The Physics Society

St.Stephen's College

Annual Report : 2020-21

CONTENTS

The Feynman Club

Event 1 (Talk):

Title : Modelling Covid-19
Speaker : Reuel Dsouza and Binayyak Bushan Roy
Designation: Third Year Physics students
Date : 3rd July 2020
The talk was delivered by two third year students, where they tried to model the pandemic COVID-19 on the large scale of a country for which we use a SIR model and include additional complications at each stage.

Event 2 (JRG Session):

Title :Inauguration and Paper reading for Journal Reading Group
Speaker : Shalika Yekkar
Designation: Second Year Physics student
Date : 11th July 2020
This session marked the inauguration of the new vertical, “The Journal Reading Group” under the Feynman Club which was followed by the research paper reading and discussion session of the paper titled "How fundamental are fundamental constants?" by Dr M. J. Duff.

Event 3 (JRG Session):

Title : MRI
Speaker :Binayyak Bushan Roy
Designation: Third Year Physics student
Date : 17th July 2020

This presentation aimed at very briefly explaining how the MRI works. The important thing that was a take away from this presentation was the new physical principles that one came across during the presentation.The session was followed by an engaging round of discussion.

Event 4 (JRG Session):

Title : What is the Temperature of a moving object?
Speaker : Manish Kumar Tamta
Designation: Third Year Physics student
Date : 31st July 2020
The event was the 3rd session of the JRG where a research paper reading and a discussion session of the paper titled “What is the temperature of a moving body?” By Cristian Farìas, Victor A. Pinto & Pablo S. Moya was held.

Event 5 (JRG Session):

Title : Electrical characterization of semiconductor materials and devices-review

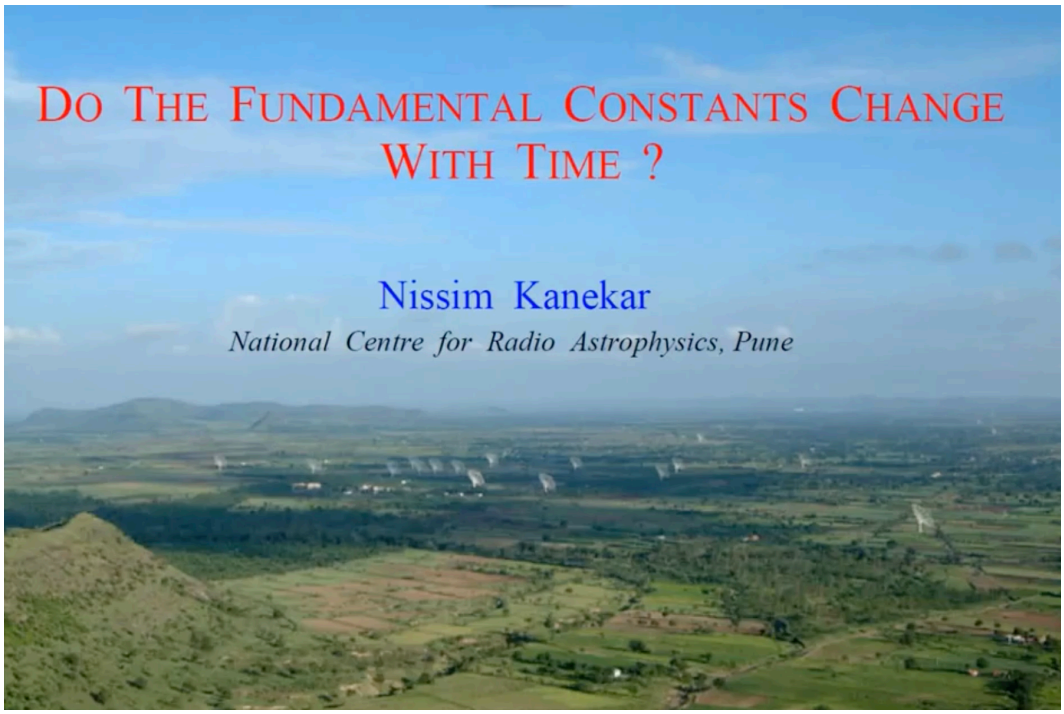
Speaker : Aklanta Hajong Sarkar

Designation: Second Year Physics student

Date : 8th August 2020

The talk was delivered by a second year student, which included a research paper reading and a discussion session of the paper titled "Electrical characterisation of semiconductor materials and devices—review" by M. J. Deen and F. Pascal in which they describe some of the more widely used and popular techniques that are used to determine the important parameters of semiconductor materials.

Event 6 (Talk):



1st Feynman Lecture by Dr. Nissim Kanekar

Title : Do fundamental constants change with time?
Speaker : Prof. Nissim Kanekar
Designation: Professor and DST Swarnajayanti Fellow at the NCRA, TIFR, Pune, India.
Date : 21st August 2020
In this talk, a description of how one uses astronomical spectroscopy to probe changes in alpha and mu on Gyr timescales was given. Then a technique based on radio spectral transitions in the hydroxyl radical, that offers a "clean" approach to such studies, was discussed. Finally, there was a discussion on where the field is today and where we hope to go over the next decade

Event 7 (Talk):

Title : How close are pure states to thermal states?
Speaker : Prof. Suvrat Raju
Designation:Professor, ICTS, TIFR, Bengaluru, India.
Date : 28th August 2020
Considering a pure state of the system with the same energy as that of a density matrix but one that is not entangled with a bath at all, a surprising fact that for almost all observations, almost all such pure states are "exponentially close" to the microcanonical ensemble. The significance of this result was discussed for some questions, including the black hole information paradox and broader discussions about thermalization.

Event 8 (Talk):

Title : Many-body localization: Breakdown of ergodicity in quantum matter

Speaker : Prof.Arijeet Pal

Designation: Dept of Physics and Astronomy, University College, London Date : 4th September 2019

A new state of matter was recently discovered which violates ergodicity and this has overturned the conventional understanding of the statistical physics of many particles. The strange nature of this novel state is encoded in subtle quantum correlations between distant particles known as "entanglement". In this talk, an overview of some of the developments in this fascinating phenomenon was given followed by a round of Q&A.

Event 9 (Talk):

Title : Crystallographic Restriction Theorem

Speaker : Sarthak Vijay

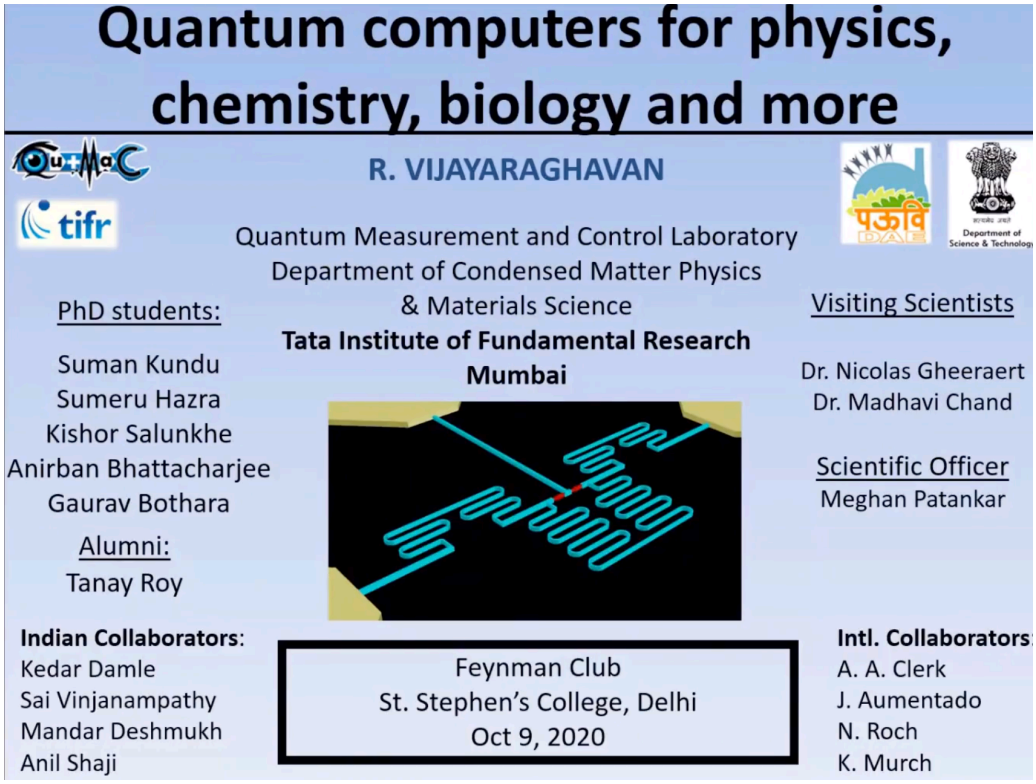
Designation: Third Year Physics student.

