

The Turning Mystery of a Spaceship

Manpreet Singh Jattana

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A problem concerning motion of a spaceship in a fluid under certain constraints, which seems counter-intuitive at first but using concepts of fluid dynamics like pressure differences, momentum transfers, conservation laws and Bernoulli's Principle, a solution is obtained. The qualitative approach would convert our problem to an analogous everyday life variation of the problem, i.e. the reverse sprinkler, and simultaneously address any issues that seem to appear by introducing more analogies and ultimately grasp a better intuitive understanding of the abovementioned basic principles of Physics.

Affordable Fuel Free Spray Pump for Green Agro Applications

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Spray pump is widely used in farming. This spray pump in common use requires fuel for its working, has a storage capacity of about 15 liters and has to be carried on one's back for its operation. Hence, pollution & high expenses on fuel, limited storage capacity and probable health issues to the operators are major drawbacks of existing pump. To overcome these drawbacks a new spray pump is designed. Main features of the pump involve no requirement of any fuel or electricity, extendable storage capacity, ease of handling, affordable fabrication cost etc. The basic elements of the device are accumulator & piston to create the required air pressure. The piston movement is materialized using the sprocket-pinion system, which can be operated manually by the operator. Each moving part of the device is fixed with a ball-bearing system to minimize the friction.

The Schrödinger Equation of Linear Potential Solution Specializing to The Stark Effects

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The shifts in the energy level spectrum due to the external electric field is examined, for a one dimensional quantum mechanical system described by the Schrodinger equation specializing to the linear potential which is perturbed by electric field. The 1D model of linear potential that is known as a quantum bouncer, is defined as $v(y) = Fy \ for \ y > 0 \wedge v(y) = \infty \ for \ y < 0$ and the symmetric linear potential which is $(v(y) = Fy)$. In this case the Airy function property is use to give a close result the shift in energy level under the electric field (Stark Effect), The approximate and exact result is compared.

A Case Study of Population I Stars in the Big Dipper Asterism

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Star formation in stellar nurseries takes place at a very high rate of a few hundred stars per year. These stellar groups of newly formed stars are called star clusters. After formation, some clusters remain bound to the central gravitational system and some evolve into anopen non-symmetric star clusters. Yet the physical and chemical properties of stars remain largely samewithin a cluster. Ursa Major (UMa)movinggroup is an example of such an open cluster containing nearly220 stars. Big Dipper is central to the evolution and kinematics of UMa moving group. Analysis of spectral data obtained from the sixstars in this prominent asterism, the Big Dipper, is used to discern their respective spectral classes. Most stars are A type suggesting temperatures of around 10^4 K with the exceptions of one B type and G type star each differing in temperature by about $\pm 5 \times 10^3$ K respectively. Big Dipper members generally showcase a radial velocity away from the earth indicating positive redshifts which can be calculated from spectral data.

Using spectral line widths, elemental abundances can be found. Such estimation suggests these stars to be relatively young at around 500 Myr old and justification of their subsequent classification as Population I.Further analysis of spectroscopic data reveals more information about spectral class of individual stars and entails estimation for the whole cluster. Elemental abundance data from spectra combined with literature based information, coupled with H-R diagram gives more detailed results for the mass and age of cluster, pointing towards a common origin of the stars.

Big Bang Theory: The Ultimate Explosion of Space

Phalak Takkar

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In this manuscript, it has been described that different mythologies have their own ruling god or giant creator who created the world in a big bang.

ATM Security System

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In this paper, a security system is designed to prevent ATM crime. When an ATM robbery takes place or the robbers try's to dislocate the ATM, the LDR circuit gets activated which is placed inside the ATM, as because the LASER source placed at the base of the ATM gets disrupted. The LDR senses the difference in the light intensity and it sends a signal to a microcontroller which in turn activates a siren and a GSM module sends SMS alert to the nearest Police Station. And the location of the machine can also be tracked. This system will prevent the ATM crime.

How Life has Come From Mars to Earth?

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The life had travelled from the fourth planet from the sun that is mars. Mars is also called

as the red planet because of its red color. In the past, around 4 billion years ago, there was a heavy rain of comets in our solar system. In that situation one of the comet collided with the mars, this collision formed Argyre crater. Due to this collision, the volcanoes on the mars erupted and they overflowed the iron containing magma from the core to surface. Thus iron came to surface. The iron reacted with the oxygen that is present at that time and formed rust iron (red color). The heat produced by the collision and volcanoes burned the life (organic molecules) of that time. Mars atmosphere was oxygen-rich and it contained basic elements which are required for the life. They disappeared due to the collision. By burning organic molecules we get carbon dioxide, water and heat. That's the reason for high content of carbon dioxide (95.32%) in atmosphere. As the recent research of NASA suggests, there was an ocean on mars, larger than Arctic Ocean. Water of that ocean had gone into space some 4 billion years ago. During the collision some land masses of mars containing life disintegrated and traveled to earth. From these Martian meteorites the life came on earth and evolved.

