SPECTRUM

VOLUME–2
(2023–24)

DEPARTMENT OF PHYSICS

J S S ACADEMY OF TECHNICAL EDUCATION,
BENGALURU

JSSATE
BENGALURU

DEPARTMENT OF PHYSICS

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EDITOR

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MEMBER

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HOD PHYSICS
MEMBER

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1JS21AI043

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1JS22CI010

OM RAJ
DEPARTMENT OF CSE(AIML)
1JS21AI032

Vision and Mission of the Institute

Vision:

To be among the finest Institutions providing Engineering and Management Education empowered with research, innovation and entrepreneurship.

Mission:

- Strive towards Excellence in teaching–learning process and nurture personality development.
- Encourage Research, Innovation & Entrepreneurship.
- Train to uphold highest ethical standards in all activities.

Vision and Mission of the Department

Vision:

Creating a thrust for research with societal concern by way of clear understanding the fundamentals of science and applying it to the real-time situation.

Mission:

- To mould a budding engineer with the finer aspects of the basics of Physics.
- To explore the opportunities to innovate in contributing to the advancement of Science and Technology.

Table of Content

Editor

Dear Reader,

It is with immense pride and enthusiasm to present the second volume of Spectrum, the official newsletter of Department of Physics, JSSATE Bengaluru. This edition builds on the foundation laid by our inaugural issue, delving even deeper into the dynamic interplay between physics and engineering.

The present issue features a diverse collection of articles, from thought-provoking insights into emerging research trends to practical applications of physics in everyday engineering challenges. It also celebrates the collaborative spirit of our department, showcasing the achievements of our students and faculty alike.

On behalf of the editorial team, I extend my sincere thanks to the Principal and Management for their invaluable support in bringing out the department's newsletter. I express my sincere gratitude to the editorial team, the contributors, and everyone who helped make this volume possible. Your dedication and enthusiasm have made this endeavor a success.

I hope this edition sparks your imagination and fuels your passion for learning and exploration. Together, let us continue to celebrate the wonders of physics and its role in transforming our understanding of the universe.

Happy reading!

Dr. Abhilasha Singh
M.Sc., Ph.D (BHU)
Assistant Professor
Department of Physics
e- mail: abhilashasingh@jssateb.ac.in

Physics Department Insights

As we present the second volume of Spectrum, we take great pride in showcasing the continuous growth and achievements of the Department of Physics at JSSATE Bengaluru. The department remains a crucial bridge between the fundamental principles of physics and their transformative applications in the field of engineering.

Throughout the past year, we have reached several significant milestones, including the expansion of research initiatives, active involvement in interdisciplinary projects, and substantial contributions to academic excellence. Our dedicated faculty and engaged students persist in their commitment to exploring the dynamic and evolving domain of physics, continuously advancing the frontiers of knowledge and innovation.

With state-of-the-art laboratories and a research-oriented approach, the department plays a pivotal role in integrating theoretical insights with practical, hands-on learning. This synergy equips students with the skills necessary to address complex engineering challenges, grounded in a robust scientific foundation.

Through a range of initiatives—such as guest lectures, workshops, and research collaborations—the department continues to cultivate a culture of intellectual curiosity and critical inquiry. As we look toward the future, we remain resolutely committed to inspiring young minds, promoting pioneering discoveries, and fostering a vibrant academic community at the intersection of physics and engineering.

PHYSICS LAB AT A GLANCE

New Technical Staff

Bhaskar R, Lab Instructor

Mr. Bhaskar R has been serving as an instructor at our institute since 2017. He holds a B.E. in Mechanical Engineering from NIE-IT and joined the Physics Department in 2024. His dedication to education and commitment to his role are evident throughout his journey as an instructor. As an integral member of our team, Mr. Bhaskar R has proven to be a valuable asset to the institute. He is currently associated with the First-Year Coordinator, contributing significantly to the department's success.

SKILL LAB PROJECTS

SKILL LAB PROJECTS

The Physics department at JSSATE, Bengaluru is actively involved in enhancing the students' skills under their guidance. As part of this effort, the department has established a dedicated skill laboratory for first-year students, equipped with hands-on training materials in electronics, mechanical, and information technology etc. The training follows a structured teaching approach, supervised by faculty and designed to create an environment conducive to repeated, anxiety-free practice of targeted skills, ensuring that all students have the opportunity to perform independently.

Following the training session, the 15 students were grouped together through a random selection process. During the first and second semester of the Academic Year 2023-24, a total of 20 groups (first semester) and 32 groups (second semester) were established, with each group being assigned specific problems to work on. Each group was assigned a faculty supervisor to oversee their progress. The students collaborated within their groups, engaging in discussions with their supervisor and conducting literature reviews. They regularly visited the skill laboratory in the Department of Physics to discuss their advancements with the supervisor. The students provided weekly updates on their progress, which were then presented to the faculty. The students presented their working projects and submitted detailed project reports upon completion. Each group showcased their project in front of the supervisor and other faculty members who were invited to witness the presentations.

During the current Academic Year projects in various areas, including IoT, communication, smart technology, optics, energy storage, and Astrophysics were allocated. The following provides the details of the projects:

Domain of Skill Lab Projects

Optics

- Laser Security System
- Pinhole Camera
- Fingerprint Sensor
- Understanding stellar Motion, Parallex Shifts, and Spectral Variabiality with Simbad
- Plastoscope
- Fingerprint Biometric Attendance System using Arduino
- Newtonian Reflecting Telescope
- Automated Solar Tracking System
- Solar Powered Air Cooler

Domain of Skill Lab Projects

Electro-Magnetism

- Wireless Power Transfer on Road for Electric Vehicle
- Accelerator Using Electromagnetic Induction
  Fingerprint Sensor
- Wireless EV Power Station
- Sound to Electricity Converter

Semiconductor Physics

- Temperature and Humidity Sensing and Display

Domain of Skill Lab Projects

Electronics

- Reduction of Traffic Congestion and smooth movement of vehicles
- Arduino Voice Assisted Fire Extinguishing Power
- Ultrasonic Distance measuring Device
- Smart Rainwater Harvesting
- Obstacle Avoider
- Smart Bridge
- Automatic Plant Watering System
- Ultrasonic Radar System and Laser Home Security System Using Sensors
- Moisture Detection Automatic Watering System
- Flame Detection System

Domain of Skill Lab Projects

Electronics

- Ultrasonic Radar
- Hazardous Gas Detection and Alarming System
- Measurement of Distance Using Ultrasonic Sensor
- Counter objects with calculator and laser beam
- Advance Parking System
- Smart Shoe
- Arduino based Water level Controller
- LPG Gas Leakage Detector
- Automatic Street Light Sensor
- Temperature based fan Control and Monitoring using Arduino
- Automated Toll gate barrier
- Smart Farming System