Date : 18th September 2020

The talk was delivered by two third year students, it mainly focused on the proof of the Crystallographic Restriction Theorem written by Sarthak himself. All the relevant concepts were explained which was followed by a discussion.

Event 10 (Talk):

Title : Quantum Computers for Physics, Chemistry, Biology and more
Speaker : Prof. R Vijayaraghavan
Designation: Professor, TIFR.
Date : 09th October 2020
The speaker explained the power of quantum computing with the help of some examples. Then, how machines using different technologies like trapped ions, semiconductor quantum dots, etc can be built were described with a particular focus on the approach followed in his lab using superconducting thin-film devices. Finally, motivation for how quantum computers can help model nature efficiently at a very fundamental level will be provided. The talk will be concluded by summarizing the current status of the field and challenges that lie ahead.



5th Feynman Lecture by Dr. Nissim Kanekar

Event 11 (JRG Session):

Title : Galaxy Cluster Science with the Sunyaev- Zel'dovich Effect
Speaker : Sandra Elsa Sanjai
Designation: Second Year Physics student.
Date : 10th October 2020
The event was the 5th session of the group where a research paper presentation by a second year student, Sandra Elsa Sanjai' and a discussion session of the paper titled "Galaxy Cluster Science with the Sunyaev- Zel'dovich Effect" had ensued.

Event 12 (JRG Session):

Title : The long term evolution of double white dwarf mergers
Speaker : Binayyak Bushan Roy
Designation: Third Year Physics student.
Date : 17th October 2020
The presentation of the research paper and a discussion session of the paper titled "The Long-Term Evolution of Double White Dwarf Mergers" was done in this session of the Journal reading Group .In this paper, the long-term evolution of the merger of two unequal mass C/O white dwarfs (WDs) was presented.

Event 13 (JRG Session):

Title : First M87 Event Horizon Telescope Results
Speaker : Deepanshu Bisht
Designation: Second Year Physics student.
Date : 24th October 2020
The event was the 7th session of the group where a research paper reading and a discussion session of the paper titled “First M87 Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole” had taken place .

Event 14 (Talk):

Title : Fast, small - yet still in control: the mechanics of insect flight
Speaker : Prof. Sanjay P Sane
Designation: NCBS, TIFR, Bengaluru, India.
Date : 06th November 2020

6th Feynman Lecture by Prof. Sanjay P Sane

In this talk, diverse aspects of the physics and biology of insect flight that have been the subject of Prof. Sanjay's laboratory study were presented. This was also accompanied by a handful of questions by the audience which were addressed by the speaker.

Event 15 (Talk):

Title : Studying Physics in the 21st Century
Speaker : Prof. Bikram Phookun
Designation: Professor, St.Stephen's College, Delhi.
Date : 08th January 2021
The speaker spoke about how in the 21st century, with the explosion of artificial intelligence, many human occupations are likely to be taken over by computers. He also addressed the key question of, 'What will this do to the practice of physics?' from his view point and finally went on to offer some advice on how to prepare for the new reality which was followed by an engaging round of dialogue between the students and the speaker.

Event 16 (Talk):

Title : An Introduction to Universality
Speaker : Kesav Saranyan Krishnan
Designation: PhD student, University of Illinois at Urbana-Champaign.
Date : 29th January 2021
The Speaker introduced the concept of Universality as it arises in the study of probability. Subsequently the speaker, then discussed the

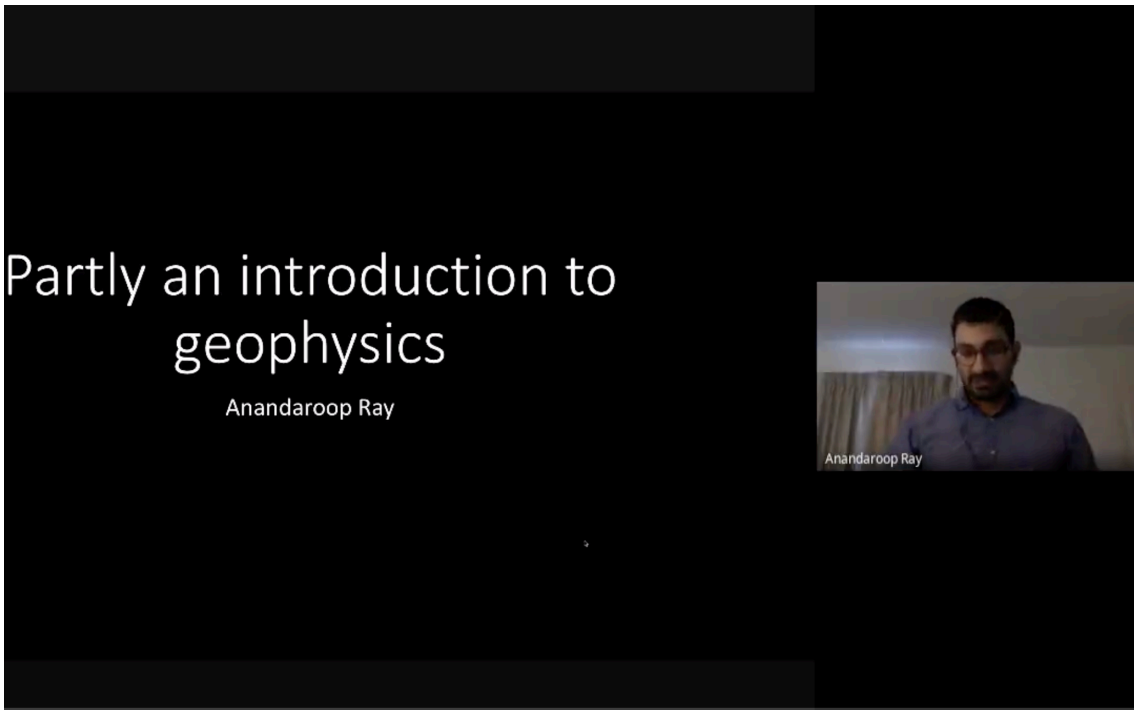
universality at the level of processes, the heuristics of why Brownian motion is a universal object and finally the interfaces in the lattice models of statistical mechanics, highlighting the importance of both the physical and mathematical views.

Event 17 (JRG Session):

Title : The Three Body Problem
Speaker : Vedanta Thapar and Hariprasad SV
Designation: First Year Physics students.
Date : 30th January 2021
The Three Body Problem : An effort to solve for the subsequent motion of 3 bodies considering only their mutual gravitational attraction given the initial conditions. In their presentation, Vedanta and Hariprasad, Students of 1st B.Sc(H) Physics explored the different approaches to this problem through its 200 year history: both Numerically and Analytically

Event 18 (Talk):

Title : Partly an introduction to geophysics
Speaker : Anandaroop Ray
Designation: Senior Geophysicist at Geoscience Australia.
Date : 12th March 2021



9th Feynman Lecture by Anandaroop Ray

The talk revolved around the area of Geophysics. Questions like, 'What is geophysics?', 'Should real physicists bother with it?', 'What is an inverse problem and what does geophysics have to do with it?', 'Most importantly, can studying inverse problems land me a job?', 'Why on earth would anyone pay me to know physics and Bayes' Theorem?' were addressed from the speaker's perspective following which the speaker went on to answer the questions raised by the audience.