Effect of Radiation on DNA

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DNA **(**Deoxyribonucleic acid) is a critical molecule for living things. Radiation is all around us and it has been this way since the creation of Earth. As such, life on Earth has evolved in an environment exposed to various types of radiation, both Ionizing and Non-ionizing. It comes from space (cosmic radiation), the ground (terrestrial radiation), from air, water and even food. These radiations have direct effect on DNA, causing DNA damage when exposed. The effect of radiation on DNA may include chemically altered bases, break in sugar phosphate backbone or break in hydrogen bonds. This study is done to review the effect of various types of radiations on DNA and to study the damaging effects so that some remedies can be made to prevent chromosomal mutation caused by radiation.

Quantum Anharmonic Oscillator- A Computational Approach

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What is *anharmonicity?* What happens to the *energy levels* of an anharmonic oscillator? What is *dissociation energy*?

Many such questions can be answered by the computational method. The *computational methods* used for solving the second degree differential equation (Schrödinger's equation) is by Runge-kutta fourth order method using Microsoft-Excel. For anharmonic oscillator, the accuracy of the results is fairly good.

X-Ray Crystalography- A Tool for Material Characterisation

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X- rays are used in medical and many industrial applications. X- ray crystallography is used to identify the quality of drugs. The paper gives the details of material characterisation and identifying quality of drugs through the X- ray crystallography.

Scanning Electron Microscopy: A Tool to Know the Materials Morphology

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A scanning electron microscope (SEM) is a type of electron microscope that produces images of a sample by scanning it with a focused beam of electrons. The most common SEM mode is detection of secondary electrons emitted by atoms excited by the electron beam. The number of secondary electrons depends on the angle at which beam meets surface of specimen. Back scattered electron imaging, quantitative X-ray analysis, and X-ray mapping of specimens often requires that the surfaces be ground and polished to an ultra-smooth surface. Specimens that undergo WDS or EDS analysis are often carbon coated. In general, metals are not coated prior to imaging in the SEM because they are

conductive and provide their own pathway to ground. In a typical SEM, an electron beam is thermionically emitted from an electron gun fitted with a tungsten filament cathode. Tungsten is normally used in thermionic electron guns because it has the highest melting point and lowest vapor pressure of all metals, thereby allowing it to be heated for electron emission, and because of its low cost. This Paper describes applications of scanning electron microscope to know the materials morphological structure.

Effect on Image Quality and Patient Dose of Various Types of Ct Detectors

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A CT (Computer Tomography) scanner use a series of X-ray beam to build up image of the body in "slice". Several individual scans may be carried out to create detailed image of the area that is being investigated. CT scanning is used to produce picture of many different part of the body.The ease of use and the short time required for the complete investigation make the CT very attractive, particularly in children. However, its radiation exposure represent a major concern, mainly in children and its use should be limited as recommended by the FDA 2009.

Synthesis Techniques of Nano-ZnO for Antibacterial Study: A Review

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Development of nano-technology has shown a new way to protect, preserve and process the food by reducing the action of bacteria and increasing the shelf life of the product. Nano-particles (nano-clays, nano-films) due to their size in nm range, enhancement in the properties of material such as diffusivity, strength, chemical reactivity, reduce spoilage due to micro-organisms and pathogen content in processing and packaging without migrating into the food product. Nano-particles can be synthesized from various metal oxides such as ZnO, TiO_2, Ag, Au; and among these ZnO has been in recent use due to its non-toxic nature.

Different methods of synthesizing ZnO nano-particles are available such as Sol-gel route, Hydrothermal process, Mechano-chemical method, Vapour Phase method, Co-Precipitation, Microwave synthesis, Pulsed layer deposition, etc. It is found that green synthesized ZnO nanoparticles were more effective than chemically synthesized.

Developments in Conducting Polymers for Organic Solar Cell: a review

Vikas Chand

VC (M.E. (Chemical)), Dr. S.S. Bhatnagar U.I.C.E.T., Panjab University, Chandigarh

The availability of solar energy is the best source of clean energy and therefore research in this field has attracted many researchers. Conventional inorganic solar cells are being used from long time, which mainly include silicon solar cells and heterojunction solar cells. But they also have some drawbacks to limit their application such as complex fabrication and high cost, and hence cannot be manufactured in large sizes industrially. In view of such shortcomings, search for other materials for fabrication of PV has resulted in Organic solar cell (OSC). A Organic Solar Cell is a device whose active layer is composed of polymers, small molecules or both, with or without the use of nano-particles. The discovery of conducting polymers in OSC has led to their use in many applications.

Abstracts of Poster Presentations

Nonlinearity as a New Branch in Science

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In physics and other sciences, a nonlinear system is a system which does not satisfy the superposition principle – meaning that the output of a nonlinear system is not proportional to the input. In mathematics, in a nonlinear system the equation(s) cannot be written as a linear combination of the unknown variables or functions that appear in them. It does not matter if nonlinear known functions appear in the equations. In other words, the behavior of a nonlinear system is described by a nonlinear system of equations. Nonlinear problems are of interest to engineers, physicists and mathematicians and many other scientists because most systems are inherently nonlinear in nature. In this poster, detailed information about this new branch of science, also known as nonlinear science, will be presented.