Domain of Skill Lab Projects

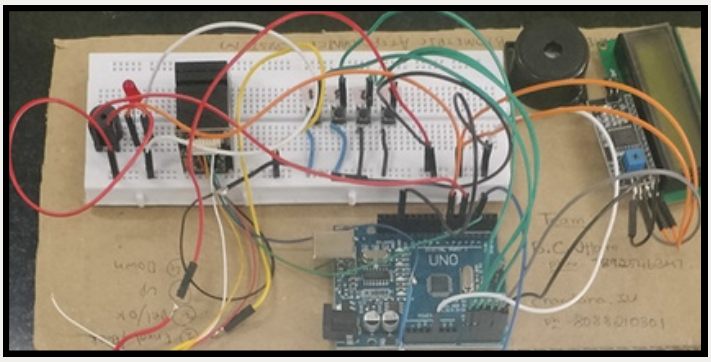
Mechanics

- Human Following Robot Using Arduino
- Hydraulic Jack
- Embedding Artificial Thermoregulation in Clothing
- Multifunctional Robot using Arduino
- Roof Retraction System
- Drip Irrigation Systems
- Power Generation By Speed Breakers
- River Boat Cleaner
- Automatic Plant Watering System
- Arduino Line Follower Car at Home
- Automatic Pothole Filler
- Manual 3- Speed Simple Gear Box
- Automatic Railway Gate
- Van de Graff Generator

Fingerprint Biometric Attendance System Using Arduino:

Planned and executed by: B C Uttam and team (CSE A Section)
Supervised by: Dr. Abhilasha Singh

The Fingerprint Sensor Based Biometric Attendance System designed by second-semester students from CSE-A is an innovative solution for accurate and efficient attendance tracking. This system utilizes an Arduino microcontroller, coupled with a fingerprint sensor, LCD display, and RTC (Real-Time Clock) module.

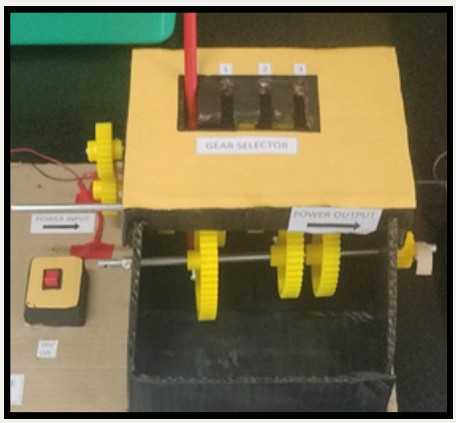


When a user scans their fingerprint, the system authenticates the identity and records the attendance data along with the timestamp provided by the RTC module. The use of biometric fingerprint technology ensures a high level of security and eliminates the possibility of proxy attendance. This project demonstrates the students' ability to integrate hardware components with software programming, offering a practical application that can be utilized in educational institutions, workplaces, and other sectors requiring reliable attendance management.

Manual 3: Speed Simple GearBox:

Planned and executed by: Daksh Sahu and team (ISE A Section)
Supervised by: Mr.Mohanakumara LB

This project was undertaken by second-semester students from Information Science and Engineering (ISE-A). The students successfully fabricated a functional gearbox, which plays a crucial role in various applications such as vehicles, machinery, and industrial equipment.



The gearbox is essential for efficiently transferring and controlling power between components. The students performed detailed calculations for gear ratios, rotations per minute (RPM), and torque output for the first, second, and third gears.

This involved understanding the mechanical principles and engineering design processes to ensure optimal performance and reliability. The successful completion of this project showcases the students' ability to apply theoretical knowledge to practical challenges, demonstrating their proficiency in mechanical engineering and design.

Portable Microscope (Plastoscope):

Planned and executed by: Manoj DS and team (CSE B Section)
Supervised by: Dr. Shashidhar R

The students from CSE-B designed a plastoscope for analyzing the internal structure and detecting defects in plastic materials, which is valuable in manufacturing, engineering, and materials science. Operating on the principle of polarized light examination, they fabricated this device using a plastic water bottle, a 100X power lens, and a 15X eyepiece. The plastoscope project provides a comprehensive platform for understanding the scale and impact of plastic waste, demonstrating the power of data-driven approaches and collective action in addressing environmental challenges. This innovative device not only aids in quality control and research but also emphasizes the importance of sustainable practices by repurposing common plastic waste materials in its construction. The project highlights the students' creativity and commitment to leveraging technology for environmental sustainability.

Pinhole Camera:

Planned and executed by: Shreya BS and team (CSE C Section)
Supervised by: Dr. Nityanand Choudhary

The students from CSE-C have constructed a functional pinhole camera to study the behavior of light and image formation. Unlike modern cameras that rely on complex lenses and digital sensors, a pinhole camera uses a small aperture to project an image onto a surface inside a darkened enclosure. They fabricated this camera using a cardboard box, black paper, and a pin.

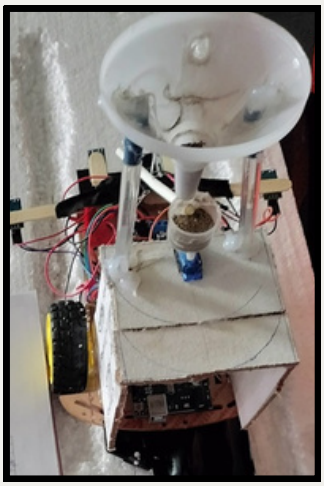
Pinhole cameras can be used to observe solar eclipses and are valuable in classrooms for teaching basic principles of optics, such as light travel, image formation, and the effects of aperture size on image clarity. This project allows students to explore fundamental concepts of physics and optics through hands-on experimentation, fostering a deeper understanding of how light interacts with objects and how images are formed.

The simplicity and effectiveness of the pinhole camera make it an excellent educational tool for demonstrating the principles of light behavior in a tangible and engaging manner.

Automatic Pothole Filler:

Planned and executed by: Shreya Shetty and team (ISE C Section)
Supervised by: Ms. Sushma KC

This project was designed and executed by second-semester students from ISE-C. The students developed an Automatic Pothole Filler that detects and fills holes or gaps on a surface without human intervention. The system was constructed using Arduino Uno, IR sensors, an L298N motor driver, and a reliable power supply.