Event 19 (Talk):

Title : Citizen Science and Artificial Intelligence
Speaker : Dr.Advaith Siddharthan
Designation: Third Year Physics students
Date : 19th March 2021

The speaker introduced the realm of citizen science and briefly also spoke about its history and evolution. He then went on to discuss the future of Citizen Science, the implications for how society addresses the grand challenges of our era such as climate change and biodiversity loss, and where his research fit in to this narrative.The talk was followed by a round of Q&A from the students.

Astronomy Club

1 Introduction

Science has been valued by man for years. Going back in history, the Greeks never differentiated the lines that now divide the humanities and sciences but now we are going back and forth. We define a new class of multidisciplinary subjects that gives us the understanding that we cannot put subjects into concrete boxes but that different approaches help us gain a better understanding of the subject itself. With 2020 being an unprecedented one, we have tried our best to adapt to the new 'normals' and make the best of it, the summary report of which is presented below.This year has been a momentous year for the Astronomy club. We have accomplished a lot starting from establishing new verticals to rediscovering interesting astronomical results from computational simulations.

Figure 1: Physics Society's Astronomy Club — Verticals

2 Sessions

DATE	EVENT	TOPIC	PRESENTER
07-08-2020	Orientation	Introduction to the new verticals	Astronomy Club Executive Council
22-08-2020	Discussion	Introduction to Sky Viewing	Neel Lohit Dash
24-08-2020	Discussion	Introduction to Computational Astronomy and Data Analysis	Binayyak Bushan Roy & Neel Lohit Dash
21-08-2020	Discussion	Introduction to Radio Astronomy	Rahul Mallikarjun
09-09-2020	Discussion	N-Body Problem	Binayyak Bushan Roy
11-09-2020	Discussion: Stellar Dynamics Problem	Astronomy with Python: CSV Files	Neel Lohit Dash
12-09-2020	Data Analysis Session	HR Diagram and Color Magnitude Graphs	Neel Lohit Dash
15-09-2020	Data Analysis Session	Introduction for First Years	Neel Lohit Dash
26-09-2020	Discussion: Stellar Dynamics Problem	Three-body problem	Aleena Sibi & Samuel John
03-10-2020	Discussion: Stellar Dynamics Problem	Sable orbits	Aleena Sibi & Samuel John
05-10-2020	Discussion	N-Body Problem	Binayyak Bushan Roy
19-10-2020	Discussion	N-Body Problem	Binayyak Bushan Roy
11-10-2020	Data Analysis Session	Doubt Session	Aleena Sibi &Samuel John

17-01-2021	Radio Astronomy	Simulating a Radio Antenna	Rahul Mallikarjun & Neel Lohit Dash
24-01-2021	Sky Viewing	Introduction to Sky Viewing	Chaitamya Varma
30-01-2021	Data Analysis Session	HR Diagram, Stellar Classifications, Colour Magnitude Diagram, CSV files,Wien's Law and Black-body Radiation, Spectral Types, FITS files	Neel Lohit Dash
05-02-2021	Stellar Dynamics	Introduction for First Years	SY Stellar Dynamicsmembers
19-02-2021	Stellar Dynamics	Precession of the Perihelion of Mercury	Neel Lohit Dash
21-02-2022	Stellar Dynamics	Basic session	SY Stellar Dynamics members
28-02-2021	Stellar Dynamics	Non-dimensionalising	Sandra Elsa Sanjai
05-03-2021	Collaboration with JRG	Type 1A Supernova as a Cosmological Probe	Binayyak Bushan Roy & Neel Lohit Dash
06-03-2021	Collaboration with JRG	Type 1A supernova as a Cosmological Probe	Binayyak Bushan Roy & Neel Lohit Dash

And various informal discussion and doubt-solving sessions were carried on the Astronomy Club's Discord Server.

Figure 2: Astronomy Club — Sky-viewing Activities

This year was pretty challenging for sky viewing vertical, but all efforts were made to create sky gazing consciousness amongst the members of the club.

1. Sessions on working and using optical telescope.

2. Individuals with telescope at their residence participated in observing various astronomical events.

3. An application called Stellarium was introduced to participants to view objects in sky on their computer itself.

4. A group of students work on a small report on ”Advancements in Observational Astronomy”.
Figure 3: Report — Advancements in Observational Astronomy

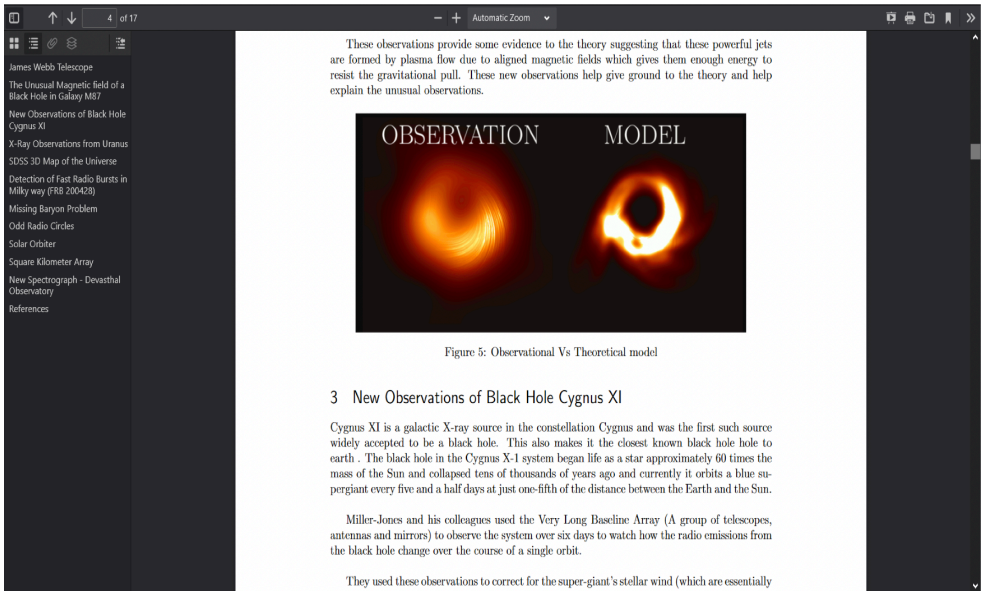


Figure 3: Report — Advancements in Observational Astronomy

Figure 4: Astronomy Club — Radio Astronomy Activities

The Radio Astronomy Club aimed at teaching students the use of softwares to study radiowaves from space and analyze different systems in space. We wanted to start small with a basic software of modelling antenna like 4nec2. Having participated in a competition like SWAN which was basically about designing an antenna of given specifications. The second and third years had some amount of experience in designing an antenna. There we started with explaining how to use the software to build antenna to the FYs. Having studied on how to model antenna one can easily extend it to other parts of the field and move on to next part of the experiment i.e., to analyse the observations.