Synthesis of Graphene Oxide for Water Remediation from Heavy Metal Ions

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Water quality has become a major global concern due to ever increasing human development activities, depletion of natural resources and pollution of surface and groundwater. The drastic environmental changes and rapid industrialization led to change of water quality. The most common heavy metals contaminants in water are arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc. Arsenic enters into water environment due to natural minerals like arsenopyrite, orpiment and realgar and human activities like pigments, insecticides, herbicides, wood preservatives, glass manufacture, feed additives, electronics and catalysts.

The World Health Organization (WHO) report in 2012 set a maximum permissible concentration of 0.01 mg/l for arsenic in drinking water. Central Ground water Board North Western region Chandigarh has reported the presence of traces of arsenic in the wells of Amritsar, Kapurthala and Ropar districts of Punjab. Conventional methods such as membrane separation, nanofilteration, reverse osmosis, electrodialysis, coagulation, lime softening and sorption are used to remove arsenic from drinking water, but all these are non selective and ineffective at low concentrations of heavy metal traces present in water. So, there is growing need of material that carries property of selective and should be capable of removing metal ion contaminants present at low concentration in water. Present study focuses on the preparation of Graphene Oxide (GO) which can act as adsorbent for the removal of heavy metal ion (Such as Arsenic) contaminants from water.

Li-Fi: Light fidelity (LiFi) is a Wireless Optical Networking Technology That Uses Visible Light From Leds for Data Transmission

Brijesh D. Vekaria, Nidhi B. Bakori

Sir P.T. Sarvajanik College of Science, Surat

Li-Fi, as coined by Prof. Harald Haas during his TED Global talk, is bidirectional, high speed and fully networked wireless communication, like Wi-Fi, using light visible to human eye. Visible light communication uses light emitting diodes (LEDs), for the dual role of illumination and data transmission. With this leading edge technology, data including video and audio, internet traffic, etc, can be transmitted at high speed using LEDs. Data from the experimental system shows that data density of 0.41 bits/second/Hz/m^2 is being achieved from a VLC implementation which is 10^3 times greater than the wireless radio system which is just 4×10^{-4} bits/second/Hz/m^2. That means in visible light spectrum, one can have the data density 10,000 times more compared to radio spectrum. THIS IS THE WINNING SOLUTION TO THE RADIO SPECTRUM PROBLEM.

Determination of Mass Attenuation Coefficients of Guava Leaves Using Beta Attenuation

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The mass attenuation coefficients of fresh and dry leaves of guava are determined using radioisotope Tl^{204} (with end point energy 0.776MeV). The Geiger Muller Counter is used as detector for the measurement of beta attenuation for leaf samples. It is observed that transmitted intensity decreases exponentially with the increase of leaf thickness. Thus the study explores the validity of exponential absorption law. The measured value of mass attenuation coefficient agrees well with that calculated from statistical regression method. The mass attenuation coefficient of dry leaves is found to be more than that of fresh leaves. The attenuation coefficient values are useful for quantitative evaluation of interaction of beta particles with plant leaves. These coefficients play an important role in agriculture, industry and forestry sciences.

The Fundamental Particle: Higgs Boson

Dharini Visave G.

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As per Standard Model, all the particles that came into being just after the big bang had zero mass. The question is then how the particles have acquired mass? It was suggested by Prof. Peter Higgs that as the universe cooled down and the temperature fell below a critical value, an invisible force field called Higgs field was formed together with an associated particle, called Higgs Boson. Particles acquire their characteristic mass by interacting with Higgs field. The field requires explanation that why some but not all fundamental particles have mass. The Large Hadron Collider (LHC) was built to find the answer of the unresolved question in particle physics. In this paper, I have tried to discuss this fundamental question. The recent development in this field is the discovery of "pentaquarks". The theorists realize that the standard model also allows the formation of five quarks, in the same particle.

Tin Oxide/Reduced Graphene Oxide nanocomposites

Avneet Singh[1], Devangi Grover[3], Swati Chhikara[3], Monika Tomar[2], and Vinay Gupta[1]

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Nanostructures and nano sized devices are making our appliances more compact and easily assessable. Various properties like optical band gap, electrical conductivity, absorption spectra and many more change drastically when the size of a material is controlled within few nano meters of scale. Thus to engineer the properties of materials, nanotechnology is the best option. When a material is fabricated in the form of nano structures, its surface to volume ratio is enhanced, which make them an ideal candidate for sensing applications. In the present study, an attempt has been made to grow nano structures of tin oxide (SnO_2) and reduced graphene oxide (rGO), which can be utilized for the various sensing application like UV detection, gas sensing, etc. SnO2 is found to be a potential material for sensing application because of its high rate of adsorption and desorption. However there are few problems with SnO2 based sensors like selectivity, high operating temperature etc. So rGO has been incorporated in the form of thin nano sheets. SnO_2 has been prepared using conventional sol gel method and rGO is prepared using modified hummers method followed by reduction using ascorbic acid. X-ray diffraction (XRD) and transmission electron microscope (TEM) were employed to characterise the prepared samples.