This innovative solution not only extends the lifespan of pathways by addressing issues before they escalate but also reduces the need for manual labor, thereby cutting costs and enhancing safety for maintenance workers. By automating the process of pothole detection and filling, the project demonstrates a practical application of robotics and sensor technology in civil infrastructure maintenance. The success of this project highlights the students' ability to integrate multiple technologies to solve real-world problems efficiently and effectively.

Arduino Line Follower Car at Home:

Planned and executed by: Shraddha Baidya and team (AIML Section)
Supervised by: Dr. Prasanna Kumara S

The students from the AIML group have designed a line-following robot that detects a black line to navigate over a bright surface. They constructed the robot using an Arduino Nano, a microcontroller, and infrared sensors. The infrared sensors detect the black line and send signals to the Arduino, which controls the robot's movement.

This project serves as a miniature model for understanding automated guided vehicles (AGVs) and their basic navigation principles. The line-following robot demonstrates the application of sensor technology and programming in robotics, providing a foundation for more complex autonomous systems. Through this project, students gain hands-on experience in robotics, automation, and the integration of hardware and software components, preparing them for future advancements in AI and machine learning-driven technologies.

Ultrasonic Radar:

Planned and executed by: Abhinav Chandra HS and team (AIML Section)
Supervised by: Dr. Prasanna Kumara S

The students from the AIML branch have designed a radar system using Arduino, a servometer, and an ultrasonic sensor. This system detects the position and distance of obstacles in its path and converts this information into a visually representable format. It can be used in robotics for object detection and for intrusion detection to identify the location and size of objects. By rotating the ultrasonic sensor with the servometer, the radar system scans the surroundings and creates a map of detected objects, displaying the information in a user-friendly visual format. This project showcases the students' ability to integrate sensor data with real-time processing and visualization, providing valuable insights into the principles of radar technology and its applications in various fields. The radar system serves as a practical tool for enhancing the capabilities of autonomous robots and improving security systems through precise object detection and tracking.

Flame Detection System:

Planned and executed by: Rakshitha B and team (CSE C Section)
Supervised by: Dr. Nityanand Choudhary

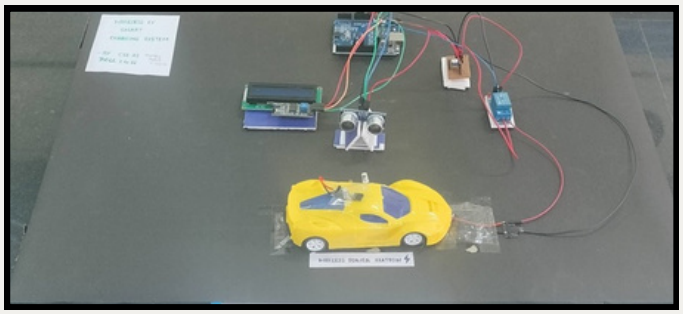
The students from CSE-C of the second semester have designed a flame detector using Arduino and a flame sensor to detect flames or fires. This system operates by sensing the infrared radiation emitted by a flame, allowing it to quickly and accurately identify the presence of a fire. The flame detector can be used in gas-powered appliances, furnaces, and fire detection systems, providing an essential safety measure to prevent potential hazards.

By integrating the flame sensor with an Arduino, the students have created a reliable device that enhances the safety of individuals and property. This project demonstrates the practical application of sensor technology in ensuring safety and underscores the importance of early fire detection in mitigating risks and protecting lives and assets.

Wireless EV Power Station:

Planned and executed by: Ananya SR and team (CSE A Section)
Supervised by: Dr. Abhilasha Singh

The students from CSE-A undertook a project on a Wireless EV Power Station, utilizing Arduino Uno, an LCD display, an ultrasonic sensor, and a Tesla coil. This innovative project explores a transformative approach to charging electric vehicles through electromagnetic fields, as opposed to traditional plug-in methods. The wireless power station transfers energy between a ground-based charging pad and a receiver mounted on the vehicle, offering a hassle-free and efficient charging solution.



By leveraging the principles of electromagnetic induction, the project aims to enhance the convenience and accessibility of EV charging infrastructure.

The integration of an Arduino Uno and ultrasonic sensor allows for precise alignment and optimal energy transfer, while the LCD display provides real-time feedback on the charging status. This project not only demonstrates the students' proficiency in combining hardware and software components but also contributes to the advancement of sustainable transportation technologies.

Solar Powered Air Cooler:

Planned and executed by: N Mithun and team (ISE A Section)
Supervised by: Mr. Mohanakumara LB

The students from ISE-A executed a project titled “Solar Powered Air Cooler.” They constructed a temperature-controlled, solar-powered portable fan using a solar panel, temperature sensor, Arduino boards, and a controller. This innovative solar-powered cooler offers a sustainable and cost-effective solution for cooling needs across various applications. By harnessing renewable solar energy, it reduces reliance on traditional electricity sources, leading to lower energy bills and a decreased environmental impact. The system's temperature sensor ensures optimal cooling by adjusting the fan speed based on the ambient temperature, providing a comfortable and energy-efficient cooling experience. This project highlights the students' commitment to sustainable technology and their ability to integrate renewable energy sources with modern electronics to address real-world challenges.

Smart Shoe:

Planned and executed by: Kushal G and team (CSE C Section)
Supervised by: Dr. Shashidhar R

This project was executed by second-semester Computer Science and Engineering (CSE-B) students. The students have designed “Smart Shoes” using Arduino Uno and Nano along with ultrasonic sensors. The major features of this project include a GPS tracker, obstacle detector, and pedometer. Smart Shoes hold significant potential for the blind by providing sophisticated GPS navigation, enabling them to navigate their surroundings with greater ease and independence.

For women, these innovative shoes prioritize personal security with embedded panic buttons and GPS tracking, ensuring safety in various situations. Additionally, the shoes offer comprehensive health monitoring for fitness and vital signs, aiding in personal health management.

The customizable designs elegantly merge technology with fashion, making the Smart Shoes both functional and stylish.

This project exemplifies the students' ability to integrate multiple technologies into a wearable device that addresses various needs, from navigation assistance to personal safety and health monitoring.

DEPARTMENT ACTIVITIES

Research Excellence

Congratulations

Heartiest congratulations to Ms. Sushma KC on achieving her Ph.D. in the academic year 2023-24!