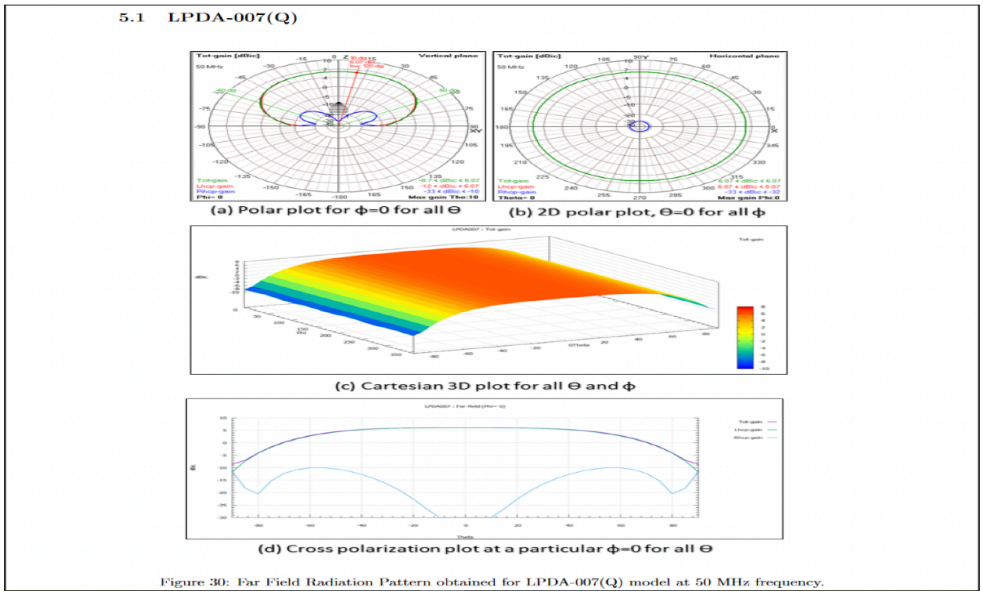


Figure 5: Report —SWAN Project

Figure 6: Astronomy Club —
Stellar Dynamics Problem

Problem 1: Interaction of a planet with a Binary-Star System

The three-body problem in which three particles move via pairwise interactions can be complicated and chaotic.
So you can model a simpler problem in which we set a constraint that two heavy bodies 1 and 2 are kept at a fixed separation along the x axis, while a lighter body moves about them. We use natural units G = 1 to keep the calculations simpler and treat all bodies as point particles.

Use the visualizing tools available in python to view the output as animations so that you can observe the planet pass through a number of orbits.
You can analyse the problem by varying the initial conditions and see if any chaotic behavior arises or not.

1. Start with $M_1 = M_2 = 1$ and the planet at $(x_0, y_0) = (0.4,0.5)$ with $(V_{x_0}, V_{y_0} = (0,-1)$. (Where, M_1M_2 is mass of the Star/Sun 1 and 2 respectively, x and y are their respective position and V is the velocity.)

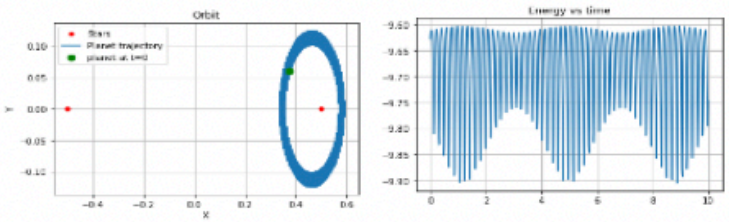
2. Set $M_2 = 2$ and see if the planet remains in a stable orbit about sun 2.

3. Return to the equal mass case and investigate the effect of differing initial velocities.

4. What might be the difficulty of having life develop and survive in a two sun system?

5. Explore the effect on the planet of permitting one of the suns to move.

6.2 Fixed Stars-Unequal mass

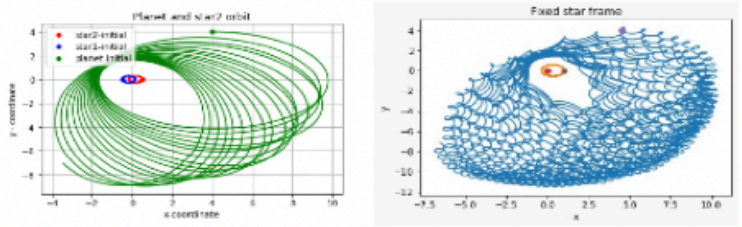


(a) $\tau_f = 1000$, $\Delta\tau = 0.01$

(b) $\tau_f = 10$: Energy always oscillates in verlet algorithm

Fig. 7. S-type stable orbit for this simplified case. $M_2 = 2M_1$

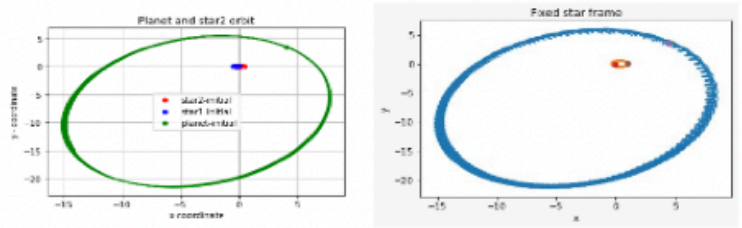
6.3 Stars moving - Influence of Planet ignored



(a) Orbits as seen from the centre of mass : $X = 4.0$, $Y = 4.0$, $V_X = 0.6$, $V_Y = 0$, $X_2 = 0.5$, $Y_2 = 0$, $V_{X_2} = 0$, $V_{Y_2} = 0.5$

(b) Orbits as seen from star1 : $X = 4.5$, $Y = 4.0$, $V_X = 0.6$, $V_Y = 0.5$, $X_2 = 1.0$, $Y_2 = 0$, $V_{X_2} = 0$, $V_{Y_2} = 1.0$

Fig. 8. Stable orbit when ignoring planet's influence. $\Delta\tau = 0.001$, $\tau_f = 1000$



(a) Orbits as seen from the centre of mass $X = 4.0$, $Y = 3.5$, $V_X = -0.6$, $V_Y = 0.5$, $X_2 = 0.5$, $Y_2 = 0$, $V_{X_2} = 0$, $V_{Y_2} = 0.5$

(b) Orbits as seen from star1 $X = 4.5$, $Y = 3.5$, $V_X = -0.6$, $V_Y = 1.0$, $X_2 = 1.0$, $Y_2 = 0$, $V_{X_2} = 0$, $V_{Y_2} = 1.0$

Fig. 9. Stable orbit 2 when ignoring planet's influence. $\Delta\tau = 0.001$, $\tau_f = 1000$. The orbits look almost similar in both frames

Figure 7: Report — Stellar Dynamics Problem1

Figure 8: Astronomy Club — N-Body Problem

We explored the cosmological N-body problem and started out with setting up the mesh for the problem. We followed the fixed mesh ideology because a moving mesh would bring in unnecessary complexities. Then we moved on to defining the domain for the problem depending on the scale of the systems that we wanted to look at. Finally, we also settled on doing a comparison of the Eulerian and Lagrangian distribution of mass. We also looked into the tree method.

Figure 9: Astronomy Club — Data Analysis

Data Analysis — Coronal Mass Ejection Project

A coronal mass ejection is a significant release of plasma and accompanying magnetic field from the solar corona. They often follow solar flares and are normally present during a solar prominence eruption. The plasma is released into the solar wind, and can be observed in coronagraph imagery.
Sun isn't very active during solar minimum, coronal mass ejections are rare. There might only be one coronal mass ejection every week. When the Sun's activity increases towards solar maximum, coronal mass ejections become more common and we can see multiple coronal mass ejections every day. Following topics were covered:

1. Anatomy of the sun

2. The Core

(a) Photon-Photon Chain Reaction

(b) CNO Cycle

3. The Radiative Zone

(a) Random walk of photon from core

(b) Net Direction of travel

4. Tachocline

5. Convective Zone

6. Photoshhere

(a) Granuels

(b) Sunspots - Blemishes on the Sun

(c) Solar Cycle

(d) Calculating Sunspot Number

(e) Sun's Magnetic Field

(f) Babcock Model

(g) Butterfly Diagram

(h) Sporer's Law Behaviour

7. Chromosphere

8. Transition Region

9. Corona

10. Coronal Mass Ejection

Activity 1

Studying variation of Total solar irradiation and the sunspot number over the solar cycle.

Activity 2

Analysis of oscillatory behaviour in H-Alpha intensities of solar flares and sun spots of chromosphere observed by mast telescope, USO

1 Introduction — Anatomy of the Sun

The Sun is an incandescent mass of hydrogen, helium, and other heavier elements.It is a nearly perfect sphere of hot plasma,heated to incandescence by nuclear fusion reactions in its core, radiating the energy mainly as visible light and infrared radiation. While it appears constant and unchanging from our vantage point on Earth, it actually has a dynamic and variable system of twisting magnetic fields that cause solar events of almost unimaginable power. Its diameter is about 1.39 million kilometres (864,000 miles), or 109 times that of Earth. Its mass is about 330,000 times that of Earth, and accounts for about 99.86 percent of the total mass of the Solar System.Roughly three quarters of the Sun's mass consists of hydrogen (73 percent); the rest is mostly helium (25 percent), with much smaller quantities of heavier elements, including oxygen, carbon, neon, and iron. As shown in the picture that is available to the public on the NASA website. It clearly shows the different layers of our star.