Importance of Light-in Physics and Technology

Devansh Desai

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Recent discoveries in the field of optics and their use in technology has been discussed.

Effect of Magnetic Field on Properties of Hard Water

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Water is an odourless, tasteless and transparent fluid which forms the world's streams, lakes, oceans and rains. It is a major constituent of all fluids of living things. As a chemical compound, a water molecule contain one oxygen and two hydrogen atoms that are connected by covalent bonds. Water is also called as universal solvent because of it's ability to dissolve or dissociate most compounds. As water seeps through soil and aquifers, it often contacts minerals such as limestone and dolomite. Under the right conditions, small amounts of these minerals will dissolve in the ground water and the water will become "hard". The magnetic treatment of hard water is a physical method and a simple approach in which the hard water that needs to be treated is placed in a magnetic field. The study of inherent properties of hard water such as electrical conductivity, TDS and pH will give more insight to the concept of magnetic water treatment. The purpose of the present study is to investigate the effect of magnetic field on the electrical conductivity (EC), total dissolved salts (TDS) and pH of 0.05% concentration of $CaCl_2$ solution (hard water). The EC, TDS and pH of hard water are measured under the different strengths of magnetic field – 0.05T - 0.20T respectively. It is experimentally observed that under the exposure of magnetic field, there is no variation in the EC, TDS and pH of hard water.

The Origin of the Universe

Heenam, Richa, Shallu

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In this presentation some basic questions – How did universe originate? What is its structure? How will it end? – have been considered.

Organic Solar Cells: Sustainable, Green and Innovative Source for Smart Future

Ishita Aggarwal, Arushi Arya,Vikas Chand

Dr. S.S. Bhatnagar U.I.C.E.T., Panjab University, Chandigarh, India

In this work, a review has been presented on the current status of organic solar cells. The main areas of study include -Altering band gap by the modification of film morphology and controlled growth of heterojunction. Device degradation due to instabilities against oxidation and reduction, recrystallization and temperature variation has also become the areas of research. Plastic electronics is also an emerging area of research. Organic solar cells possess the potential of controlling global warming and dwindling fossil fuel reserves by making its efficient and sustainable use in industries.

Study of Dielectric Properties of Different Dairy Products

Jaishree Phoolia

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Dielectric properties provide information about material's interaction with electromagnetic energy during microwave dielectric heating. Dielectric constant and Dielectric loss of dairy products (cheese,butter, powdered milk) have been studied by using specially designed dielectric cell and two point method with transmission line. Results are found at different frequencies which show dielectric properties depend on amount of moisture. This paper covers theoretical aspects of dielectric properties, their measurement techniques, standard results, literatures, paper presented and significance.

Effect of Ohmic Heating on Electrical Conductivity of Soymilk.

Jasleen Kaur and P.S. Tarsikka

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Development of new thermal treatments to food materials is of great scientific use. Ohmic heating is one of these methods which provides uniform and rapid heating to food materials, resulting in less thermal damage to the food products.

Taking its name from Ohm's law, ohmic heating is a thermal process in which heat is internally generated by the passage of alternating electrical current (AC) through a body such as a food system that serves as an electrical resistance. This technique has certain advantages as compared to conventional techniques like it provides uniform heating to food materials and retains its nutritional value. In this study, ohmic heating treatment was applied to soymilk of TSS (Total soluble solids) 3˚Brix and it was observed that heating rate of soymilk was highly influenced by its electrical conductivity. Five different voltage gradients were applied (6,8,10,12 and14 V/cm). Temperature measurements, made from 32˚C to 70˚C, showed a linear increase in conductivity values with increasing temperatures. Other parameters such as viscosity, pH and TSS were observed. It was observed that pH and TSS were approximately same before and after ohmic treatment. However, viscosity shows a decreasing trend after ohmic treatment. System performance coefficient (SPC) was calculated for different voltage gradients. It was observed that SPC value was higher for lower voltage gradient and lower for high voltage gradient.

Water Purification by Using Oxide Nanomaterials

Jyoti Pareek

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Recently water purification has become major problem in various developing countries like India. To purify the water for human consumption, it is essential to remove the impurities like copper (Cu), lead (Pb), mercury (Hg), zinc (Zn), algae, viruses & bacteria and fungi. These impurities can be detected by pH value measurement, TDS value or by naked eyes. Nowadays, nanotechnology has made possible some new water purification technologies that clean water very simply, effectively with very little power. Nanomaterials like nanoparticals, nanotubes and nanomembrane of metal oxides are used for the purification of water due to their large surface area, easy surface modification and selective catalytic activity.