RESEARCH EXCELLENCE

Mr. Anand B.C

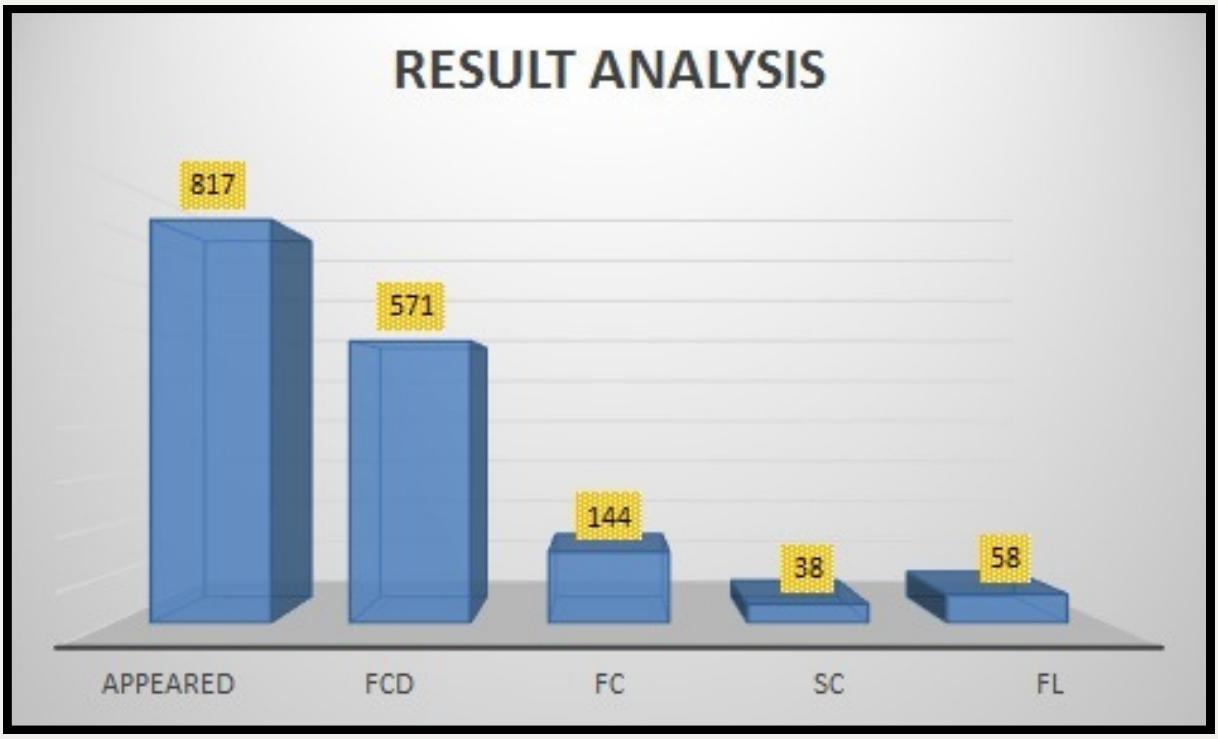
Heartiest congratulations to Mr. Anand B.C on achieving his Ph.D. from Department of Physics under the supervision of Dr.Shashidhar R (Guide) and Dr. Nityanand Choudhary (Co-Guide) in the academic year 2023-24!

Faculty Publications (2023-24)

- **Shashidhar R**, Influence of isochronical heat treatment on spray-deposited mixed phase tin based thin films for ammonia gas sensor applications, Results in Surfaces and Interfaces, https://doi.org/10.1016/j.rsurfi.2024.100348
- **Nityanand Choudhary**, Detection and Enhancement of latent fingerprint by powder method using bio-stnthesized spherical-shaped bismuth oychloride nanoparticles, Nursing Research and Practice, 10.21203/rs.3.rs-4685142/v1.
- **Abhilasha Singh**, Investigation of electro-optical and dielectric properties of pure and dispersed nematic liquid-crystal, Liquid Crystals, https://doi.org/10.1080/02678292.2024.2369957.
- **Abhilasha Singh**, Thermodynamic model for electro-optical properties of antiferroelectric phase in mesogen W-330-3 and W-331-3, Soft Materials, https://doi.org/10.1080/1539445X.2024.2360010.
- **Shashidhar R**, Influence of air annealing on the microstructural, morphological, compositional, optical and electrical properties of spray deposited CuO thin flms and their utility as MOM gas sensors, Emergent Materials, https://doi.org/10.1007/s42247-024-00738-6.
- **Shashidhar R**, Effect of post air annealing on the characteristics of spray deposited ZnO thin films and their use as MOS Ethanol gas sensor, Indian Journal of Pure and Applied Physics, https://doi.org/10.56042/ijpap.v62i3.6789.
- **Prasanna Kumar S**, Studies on the Incoherent scattering of some Steel alloys for Compton Effect in the incident angular range 600-1000, Aegaeum Journal, Volume:12, Issue 2, 2024, pp 43-46.

Academic Excellence

Analysis of Physics Results for the Academic Year 2023-24

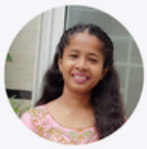


Academic Excellence

Academic Excellence

A significant number of students have achieved exceptional success in the first and second semester of the 2023-24 academic year. The majority have earned impressive distinction marks, reflecting their dedication and mastery of the subject.

Harshini N
1JS23EC082
95



Rakshitha Naik
1JS23EC116
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Chinmay S Patil
1JS23EC026
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Anika Ragini Murthy
1JS23EI004
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Shreya S
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Yeshas U
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Chandushree S
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Manjula
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Likhitha M S
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Shravya S
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Shrishthi G
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Avinash P
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Chaitanya UR
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Toppers in Physics 2nd Sem Examination, July 2024

Appeared: 478
Pass: 470
FCD: 415
FC: 46
Pass %: 98.32

Club of 90
131

Pruthvi Upadhya
1JS23CS121
100 Marks

Moksha L S
1JS23CS093
100 Marks

Meghana Y R
1JS23CS087
100 Marks

Bhoomika B R
1JS23IS030
100 Marks

Shubham Vatsa
1JS23IS163
100 Marks

Chindanuru Sanjana
1JS23CS034
99 Marks

Abhishek R
1JS23CS004
99 Marks

Siri V
1JS23CS164
99 Marks

Varsha G
1JS23IS183
99 Marks

Monica C R
1JS23CI051
99 Marks

Anurag Jaiswal
1JS23IS015
99 Marks

Amulya M
1JS23CS008
98 Marks

Challa Harshitha
1JS23CS026
98 Marks

Rakshitha B
1JS23CS130
98 Marks

Kushal Gowda L
1JS23IS073
98 Marks

Harshitha D S
1JS23IS055
98 Marks

Mouriya R
1JS23IS095
98 Marks

Industrial Visit

Title: **Educational Visit to IISc Bengaluru**
Date: February 24, 2024
Venue: IISc. Bengaluru

Participants:
30 students from ECE, EIE, ME&RA

Faculty Coordinators:
Dr. Abhilasha Singh and Mr. Mohanakumara LB

Departments Visited:

- Centre for infectious diseases
- Centre for Sustainable Technologies (CST)
- Centre for High Energy Physics
- Centre for Atmospheric and Oceanic Sciences
- Developmental Biology and Genetics
- Electronics Communication Engineering Department
- SPS Lab
- Centre for NanoScience and Engineering (CeNSE)

Learning Highlights:

Participants gained insights into:

- Various viruses and bacteria causing infectious diseases
- Sustainable technologies for eco-friendly buildings and waste management
- Concepts related to high-energy physics including gravity, black holes, and the universe's building blocks
- Principles of genetics and developmental biology

- Advanced technologies in electrical communication engineering such as 5G
- Cutting-edge research in nanoscience and engineering including graphene applications and diamond growth mechanisms.