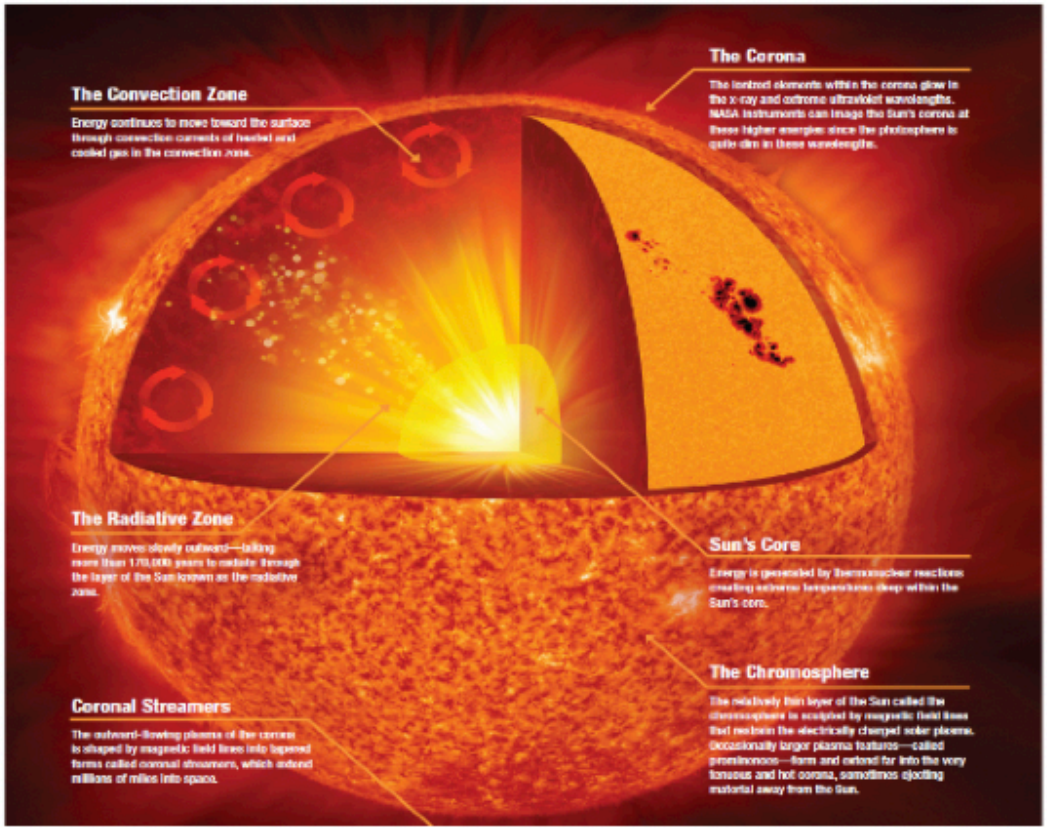


Figure 10: Report —CME Project

Figure 11: Astronomy Club — AstroEd

This Vertical aimed at making astronomy fun and reachable to everyone regardless of their course. The first effort being having a dedicated section in the journal about recent advances in astronomy and it's impact. The aim is to have a small bi-monthly newsletter from next academic year.

Problem Solving Club

Date: 14th August 2020
Description: Discussion session for problems regarding minimal surfaces and nearest neighbour distributions

Date: 29th August 2020
Description: Discussion session for the solutions to problem set 1.

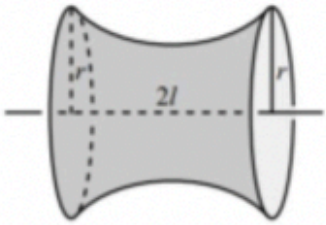
Problem Solving Club - Set 1

The Physics Society, St. Stephen's College

8^{th} August 2020

Problem 1

Consider a soap bubble that stretches between two identical circular rings of radius r. The planes of the rings are parallel to each other and let's say the distance between them is $2l$. The figure is shown below-



Deduce an expression for shape of the bubble formed above-

1. Can you deduce the solution (approximately) without doing anything mathematically.
2. Make justifiable assumptions about the effects from the surroundings of the above system to be taken into consideration to solve the problem.
3. Try to solve the problem mathematically.
4. Find the maximum value of l/r for which the above shape exists without the soap surface breaking into two separate parts.
5. Does your answer match up with real life observations? Try to set this up with some soap water and 2 rings.

A YouTube video of the process

Problem 2

Assuming a uniform random distribution of stars in space. Fixing the origin of a coordinate system at any one star. Find the probability distribution $P(r)$ of finding its nearest neighbour at a distance r from it.

To do this take a moment to think about what it means for a point to be a **nearest neighbour** to another point in space and try to write this down mathematically.

1. State the assumptions made in finding this distribution. (Hint: Divide the region into concentric shells about the origin.)
2. Test your answer to part 1 on a computer.
3. What is the probability of two stars being mutual nearest neighbors ?

Further explorations : The birds on a wire problem (An interesting 1-dimensional variant).

Date: 25th September 2020

Description: Discussion session for problems dealing with modifications to Newton's laws and quantitatively describing the slowing down of the fall of a magnetic object in a metallic pipe.

Problem Solving Club - Set 2

The Physics Society, St. Stephen's College

14^{th} September 2020

Problem 1

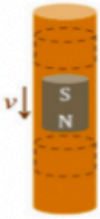
One thing that rarely faces any sort of skepticism in introductory physics courses is Newton's second law. The equation $\mathbf{F} = m\ddot{\mathbf{x}}$ has always been accepted without any comment. How do we know that the general law isn't of the form.

$$\mathbf{F} = m(\ddot{\mathbf{x}} + k\dddot{\mathbf{x}})$$

One may be quick to dismiss any doubt owing to the massive body of evidence that supports the usual form of the second law. Despite the fact that conservation laws and symmetries of nature argue in favour of $\mathbf{F} = m\ddot{\mathbf{x}}$, it is unreasonable to dismiss, without any further thought, other possibilities. A mathematical proof of the impossibility of such a law (the suggested alternate) using more sophisticated formalism of classical mechanics maybe out of scope but imagine yourself to be audacious and mathematically inept and design an experiment to disprove the new suggested form of the second law. Provide an estimate of the experimental error in your hypothetical experiment in the event that the true value of k (say 10^{-6}) is too small for the apparatus to determine.

Problem 2

A common demonstration of Lenz's law involves the slowing down of the fall of a magnetic object in a metallic pipe. Let's quantify this, Find the terminal velocity of a magnetic object falling under the influence of gravity in a metallic pipe expressed in quantities relevant to the system using Newton's laws.



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Date: 21st January 2021

Description: Discussion session for problems dealing with discrete trajectories and electrostatics in different spaces.

Problem Solving Club - Set 3

The Physics Society, St. Stephen's College

January 2021

Problem 1

Figure 1: A wheat field

You are in the middle of a huge field, and being bored, you decide to play with your watch.Therefore you put bent arm infront of your nose, and

1. Each second you turn in the direction of the second hand and a make a step forward.(Your arm is kept fixed i.e. it turns along with you).Where will you end up in a minute's time? Describe the trajectory mathematically.

2. You decide to make a step(in the direction of the second hand) only for every n^{th} tick .You do not necessarily start at the minute sharp.How does trajectory depend on n and the initial moment?Classify possible trajectories.

Problem 2

Electrostatics on a spherical surface.