Saturn's Moon Titan - Alive or Dead

Kanika and Komal Sharma
Panjab University, Chandigarh.

The extraterrestrial life, the life outside our Solar System and galaxy has always been of great interest to astronomers. With a thick atmosphere teeming with organic compounds and stable liquids on its surface, many believe that Titan is among the most likely locations for life. The majority of our knowledge about Titan can be credited to the Cassini- Huygens mission conducted by NASA which confirmed the presence of liquids on Titan's surface. The Earth-like climate system reinforces Titan's status as the most similar planetary body to our planet. Gravity on Titan is about 14 percent that of Earth, or just a bit weaker than the gravity of Earth's Moon. The Titan Aerial Daughtercraft has been put forward by the NASA Innovative Advanced Concepts (NIAC) programme with the aim of sending a small quadrupole drone to Titan, alongside a motherside. The drone would operate above the moon's surface landing on the ground to take samples when required. It has also been proposed that Titan may be a better choice than Mars. The azotosome is made up of carbon, nitrogen and hydrogen, all of which exist in the seas of Titan. The astronomers are looking forward how these cells would function within Titan's methane environment.

Screenless Displays - The Future of Technology

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To display or transmit the information without the help of a screen or a projector is the main aim of screenless displays. Screenless display currently uses interactive projection technology with visual display and 3D projection. This technology can be divided into wide three categories-projection into human retina, open space projection and even to human brain. Optical technology enables screenless displays by projecting images and data from computers, DVD players into the viewer's eye, displaying them in the visual field of the viewer. We will explore the future possibilities of this technology and an insight into the wide rande of applications it can have, taking into the consideration the current scenario of technology in this field including 3D technology and holography.

Deposition of Barium Strontium Titanate Thin Film using Pulsed Laser Deposition

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Barium Strontium Titanate thin films have been extensively exploited for the development of various devices starting from filters to tunable resonators. For the progress of integrated circuit technology, there is a need for the establishment of highly stable materials having high dielectric constant and tunability. Among various metal oxides, Barium Strontium Titanate (BST) is the most promising candidate. BST thin film can be utilized widely for the applications in wireless communication and can make the national research society independent. The properties of the BST thin film can also be easily tuned by varying the composition of either barium or strontium. In the present work, authors have taken initiative to grow a high quality BST (50/50) thin film using Pulsed Laser Deposition (PLD) technique. BST thin film was deposited on platinized silicon wafer using PLD technique. The deposition was carried out at 200mTorr and 700°C substrate temperature. The pulsed NdYAG laser of wavelength 355nm was used to ablate the BST target and the repetition rate was fixed at 10 Hz. The fluence of the laser was kept at 2J/cm^2 which was enough to ablate the BST. The structural characteristics as well as optical studies were carried out to study the BST thin film. BST thin film deposited using PLD technique at the optimized parameters was found to be polycrystalline. No extra phase was observed from the X-Ray studies revealing the formation of single phase material. Moreover, the optical studies verify the band gap and transmission properties of the BST thin film with that reported in literature.

LIGO - A New Way to Explore the Universe

Nakum Sanjay B. and Gangariya Sagar V.

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LIGO is an acronym for "Laser Interferometer Gravitation Wave Observatory". It is used for the detection of cosmic gravitational waves. The laser interferometer at LIGO uses the fringe pattern of a divided laser beam to measure any lengthening or shortening of space

due to gravitational waves. The divided laser beam will travel through two steel vacuum tubes oriented at a right angle. When a gravitational wave distortion causes one beam to lengthen and the other to shrink, the resultant interference pattern of the two beams will be out of phase. LIGO was first designed to have an effective range of ~70 million light years. LIGO is an instrument for sensing the presence of matter, whether shinning or dark, in the distant reaches of the cosmos. LIGO does this by detecting the gravitational waves-ripples in the force of gravity, created by violent events such as the collisions of stars and the vibrations of black holes. Thus, we can say that, LIGO is a new way to explore the universe.

Aero Braking space problem at Neptune

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Aero Braking is crucial for the planetary science missions. Present day study is being carried out for "Aero Braking space problem at Neptune planet". For a space craft to enter into a circular orbit around another a planet, it must change its trajectory and must decelerate significantly. As a result, it requires some amount of fuel for such maneuver. (1) If we consider that the only forces acting on the spacecraft are gravity and thrust, then the amount of fuel required to decelerate the spacecraft is significant as percentage of the initial mass m_o = 2500 kg. Present study calculates fairly accurate estimate of this percentage. (2) Another way to achieve the appropriate deceleration without more use of fuel is atmospheric entry in Neptune's atmosphere in which, the resulting drag will decelerate the velocity of the spacecraft at no fuel cost. In this study, we have also derived the equation of motion for a spacecraft experiencing drag and gravitational attraction in the atmosphere of Neptune and trajectories depend on the angle $\square$, at which the spacecraft enters in the atmosphere of Neptune. We have also solved for the range of $\square$ in which the spacecraft is able to emerge from the atmosphere with a velocity that allows for a transition to the circular orbit at R_{atm}.