Training Programme for Instructors

Title:Training program:I-STEM / I-RISE - OTT (Operator Teaching & Training)

Date: June 21, 2024

Venue: RVCE Bengaluru in association with I-STEM, Govt. of India

Participant: Ms.Jyothi HR, Instructor, Physics

I-STEM (India Science, Technology & Engineering Facilities Map), an initiative by the Government of India, in collaboration with RV College of Engineering, Bangalore, organized a one-day training programme of the I-RISE/OTT (Operator Teaching & Training) Series for 40 participants. This program aims to empower equipment operators in engineering, agriculture, medical, science, and polytechnic institutions.

As part of the training, Ms. Jyothi HR gained hands-on experience with advanced characterization tools, including solar simulators, FTIR spectrophotometers, XRD profilometers, nano-indenters, and scanning near-field optical microscopes (SNOM, RAMAN, and AFM).

National Science Week and Science Day
JSSATE, Bengaluru

Date: 27th March to 6th April 2024
Participants:1st Year BE Students (700)
Faculty Coordinator: Dr. Abhilasha Singh
Resource Person with Designation:

- Dr. B R Guruprasad, Director, Jawaharlal Nehru Planetarium, Bengaluru
- Mr. Rajeev Deekshit, CMD, Pyro eco-green technologies PVT Ltd, Bengaluru

To honor the discovery of the Raman Effect by Nobel Laureate and renowned physicist, Dr. C.V. Raman, the Department of Physics and Chemistry organized a week-long National Science Day celebration. The events were held from 27th March to 3rd April 2024 and comprised various competitions and activities on the theme (Indigenous Technologies for Viksit Bharat)

Competitions and Activities:

- Essay Writing
- Technical Talks
- Science Quiz
- Poster Presentations
- Working Models

Expert Talk

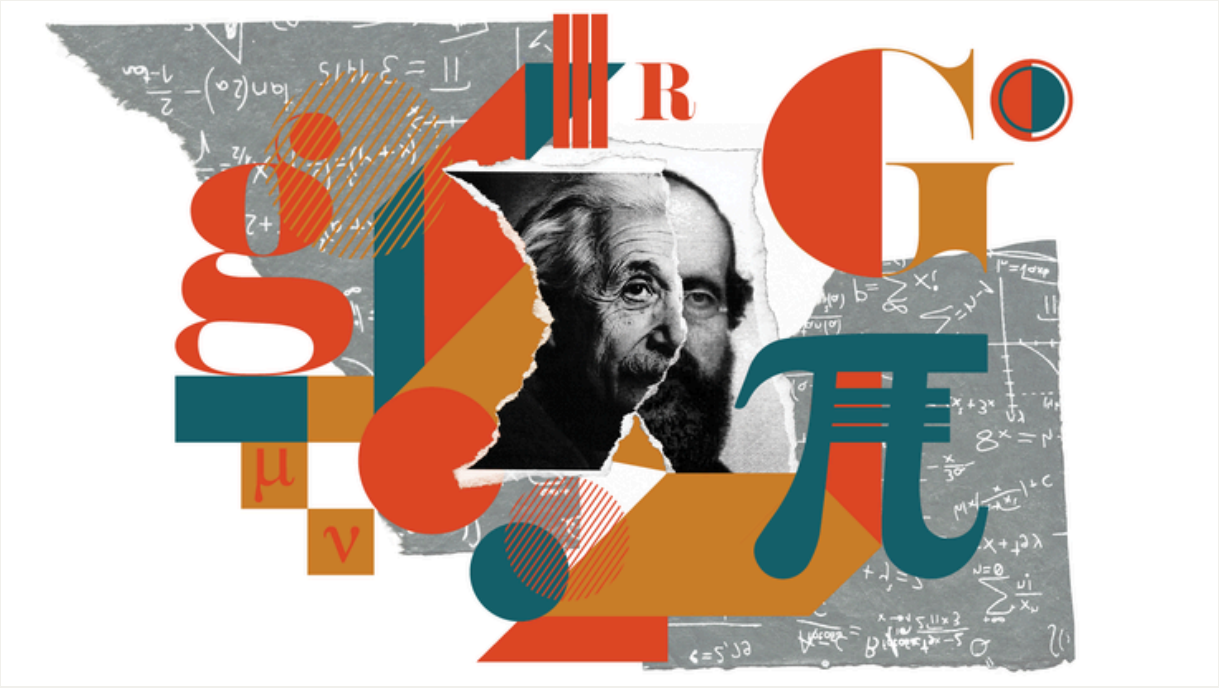
- Date: 5th April 2024
- Speaker: Dr. B. R. Guruprasad, Director, Jawaharlal Nehru Planetarium
- Topic: “India’s Historic Achievements: Chandrayaan-3, Aditya, and Xposat”
- Description: The talk showcased India’s significant achievements in space science and technology, highlighting missions like Chandrayaan-3, Aditya, and Xposat. Dr. Guruprasad's insights aimed to inspire and educate attendees about India's advancements and contributions to space exploration.

- Date: 6th April 2024
- Speaker: Mr. Rajeev Deekshit, CMD, Pyro Eco-Green Technologies Pvt Ltd, Bengaluru
- Topic: “Waste to Wealth”
- Description: Mr. Deekshit addressed the students, discussing green methods of turning waste into valuable resources. His talk emphasized promoting environmental sustainability and economic benefits through innovative waste management techniques.

Expert Talk on "Telescope making workshop"

- Date: 22nd August 2024
- Speaker: Dr. Shashidhar R, Associate Professor & HOD, Department of Physics, JSSATE Bengaluru
- Participants: Students of JSS School, Ganakal, Bengaluru
- Description: As part of the National Space Day celebration, the JSS Academy of Technical Education (JSSATE), Bengaluru, organized a telescope-making workshop on the 22nd of August 2024. The event was held at the Physics Lab from 2.00 to 4.00 pm. Dr. Shashidhar R, an expert in the field, provided hands-on guidance to the participants, sharing his knowledge on telescope construction and its applications in space observation.