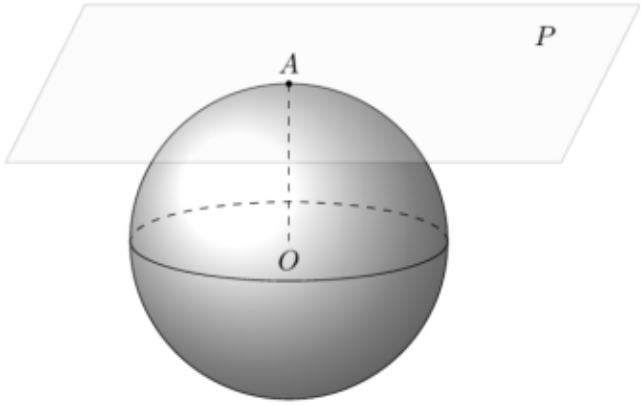


Figure 2: A sphere and a tangent plane

We are quite familiar with electrostatics in a three dimensional euclidean space. But let's be brave let go of this familiarity and try to see what electrostatics would look like on a spherical surface.

1. Let's first try to figure out how to formulate electrostatics on the surface of a 2-D euclidean space. What laws would you borrow from 3-D electrostatics and how would you modify them?

2. Following the principles used in part (i) derive "electrostatics" on a spherical surface. *Hint: How would the rule of distance on a sphere be different from a euclidean space?*

3. Are the results of part (ii) consistent with part (i)?

Date: 16th April 2021

Description: Discussion session for problems dealing with predicting the equatorial bulge of the earth due to the centrifugal force and estimating the time it takes for a pencil balanced on its tip to fall.

Problem Solving Club - Set 4

The Physics Society, St. Stephen's College

April 2021

Problem 1

The equatorial bulge

It is a known fact that the Earth bulges at the equator. Infact, the estimated height of this bulge is much greater than Mt. Everest. This Article explains the reason why the bulge is a direct consequence of the centrifugal force.

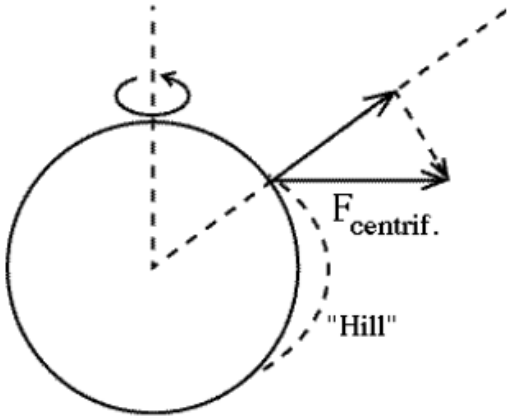


Figure 1: Earth's bulge at the equator

The problem is to give a close estimate to this height of the bulge from theoretical principles in the way the article explains it. Any required experimental parameters can be taken from internet.

Problem 2

An upright pencil in a vacuum

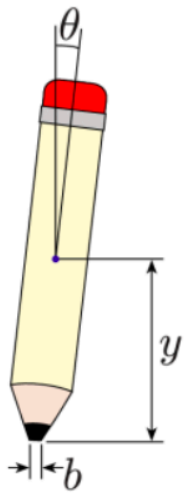


Figure 2: Pencil balancing

Consider a pencil of mass m and length l that stands on its tip. Let's try to estimate how long it takes to tip over.

1. Assume that the pencil makes an intial small angle θ_0 with the vertical, and that its initial angular speed is ω_0.The angle will eventually become large, what is θ as a function of time?

2. You might think that it would be possible (theoretically, at least) to make the pencil balance for an arbitrarily long time, by making the initial θ_0 and ω_0 sufficiently small. It turns out that due to Heisenberg's uncertainty principle (which puts a constraint on how well we can know the position and momentum of a particle), it is impossible to balance the pencil for more than a certain amount of time. The point is that you can't be sure that the pencil is initially both at the top and at rest. The goal of this problem is to be quantitative about this. The time limit is sure to surprise you.

   Use the Heisenberg uncertainty principle to get an inequality involving θ_0 and ω_0 and substitute it in the solution to part 1 .

3. Is this a valid procedure or just abusing the uncertainty principle?

Meera Memorial Paper Presentation 2020-21

The Meera Memorial paper reading competition has been a long-held tradition of the Physics Society at St. Stephen's College. It presents an exciting opportunity for those looking to present their ideas in front of an audience and willing to improve from the feedback from the ensuing discussion.

This year the Physics Society of St.Stephen's College had organised The Annual Meera Memorial Paper Reading Competition, on the 23 , 24 and 25th of February, 2021 due to the overwhelming increase in the number of participants(23 participants). The event was held on the afternoons and consisted roughly 3 hours of presentation and a Q & A session on each day.

This year's competition was indeed an enriching one and consisted of the participants presenting a research paper, summer projects or term projects or many more new topics that they found interesting or would study upon in the near future.

The event started off by Dr. Bikram Phookun , Department of Physics, St.Stephen's College talking about the multidimensional process of learning a subject and how the curriculum caters to just one aspect of it that is solving the problem. He then went on to say about the different aspects of this process and how in complete education one needs to develop these skills one of which being the art of presentation, thereby reiterating the importance of events like Meera Memorial Paper Presentation.

Over the course of 3 days, 21 out of the 23 registered participants presented their work in a time slot of 12 minutes which was followed by a 3 minute Q & A session. Dr. Sanjay Kumar , Dr. Akshay Rana and Chaitanya Verma of 3rd Physics (St. Stephen's College) presided over the event as the judges.

Finally the staff advisor of the Physics Society - Dr Harish Kumar Yadav thanked the judges, participants and the audience for making the event a huge success.

Popli Memorial Lecture Series 2020-21

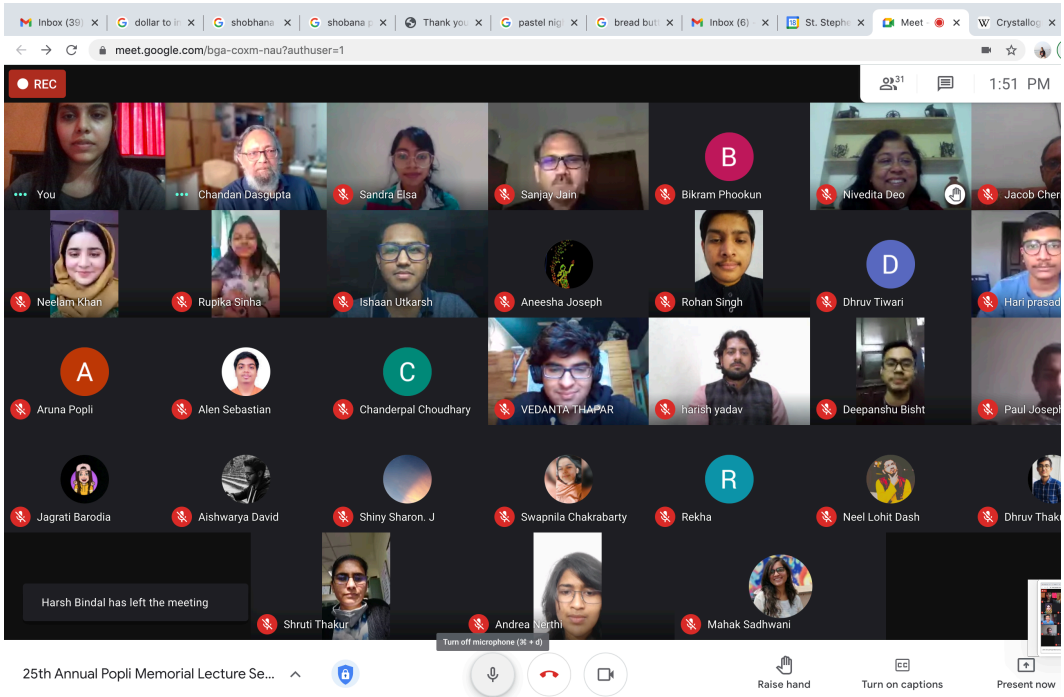
The Physics Society of St.Stephen's College organized this year's **25th Annual Popli Memorial Lecture Series** successfully from 18th February 2021 to 20th February 2021 .The lecture series was on the topic : Emergent Phenomena in Condensed Matter Physics. The talk was delivered by the esteemed Prof. Chandan Dasgupta , Indian Institute of Science and International Centre for Theoretical Sciences, Bengaluru.