The Variation of Viscosity with Temperature in Light and Dark Coloured Honey

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Viscosity is one of the most significant physical and sensory characteristics of honey, which affects the quality of the product as well as the design of honey processing equipment. It is greatly influenced by temperature change. The aim of this study is to investigate the influence of temperatures (20, 30, 40, 50, 60, 70 and 80°C) on the viscosity of two honey samples one of processed honey (light coloured) available in the market and other unprocessed honey sample (dark coloured). The viscosity of honey samples was measured at 20 rpm shear rate using Brookfield DV2T Viscometer (accuracy ± 1.0% of full scale range) having temperature regulator water bath. It was found that the viscosity ranged from 24.77 to 0.32 Pa.s for processed honey and from 19.44 to 0.50 Pa.s for unprocessed honey. The viscosity of both the honey samples decreased as power function of temperature. Activation energy which is an indication of sensitivity of change of viscosity with evolution of temperature is also calculated for both the samples.

The Utilization of Wind Energy in Vehicles

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We all know that wind energy is a wide source of renewable energy. But mostly it is used in onshore or offshore areas,which is far from cities although cities have high demand of electricity and power. Here we introduce an idea of generating power by wind energy in vehicles. When we drive vehicles e.g.-cars, bus, trains etc. then it face heavy retarding force (due to wind force).we can utilize this wind energy and can convert to it as mechanical or electrical energy. Mostly wind farms are of greater height and large blade diameter to achieve the high speed winds .But in case of trains or cars moving at height speed we can establish small size wind turbines (of both VAWT,HAWT types) at the roof or in front space of vehicles by suitable techniques. We have estimated that with a vehicle speed of 100 km/h, as much as 5.65 kW power can be generated using a suitable turbine.

Functionalized Carbon Nanotubes for Decontamination of Water from Heavy Metal: Mercury

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The rapidly declining source of clean water, the shrinking levels of surface water, waste water pollution, and contamination of environment by toxic pollutants has emerged as the most serious problems facing our globe in the twenty-first century. The major toxic metal ions hazardous to humans as well as other forms of life are chromium, iron, selenium, vanadium, copper, cobalt, nickel, cadmium, mercury, arsenic, lead, zinc etc. Mercury (Hg) is one of the most toxic heavy metal found in water sources and affects the human health in many ways. WHO has prescribed acceptable limit for mercury to be $1\mu g/L$ (Kumar and Puri, 2012) but it is found 250 times more than its permissible value in Malwa region (Sharma 2014) and various parts of the country. Therefore, removing mercury from water system is an important challenge. Various traditional methods like ion-exchange, coagulation, solvent extraction, ultra filtration etc. is being used to remove Hg ions from water bodies but due to their low removal efficiency and their requirement for additional treatment methods makes them unfit in present scenario. So, it becomes necessary to design a technology for developing an adsorbent that can afford high efficiency and selectivity for Hg (II) ion removal. The presented study focuses on effective functionalization of carbon nanotubes (CNTs) to increase their selectivity towards target contaminant and exploring the potential for adsorption of mercury ions.

Application of Biosensors

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A new tool is now available for the detection of drugs and explosives:- Biosensors. The biosensor is based on simple but advanced technology. It is able to screen people, baggage, cargo, buildings, vehicles, and aircrafts. The biosensors promise to radically improve the detection of drugs, explosives, and other illicit and dangerous substances at airport. As such it will greatly improve airport safety and security.

Real World Application of Quantum Mechanics

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For thousands of years, humans relied on their intuition to understand how the world works. Slowly but surely, humanity gained an understanding of everything from the laws of motion to thermodynamics, and all of it made intuitive sense. And then came quantum mechanics, the absolutely baffling branch of physics exploring the very smallest types of matter. The study of quantum mechanics led to some truly astounding conclusions. For instance, scientists found that electrons behave both as waves and as particles, and the mere act of observing them changes the way they behave. Revelations like this one simply defied logic, prompting Einstein to declare "the more success the quantum theory has, the sillier it looks." More than a century after humanity's first insights into the quantum world; quantum mechanics makes perfect sense mathematically but defies our intuition at every turn. So it might surprise you that, despite its strangeness, quantum mechanics led to some revolutionary inventions over the past century – quantum entanglement, a process which seems to defy common sense to the most personal human experience, our sense of smell is touched by ethereal quantum vibrations, according to the latest experiments our noses are listening to smells , and the most famous law of physics – uncertainty principle is obeyed by plants and trees as they capture sunlight during the vital process of photosynthesis .

Neutrino: The Ghost Particle!