ARTICLES



The War Against Digital Fraud: Recent Arrests, Trends, and Precautionary Steps

Dr.Nityanand Choudhary
Professor(Physics) and
First-Year Coordinator

In the rapidly evolving digital landscape, fraud has taken on new and more sophisticated forms. As the world becomes increasingly dependent on digital transactions, the vulnerabilities in the system grow. Digital fraud, which encompasses various types of financial fraud and cybercrime, has surged with the rise of online banking, e-commerce, and digital currencies. The recent increase in digital fraud cases has brought attention to the severity of this issue, with law enforcement agencies taking substantial steps to address it, including high-profile arrests. Understanding the nature of digital fraud, the recent arrests, and the precautions individuals and businesses can take is essential for mitigating these risks.

Understanding Digital Fraud

Digital fraud refers to the illegal use of online platforms to deceive individuals or organizations for financial gain. It can take many forms, including identity theft, phishing, credit card fraud, account takeovers, and cyber extortion. Fraudsters exploit vulnerabilities in digital systems, taking advantage of both technological weaknesses and human error.

Some of the most common forms of digital fraud include:

Phishing: Fraudsters send deceptive emails or messages that appear to come from legitimate sources, such as banks or service providers, in an attempt to steal sensitive information like passwords or credit card numbers.

Account Takeovers: Cybercriminals gain unauthorized access to user accounts, often through stolen credentials, and use them to transfer funds or make purchases.

Credit Card Fraud: Criminals use stolen credit card information to make unauthorized transactions, often online.

Ransomware: Hackers encrypt a victim's files and demand a ransom, usually paid in cryptocurrency, for their release.

Cryptocurrency Fraud: Scams involving fake investment opportunities, Ponzi schemes, and other fraudulent activities tied to digital currencies.

As the digital economy grows, so too does the sophistication of fraudsters. They employ techniques like social engineering and advanced hacking tools to bypass security measures and exploit unsuspecting victims. According to reports, losses due to cybercrime are expected to reach trillions of dollars in the coming years, highlighting the importance of heightened awareness and improved cyber security practices.

The Table 1 and 2 below reflects key statistics and trends in the rise of digital fraud, including types of fraud, financial losses, methods used by criminals, and the effectiveness of prevention strategies.

Table 1: Types of the Digital Fraud

Fraud Type	Description	Percentage of Total Frauds (2023)	Recent Trends
Phishing	Fraudsters impersonate trusted entities to steal credentials or sensitive information	35%	Significant rise in COVID-19-related scams and tax-related phishing
Account Takeovers	Unauthorized access to accounts using stolen credentials	28%	Increased use of stolen data from data breaches

Table 1: Types of the Digital Fraud

Fraud Type	Description	Percentage of Total Frauds (2023)	Recent Trends
Ransomware	Malicious software that encrypts files for ransom payment	18%	Increasing targeting of critical infrastructure and healthcare
Credit Card Fraud	Use of stolen card details for unauthorized purchases	12%	Surge in online card-not-present fraud
Cryptocurrency Fraud	Fraudulent schemes involving digital currencies	7%	Increase in Ponzi schemes, fake ICOs, and scams related to crypto investments

Table 2: Methods of Digital Fraud

Method	Description	Impact on Victims	Example Case/Trend
Phishing Emails	Deceptive emails that mimic trusted sources to gather sensitive data	Financial loss, identity theft	Fake emails from "bank" asking for account verification
Social Engineering	Manipulating individuals into divulging confidential information	Loss of personal data or finances	Fraudulent calls pretending to be from customer support
Malware (Ransomware)	Malicious software encrypts files and demands ransom payment	Loss of data, financial disruption	Attacks on schools, hospitals, and municipalities
Data Breach	Large-scale theft of personal or financial data from organizations	Identity theft, account takeovers	Data leaks from major social media platforms and retailer

Recent Digital Fraud Arrests

Recent arrests related to digital fraud have shed light on the severity of this issue and the measures being taken by law enforcement to combat cybercrime. One notable case involved the arrest of a major international fraud ring operating through phishing campaigns. The group was responsible for stealing millions of dollars from unsuspecting victims by impersonating banks and government agencies. Authorities in multiple countries coordinated efforts to take down the network, arresting individuals involved in different roles, from hackers to money launderers.

In another case, an individual was arrested for operating a large-scale account takeover scam. By using stolen login credentials from data breaches, the perpetrator gained access to thousands of victims' online accounts and used their funds for personal gain. The arrest followed a thorough investigation that included tracing the funds, analyzing the techniques used by the fraudsters, and identifying the members of the crime network.

These arrests serve as a stark reminder that digital fraud is not just a minor crime-it’s a serious global issue with widespread implications for individuals, businesses, and governments alike. Law enforcement agencies worldwide are stepping up efforts to track down perpetrators, dismantle criminal networks, and prevent further losses.

Precautions Against Digital Fraud

As digital fraud becomes more prevalent, both individuals and organizations need to adopt proactive measures to safeguard themselves against falling victim to these crimes. Here are some key precautions to consider:

1.Strong Passwords and Multi-Factor Authentication (MFA)

One of the most fundamental steps in protecting personal and business accounts is using strong, unique passwords for each account. Weak passwords are one of the easiest ways for cybercriminals to gain access to sensitive data. A good password should be long, include a mix of uppercase and lowercase letters, numbers, and special characters, and avoid easily guessable information like birthdays or common words.

In addition to strong passwords, enabling Multi-Factor Authentication (MFA) adds an extra layer of security. MFA requires users to provide two or more forms of identification before accessing an account, such as a combination of something they know (password) and something they have (mobile phone for receiving a one-time passcode).

2. Be Cautious with Emails and Links

Phishing attacks are among the most common ways fraudsters gain access to sensitive information. To protect yourself from phishing, avoid clicking on links or downloading attachments from unsolicited emails. If you receive an email from what appears to be a legitimate institution, such as a bank, always verify its authenticity by contacting the institution directly.

3. Monitor Accounts Regularly

Frequent monitoring of bank and credit card accounts can help detect fraudulent activity early. Many financial institutions offer alerts for transactions, which can help customers spot any unusual activity promptly. It’s also important to keep an eye on credit reports to ensure that no unauthorized accounts or credit lines are opened in your name.