The lecture began with the exploration of "What is Condensed Matter Physics and Emergent Phenomena ??" and proceeded with the investigation of different kinds of

Invite poster of the 25th Popli Memorial Lecture Series.

Emergent Phenomena that we encounter in condensed matter physics with emphasis on a particular class of phenomena called Phase Transitions and in particular "Spontaneous Breaking of symmetries" was explored in depth, which formed the bulk of the talk. The final lecture revolved around the statistical mechanics of Disordered Systems and the new concepts necessary to understand the properties of Disordered Systems.
The Talk was indeed an enriching one and was followed by a comprehensive Q & A session on each day. The Physics Society is extremely grateful to Prof. Chandan Dasgupta for agreeing to be our guest speaker. We are also thankful to Mrs. Aruna Popli for being with us through the Lectures. We also extend our gratitude to our Principal Prof. John Verghese and all the people who have been with us and supported us throughout the lectures which has indeed made the event into a successful one.

We were also proud to send out the electronic version of the **Physics Journal for the year 2021, ECHO '21** which would not have been possible without the guidance of our Staff advisor Dr. Harish Kumar Yadav.We were honoured to have the journal released by Prof.Chandan Dasgupta on the last day of the lecture on the very first day.The spectacle was worth a look as people interested in Physics from different generations assembled together to make the 24th Anniversary of the series possible. The event would not have been possible without the guidance of staff members especially Dr Harish Yadav as well as dedicated work of the council of the Physics Society and the enthusiasm of students from all the three years.



Gmeet Screenshot of Day 3

Ranjan Roy Memorial Lecture Series 2020-21

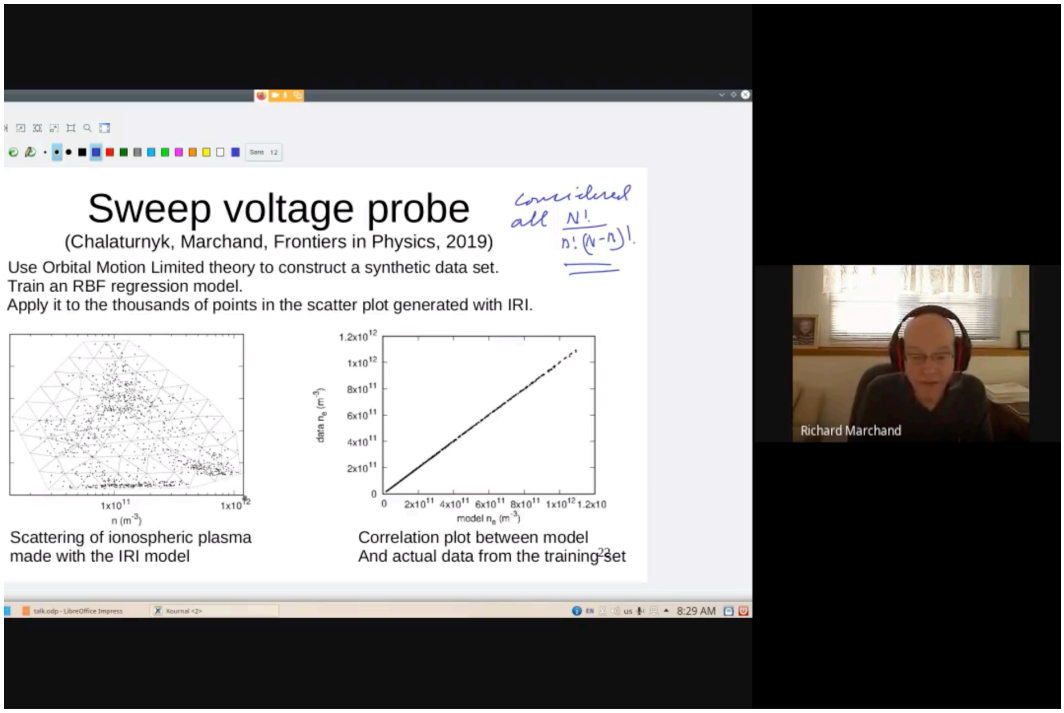
Ranjan Roy was a student of Economics at Jawaharlal Nehru University, having done Physics in St. Stephen's and then switched subjects. The academic lecture is in his memory, and thus, we invite speakers with work in interdisciplinary fields. Students from all colleges in Delhi University were invited to attend it.

The Physics Society of St. Stephen's College organised this year's Ranjan Roy Memorial Lecture, on the 17th of February, 2021 at 7.00 pm.
The lecture will be delivered by Prof. Richard Marchand of University of Alberta, Canada on 'Measuring the Vacuum in space.'

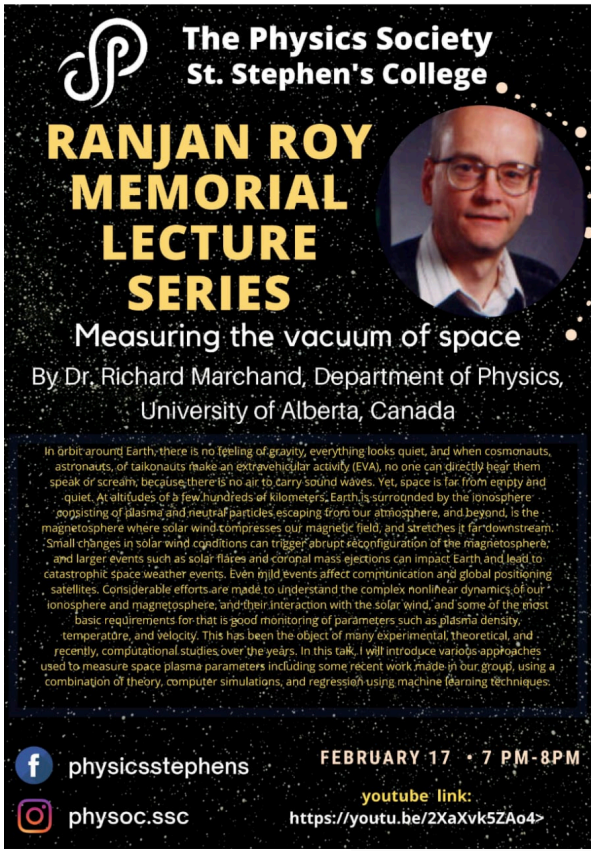
The event was held on the google meet platform and also live streamed on the society's official Youtube Channel. Mr. Anjan Roy, brother of Ranjan Roy was also present during the event and spoke a few words about his time with his brother. The event was mediated by Sandra Elsa Sanjai of 2nd Physics, St.Stephen's College.

The talk began with the speaker providing us with a picture of the universe then proceeding to talk about the life of a star specifically the sun. The speaker also spoke luminosity of the sun, sun cycles and coronal mass ejections in quite details.The speaker further went on to investigate the way in which we measure mass and temperature in air and in plasma. The talk also covered areas like earth's magnetosphere, floating Potential ,Debye Shielding and anthropocentric space environment.

The talk was followed by an engaging session of Q & A.Then Dr Harish Kumar Yadav (our Staff Advisor) introduced the entire society council & thanked everyone, especially the Speaker for being a part of the event and thus leading the day event to a memorable end.



Ranjan Roy Memorial Lecture Series talk by Prof. Richard Marchand



Invite poster of the Ranjan Roy Memorial Lecture Series.