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We aren't even aware that neutrinos are everywhere. They can be found in our galaxy, in our sun and even, every second, tens of thousands of them are passing through our body. But they are very difficult to pin down. They are nearly massless, have no electric charge. They are almost nothing. But Big Bang produced them which are still wandering around us in our space like ghosts. They have other origins too. The research over these gave rise

to Solar Neutrino Problem and the solution of which raised the question on Standard Model prediction that they are massless.Also the existence of right handed neutrinos of massive GUT scale mass is puzzle as we don't have any experimental evidences .Scientist have learned a lot about stars with study of these but there is a lot more to study about Cosmos.Nature of neutrinos whether it is Dirac or Majorana is also not known. To take a new step in new physics, the understanding of the operation of these Ghost Particles i.e. neutrinos, is essential.

Comparative Study of Humidity Sensing Properties of Tin Oxide Thin Film and Nanoparticles

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Tin Oxide (SnO_2) thin film and nanoparticles were synthesized using spray pyrolysis and solid state route respectively to study the humidity sensing properties. XRD pattern of the samples were recorded using CuK α radiation. XRD confirms polycrystalline nature of SnO_2 pellet and thin film is observed to be oriented in one direction. Crystallite sizes of SnO_2 film and pellet were found to be 17 nm and 15 nm respectively when calculated using Scherrer's formula. And lattice constants were calculated using indexing method and found to be a = b = 4.7549 Å, c = 3.1740 Å for film and a = b = 4.7058 Å, c = 3.3297 Å for pellet. UV-VIS spectra of these samples were also recorded to study band gap which confirm the direct band gap nature. The energy band gap (Eg) of SnO_2 film and pellet is 3.88 eV and 3.45 eV respectively. The comparative study of humidity sensing properties of thin film and pellet was also carried out. Humidity response was found to be higher in pellet than thin film which could be due to the porous nature of pellet than the film.

A Review on Dielectric Relaxation Studies of Some Impotant Polar Aromatic Compounds and of Some Fruits and Vegetables at Microwave Frequencies.

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The study of dielectric properties reveals the storage and dissipation characteristics of the material interacting with the electric and magnetic field, and hence its suitability for various applications can be determined. . Dielectric spectroscopy investigation mainly probes the effect of weak forces and helps to understand intermolecular re-orientational dynamics of the solute and solvent molecules. Dielectric characterization has great potential in studying the phenomenon like, H-bond interactions, dipolar alignment, hydrogen bond connectivity etc. to understand intermolecular re-orientational dynamics of the solute and solvent molecules. A review on dielectric relaxation studies of some important polar aromatic compounds and of fruits and vegetables at microwave frequencies convey some important results. This may prove to be a useful guide for storing of fruits and vegetables. It gives useful information needed for their processing and preservation. One of these two: Vector Network Analyzer Method and Two point method using a solid dielectric cell are used for this purpose.

Non-Extensivity of Entropy in Multiparticle Production at High Energy

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Entropy is a measure of the number of specific ways in which a thermodynamic system may be arranged, commonly understood as a measure of disorder. In statistical thermodynamics, a macro-state of the system can be described in terms of macroscopic parameters e.g. P,V,T. Entropy of the system is the measure of the number of microstates of the system in a particular macro-state. Normally entropy is extensive in nature in gaseous systems. It has been recognized that the concepts of equilibrium statistical physics can be applied in multiparticle production in high energy collisions.

The probability of production of particular number of particles in high energy collisions follows various statistical distributions such as Maxwell's distribution, Negative Binomial distribution, Modified NBD. It is realized that there is an existence of some degree of non-extensivity of entropy in multiparticle production. Theoretical predictions agree with the experimental observations when we consider entropy to be non-extensive in nature which leads to a new kind of distribution called "Tsalli's distribution" with entropic index $q>1$. Application of this concept for the particle production in e+e- collisions at high energy is discussed.

Age Estimation of Solar and Late-M Type Stars, and NGC 6811 Cluster Using Gyrochronology

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As elegant as it sounds, gyrochronology rests on the attribute of stars about revealing their own age by their rotation periods. These rotation periods can be calculated by observing star spots, which traverse the star's surface at regular intervals. Stars with known ages, including our Sun can be used as calibrators for these chronometers. This nearest calibrator is essentially categorized as a G type star, and can be used to determine the chronology of similar stars. The age dependence of the stars has been estimated to vary as a function of square root of their time period. The method involves bracketing a star into C or I sequence, the method being presently applicable to only I (interface) sequence stars. Infant stars have a core rotating with a higher angular velocity than that of the surface. Such stars, classified as C sequence (convective) gradually mutate to form I sequence (interface) stars due to strong magnetic fields of the star dragging the surface along with the core. I sequence stars can be discerned primarily by their colour, seconded by their mass. Gyrochronology has been studied for many clusters, one of them being NGC 6811, whose 71 stars have been estimated to deduce that the Cluster is about 1 GYr old. With an average of 21 day period of rotation of the observed stars, the time period can be compared to that of the Sun, which is 25 days and is about 4.6 GYr old.