4. **Use Antivirus Software and Keep Systems Updated**

Installing reputable antivirus software and ensuring that all systems and devices are updated regularly can help protect against malicious software, such as ransomware and spyware. Cybercriminals often exploit vulnerabilities in outdated software to carry out attacks.

5. **Educate Employees and the Public**

For businesses, educating employees on the risks of digital fraud and how to spot potential scams is essential. Regular training sessions on recognizing phishing attempts, securing work accounts, and maintaining data privacy are key to preventing insider threats and external attacks.

In addition to internal training, public awareness campaigns that educate consumers about common digital fraud schemes can also reduce the likelihood of individuals falling victim to scams.

Conclusion

Digital fraud is a significant and growing threat in today's interconnected world. The rise in online transactions, digital banking, and e-commerce has provided ample opportunities for cybercriminals to exploit weaknesses in security systems. Recent high-profile arrests related to digital fraud demonstrate that authorities are cracking down on cybercrime, but the responsibility to protect oneself also lies with individuals and organizations. By adopting best practices such as using strong passwords, enabling MFA, being cautious with emails, and monitoring accounts regularly, individuals can reduce their risk of falling victim to fraud. As technology continues to evolve, so too must our strategies for combating digital fraud to stay one step ahead of cybercriminals.

Time travel and gateway to stars: Can the answer be wormholes?

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Ever wondered how Doraemon's time-machine worked? Ever been fascinated by the idea of going back in time? Can we really reach distinct stars that are lightyears away for us?

Time travel is the concept of moving between different points in time, just like you move between different places. In movies, you might have seen characters using special machines, magical devices or even hopping into a futuristic car to travel backward or forward in time. But is this just a fun idea for movies, or could it really happen?

We believe that time is "irreversible", According to laws of thermodynamics, the universe can never go back exactly to how it was before. Time can only go forward, like a one-way street.

Time is relative

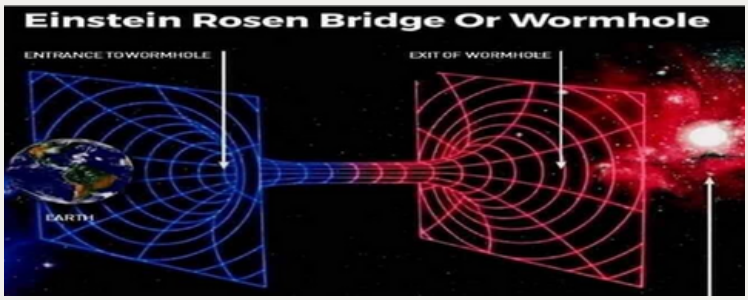
However, physicist Albert Einstein's theory of special relativity suggests that time passes at different rates for different people. Someone speeding along on a spaceship moving close to the speed of light – 671 million miles per hour! – will experience time slower than a person on Earth.

People have yet to build spaceships that can move at speeds anywhere near as fast as light, but astronauts who visit the International Space Station orbit around the Earth at speeds close to 17,500 mph. Astronaut Scott Kelly has spent 520 days at the International Space Station, and as a result has aged a little more slowly than his twin brother – and fellow astronaut – Mark Kelly. Scott used to be 6 minutes younger than his twin brother. Now, because Scott was traveling so much faster than Mark and for so many days, he is 6 minutes and 5 milliseconds younger.

What is Einstein-Rosen bridge?

In 1935, Einstein and physicist Nathan Rosen used the theory of general relativity to elaborate on the idea, proposing the existence of "bridges" through space-time. These bridges connect two different points in space-time, theoretically creating a shortcut that could reduce travel time and distance. The shortcuts came to be called Einstein-Rosen bridges, or wormholes.

Everybody's favourite astronomical mystery: Blackholes–They have a point of infinite density, known as the singularity, in their centres. They are surrounded by a boundary called the event horizon.



The event horizon doesn't exist in the same way that the surface of a planet exists. Instead, it's just a mathematical line in the sand that tells you one thing: If you cross within that special distance, you are trapped forever, because you'll have to travel faster than the speed of light to escape. All things that cross the event horizon will never escape back into the universe – things go in and never come out. Mathematically we can also define the polar opposite of a black hole, which is conveniently called a White hole. White holes also have a singularity, but their event horizons act differently. Anything already on the outside of a white hole (like, the entire universe) can never, ever cross within it, no matter how hard it tries. And anything already inside the white hole will find itself ejected from it faster than the speed of light. Now when we take a black hole and a white hole and connect their singularities together, we get an entirely new kind of object: an Einstein-Rosen bridge, better known as a wormhole.

Time travel and gateway to stars:
Can the answer be wormholes?

Wormholes are essentially hollow tubes through space and time that can connect very distant regions of the universe. A star may be thousands of light-years away, but a wormhole can connect that star to us with a tunnel only a few steps long. Wormholes also have the somewhat mystical ability to allow backwards time travel. If you take one end of the wormhole and accelerate it to a speed close to that of light, it will experience time dilation — its internal "clock" will run slower than the rest of the universe. That will cause the two ends of the wormhole to no longer be synchronized in time. Then you could walk in one end and end up in your own past.

Can Humans Travel Through Wormholes?

There's just one, problem with this setup: Einstein-Rosen bridges are indeed wormholes, but the entrance to the wormhole sits behind the black hole event horizon. And the number one rule of black hole event horizons is that once you cross them, you're never allowed to escape. Ever. Once you pass through a black hole event horizon, you are forced towards the singularity, where you are guaranteed to meet your gruesome end. In other words, once you enter an Einstein-Rosen bridge, you will never escape.

So, the unfortunate truth with Einstein-Rosen bridges is that while they appear to be magical doorways to distant reaches of the universe, they are just as deadly as black holes.

There have been attempts to stabilize Einstein-Rosen bridges and make them traversable by somehow getting their entrances to sit outside the event horizon. So far, the only way we know how to do this is with exotic matter. If you threaded the wormhole tunnel with matter that had negative mass, then in principle you could have a not-deadly-at-all wormhole. But negative matter does not appear to exist in the universe, and so our wormhole — However, wormholes remain theoretical: Scientists have yet to spot one. It also looks like it would be incredibly challenging to send humans through a wormhole space tunnel — and time travel dreams will have to remain as mere mathematical fantasies.

Time travel and gateway to stars:
Can the answer be wormholes?

How gravity actually works

Einstein's Theory of Gravity

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Newton's law of universal gravitation accurately predicts much of what we see within our solar system. Indeed, only Newton's laws have been needed to accurately send every space vehicle on its journey. The paths of Earth-crossing asteroids, and most other celestial objects, can be accurately determined solely with Newton's laws. Nevertheless, many phenomena have shown a discrepancy from what Newton's laws predict, including the orbit of Mercury and the effect that gravity has on light. In this section, we examine a different way of envisioning gravitation.