Meetings

Meeting #1

Meeting Details

Date:22 July,2020
Time: 5:00 p.m.
Venue: Zoom Online Meeting

Agenda

1. Introduction and Welcome of the new Council
2. Discussion of plans and opportunities to explore in the upcoming session

Minutes

1. Introduction of the new council members and positions
2. More activities can be organized this semester given that it is more convenient to organize sessions online.
3. More speakers and professors can be invited to give online talks
4. A blue-print/chart of events planned for the semester has to be prepared and presented in the next meeting.
5. Reports of the lectures and sessions that happened during the quarantine period has to be prepared.
6. All the upcoming sessions should be recorded and saved.
7. **New Initiative:** Journal Reading Club
    a. A really good initiative to promote journal and paper reading among students
    b. All the presenters should prepare a presentation independent of the paper and text from the paper should not be explicitly relied upon.
    c. Presentation should be precise and contain the least amount of text.
    d. More time should be given to prepare the presentation given that understanding a paper can be a challenging and time taking task
    e. Students should be divided into groups according to their interest and be allowed to present the papers particular to the field of interest
8. Secretary should prepare and circulate the agenda for every meeting 2-3 days before the day of meeting so that members come prepared for the meeting
9. Minutes of every meeting should be prepared and documented
10. **Ranjan Roy Memorial Lecture** has to be organized this year by the society. Names of suitable professors/speakers should be looked up and suggested
11. **Popli Memorial Lecture Series**: This year is the 25th Lecture series which ought to be planned accordingly but due to the possibility of an online semester it may not be possible to hold it all. The possibility of having it in the odd semester shall be discussed with the faculty members and decided upon.

Attendees

1. Dr. Harish Kumar Yadav - Staff Advisor
2. Neelam Khan - President
3. Binayyak Roy - Vice-President
4. Mahak Sadhwani - General Secretary
5. Andrea - Treasurer
6. Avneet Kaur - Feynman Club Head
7. Neel Lohit - Astronomy Club Head
8. Dhruv Tiwari - PSC Head
9. Reuel - PSC Head
10. Swapnila - Journal Head
11. Shalika - Journal Head
12. Jagriti - Library In-charge
13. Aklanta - Member
14. Paul - Member
15. Rudra - Member?

Meeting #2

Meeting Details

Date: 11th October 2020
Time: 12 pm
Venue: Zoom Online Meeting

Agenda:

1. To plan a tentative schedule for all the main society events of the academic year
2. Display the progress made so far and seek suggestions for further activities
3. Society Enrolment for IIRS and ISRO.

Attendees

1. Dr. Harish Kumar Yadav - Staff Advisor
2. Neelam Khan - President
3. Binayyak Roy - Vice-President
4. Mahak Sadhwani - General Secretary
5. Andrea - Treasurer
6. Avneet Kaur - Feynman Club Head
7. Neel Lohit - Astronomy Club Head
8. Dhruv Tiwari - PSC Head
9. Reuel - PSC Head
10. Swapnila - Journal Head
11. Shalika - Journal Head

12. Jagriti - Library In-charge
13. Aklanta - Member
14. Paul - Member
15. Varun Upreti – Member
16. Dhruv Thakurdas - Member

Minutes:

1. All the faculty members are of the opinion that first year students should not be excluded from the events. The admissions will be finalised by November so all major events will have to be postponed to the next semester.
2. The application for IIRS and ISRO has been sent to the principal but there has been no response.
3. Progress of all the clubs discussed
4. Anything that is posted on the blog should be routed through the staff advisor.
5. Request for society account on college official domain.

Meeting #3

Meeting Details

Date: 20 November 2020
Time: 7:00 pm
Agenda

1. To decide the details of orientation for first years
2. To decide the tentative dates for major society events

Minutes:

1. Orientation for first years will be held on 28th November 2020 at 2.00 pm
2. A presentation is to be made that will be shown in the orientation with all the club heads explaining about the respective club activities
3. All the first years will be asked to introduce themselves
4. The plan of action needs to be circulated among the first years. The email list of first years will be needed for that.
5. The first years need to be informed about Meera Memorial paper presentation so that they can be prepared for that.
6. Tentative schedule for major events
    a. Meera Memorial paper presentation – February
    b. Ranjan Roy Memorial Lecture – January
    c. Popli memorial lecture series - January

Meeting #4

Meeting Details

Date: 26th December 2020
Time: 5:00 pm
Agenda:

1. Finalise the calendar for events.
2. Initiate work related to Popli Memorial Lecture Series. Prof Chandan Dasgupta is our esteemed guest.
    a. finalise dates for thy talk
    b. propose and finalise Topic
    c. divide work
3. Update on Ranjan Roy Mem lecture
4. prepare an elaborate draft for Meera Memorial paper presentation for convenience of first years
5. Discuss about Judges.
6. Blog and journal Team update

Minutes:

1. Prof Dasgupta has agreed for Popli Memorial Lectures. Neelam will contact him and finalise the dates and topic.
2. Popli Memorial Lecture Series should be organized in last week of January or First Week of February.
3. The Google meet link for the actual lectures should be given to only selected members of faculty and guests and council members. Rest of the students and audience can be hosted in a separate meeting or the lectures can be live streamed on YouTube parallelly.
4. One student should be in charge of taking questions from the audience and putting them to the speaker
5. As soon as the topic is decided and abstract is received, posters should be made and circulated
6. Ranjan Roy Lecture: Binayyak to follow up with Prof Tobais and get a final answer
7. We also need to think about how to organize Popli Aptitude Test given the current scenario. Dr Harish will discuss this with other faculty members and let us know.
8. Meera Memorial- We will have live presentations only. The presentation can be rescheduled for people who have connectivity problems and if that doesn't work either we can go for a telephonic conversation.
9. Journal and Blog- Planning to post interviews in January, one interview will be published in the annual journal with the consent of the interviewee. A suggestion to put

up previous years question papers was given. The articles published in the journal should not be the ones already published on the blog.

10. A suggestion to put up the books and article recommendations by speakers and faculty on the blog. The idea was appreciated and can be taken forward.

Meeting #5

Meeting Details

Date: 15th February 2020
Time: 12 pm
Venue: Zoom Online Meeting

Agenda:

Preparation for the upcoming events

Minutes

Ranjan Roy

- Principal not free
- Ask Dr Cherian or Dr Phookun to introduce Ranjan Roy to audience
- Dr Cherian will welcome the guest.
- A group of people should record the questions and put it in front of speaker at the end.
- Vote of Thanks

Popli

- Fix the host.
- Ask principal to inaugurate the event and present bouquet.
- Decide the procedure.
- A moderator- to collect questions.
- HOD will introduce Popli
- Only one faculty member will speak.

For both

Do a demo run of the program, take care of synchronization.
Running both YouTube and google meet.
Make sure internet connectivity is good.
Make a co host.

Circulate a form to know how many people are willing to come to college for popli aptitude.

BUDGET REPORT 2020-2021

FUND NAME	AMOUNT AVAILABLE (in Rs)	AMOUNT SPENT (WITH PURPOSE) (in Rs)	AMOUNT LEFT (in Rs)
1. PHYSICS SOCIETY	6837	NIL	6837
2. MEERA MEMORIAL INTERACTION	46988	a) JOURNAL: 4,400	
		b) PHOTOFRAME: 700	
		c) COURIER CHARGES: 282	
		d) BOQUET: 460	

		MISCELLANEOUS: 200	
	46,988	**TOTAL: 6042**	**40,946**
3.MEERA MEMORIAL PRIZE MONEY	8448	PRIZE MONEY GIVEN TO 8 WINNERS: 4,800	
	8448	**TOTAL: 5200**	**3248**
4.POPLI FUND	4,42,429	a) HONORARI-UM: 11,000	
	4,42,429	**TOTAL: 11,000**	**4,31,429**
5.RANJAN ROY MEMORIAL	**23,000**	**NIL**	**23,000**
6. SC BHARGA-VA MEMOIRU-AL UNDER GRADUATE RE-SEARCH PRIZE	**81,481**	PRIZE MONEY GIVEN TO 2 WINNERS: 10,000	
		TOTAL: 10,000	**71,481**
3.KUMARI MEERA MEMORIAL MERIT SCHOLARSHIP	**38,520**	PRIZE MONEY GIVEN TO 4 WINNERS: 24,000	
		TOTAL: 24,000	**14,520**

Thank you.

Report By-
The Physics Society, St. Stephen's College (28/04/2021)