Antimatter

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The matter-antimatter asymmetry in Universe is one of the most fascinating enigmas in physics. Matter and Antimatter are created and destroyed together, it seems the universe should contain nothing other than the leftover energy. Nevertheless, a tiny portion of matter – about one particle per billion – managed to survive. And that's what we're seeing today. Soon after the big bang, an unimaginable amount of energy transformed into symmetric amounts of matter and the 'antimatter'. But since then, almost all the antimatter had disappeared and only a tiny fraction of matter was enough to create the stars, planets, and our universe. Also, there exists an imbalance between the baryonic matter and the anti-baryonic matter which is also called the baryon asymmetry. And this asymmetry problem in physics is being solved by the scientists at CERN's Large Hadron Collider (world's largest particle accelerator), the place where the Higgs particle was discovered. This future discovery is based on CP violations, which means that nature treats a particle and its oppositely charged mirror-image version differently.

Coriolis Force

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In physics, the Coriolis effect is a deflection of moving objects when the motion is described relative to a rotating reference frame. In a reference frame with *clockwise* rotation, deflection is to the left of the motion; on the other hand, with counter-clock rotation deflection is to the right of the motion of the object. This is demonstrated in the kit developed by us.

Origin of Solitons

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A soliton is a self-reinforcing solitary wave that maintains its shape while propagating at

a constant velocity. Solitons are caused by a cancellation of nonlinear and dispersive effects in the medium and the solutions of a widespread class of weakly nonlinear dispersive partial differential equations that describe physical systems. These are having permanent form, localised within a region, can interact with other solitons, stable and can travel long distances. A remarkable quality of these solitary waves is that they could collide with each other and yet preserve their shapes and speeds after the collision.

Nanomaterials: Introduction and Applications

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Nanoscience is gaining importance rapidly as a most powerful technology. Nanoscience offers the potential to overcome various serious problems facing mankind over serious decades in many fields. Nanoscience includes nanomaterials which is the main need of modern world which includes: nano wires, nano electronics, nano crystals, nano medicines, nano transistor, nano-tubes etc. Nano wires are used to manufacture faster nano or computer chips, high density memory and smaller lasers. Nano electronics contain semiconductor devices, nanoscale devices and electronic system. Nanocrystals are mainly used for new fluorescent or photonic in biotechnology, switches, lasers and LED's. Nano-medicine is specially used for monitoring, repairing construction and control of biological system at molecular levels. Nano-transistors are mainly used in switches, amplifier, photonic computing architectures and molecular electronics. Nano-tubes are very light, thermally stable, chemically inert and good conductors.

Fuel Cell: Journey from Laboratory to a Greener and a Cleaner Future

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With the continuously increasing demand of energy consumption Fuel cell is the one of the promising candidates to fulfill the requirements due to their unique low cost, low weight, high efficiency (upto 85%), and zero carbon emission [2] features. Fuel cells have ability to provide a continuous and reliable energy by direct and reversible conversion of

chemical energy to electricity at low temperature. Today, fuel cells have to be developed to address three markets: zero emission vehicles, off-grid and distributed power generation and fuel cells for portable consumer and defence electronics. The challenges of the 21st century researchers -particularly fuel security, climate change and environmental pressures -are opening up a host of opportunities for fuel cells. The paper underlines how the development of the different types of Fuel Cells makes them an innovative source for the future generations to come.

Blackholes: Quantum Mechanics Vs General Relativity

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The knowledge of black hole remains shrouded in mysteries which are yet to be unrevealed by physicists. Two major theories, Quantum Mechanics (QM) and General Theory of Relativity (GTR) have both been put together to explain the characteristics of a black hole. QM applies to particles of size comparable to electron while GTR represents the black hole as a singularity in space time graph. Both these theories have been reconciled to understand the black hole better but contradictions arise out of this amalgamation. Though many attempts have been made to check out for the theory which needs correction but the needle swings to and fro amidst the two theories. The main contrasts are between information paradox and surface corrugation and the poster presents the same.

Physics in Entertainment

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Physics plays a very important role in our day to day lives but it is also applied and responsible for our entertainment purpose. Physics is widely used in gaming and in movie making industries. Physics makes our entertainment more live and interactive. Drag of car, fight of two characters, particle effects, projectile motion, jump of hero from high

cliff etc. Every year game making industries spends millions of dollars behind research and programming to make games more and more realistic. Physicist are in great demand for performing research on laws of physics that can be applied in games. Many students are pursuing PhD on games which uses laws of physics.

Programmable magnets: Working and application

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The usual magnetic behavior of material solely consists of attraction or repulsion but it is possible to alter this behavior by using various techniques. One such technique is to correlate two magnetic surfaces by forming multipole patterns on these surfaces in some specific ways which produces a desired interaction between these surfaces. In simple words, these correlated magnets would be able attract or repel or do both depending on the distance between them can be designed to show different magnetic behavior variably with distance and orientation. These interactions could be practically employed for shear force transfer (moving gears and cogwheels) with less energy loss. In our project, we have studied the ongoing research on these programmable magnets in detail and also upon the methods of further developing and improving this technology. Present and Future applications of this technology are also considered.

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