A Revolution in Perspective

In 1905, Albert Einstein published his theory of special relativity. This theory is discussed in great detail in relativity in the third volume of this text, so we say only a few words here. In this theory, no motion can exceed the speed of light-it is the speed limit of the Universe. This simple fact has been verified in countless experiments. However, it has incredible consequences-space and time are no longer absolute. Two people moving relative to one another do not agree on the length of objects or the passage of time. Almost all of the mechanics you learned in previous chapters, while remarkably accurate even for speeds of many thousands of miles per second, begin to fail when approaching the speed of light.

A second assumption also appears in Newton's law of gravitation. The masses are assumed to be exactly the same as those used in Newton's second law, F=ma. We made that assumption in many of our derivations in this chapter. Again, there is no underlying principle that this must be, but experimental results are consistent with this assumption. In Einstein's subsequent theory of general relativity (1916), both of these issues were addressed. His theory was a theory of space-time geometry and how mass (and acceleration) distort and interact with that space-time.

The Principle of Equivalence

Einstein came to his general theory in part by wondering why someone who was free falling did not feel his or her weight. Indeed, it is common to speak of astronauts orbiting Earth as being weightless, despite the fact that Earth's gravity is still quite strong there. In Einstein's general theory, there is no difference between free fall and being weightless. This is called the principle of equivalence. The equally surprising corollary to this is that there is no difference between a uniform gravitational field and a uniform acceleration in the absence of gravity. Let's focus on this last statement. Although a perfectly uniform gravitational field is not feasible, we can approximate it very well. Within a reasonably sized laboratory on Earth, the gravitational field g is essentially uniform.

The corollary states that any physical experiments performed there have the identical results as those done in a laboratory accelerating at a=g in deep space, well away from all other masses.

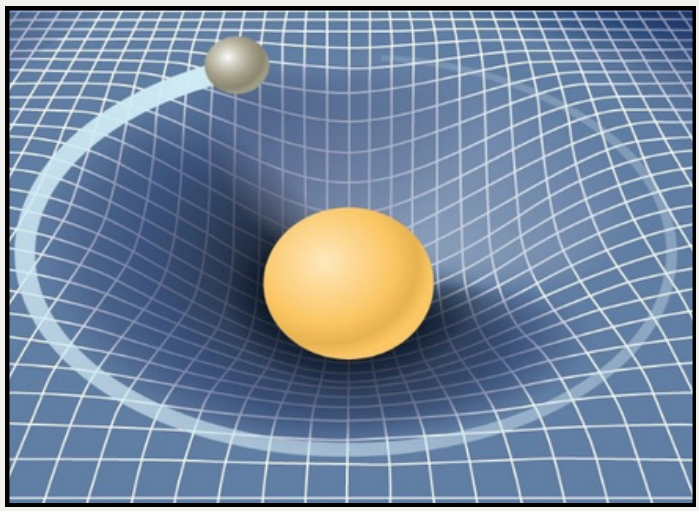
A Geometric Theory of Gravity

Euclidian geometry assumes a "flat" space in which, among the most commonly known attributes, a straight line is the shortest distance between two points, the sum of the angles of all triangles must be 180 degrees, and parallel lines never intersect. Non-Euclidean geometry was not seriously investigated until the nineteenth century, so it is not surprising that Euclidean space is inherently assumed in all of Newton's laws.

The general theory of relativity challenges this long-held assumption. Only empty space is flat. The presence of mass—or energy, since relativity does not distinguish between the two—distorts or curves space and time, or space-time, around it. The motion of any other mass is simply a response to this curved space-time. It is a two-dimensional representation of a smaller mass orbiting in response to the distorted space created by the presence of a larger mass.

How gravity actually works

In a more precise but confusing picture, we would also see space distorted by the orbiting mass, and both masses would be in motion in response to the total distortion of space. Note that the figure is a representation to help visualize the concept. These are distortions in our three-dimensional space and time. We do not see them as we would a dimple on a ball. We see the distortion only by careful measurements of the motion of objects and light as they move through space.

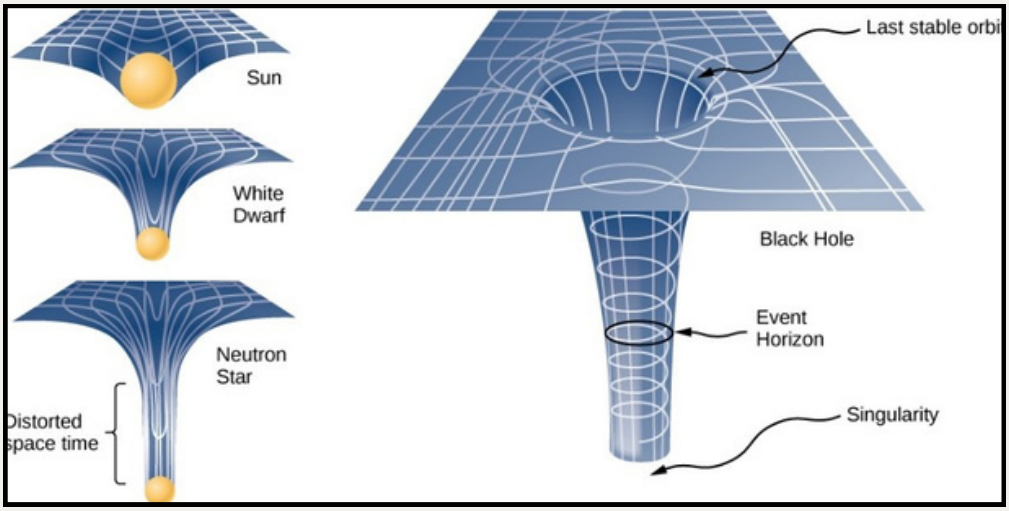


For weak gravitational fields, the results of general relativity do not differ significantly from Newton's law of gravitation. But for intense gravitational fields, the results diverge, and general relativity has been shown to predict the correct results. Even in our Sun's relatively weak gravitational field at the distance of Mercury's orbit, we can observe the effect.

The Event Horizon

The Schwarzschild radius is also called the event horizon of a black hole. We noted that both space and time are stretched near massive objects, such as black holes. This illustrates that effect on space. The distortion caused by our Sun is actually quite small, and the diagram is exaggerated for clarity. Although the distortion of space-time at the surface of a neutron star is very high, the radius is still larger than its Schwarzschild radius. Objects could still escape from its surface.

However, if a neutron star gains additional mass, it would eventually collapse, shrinking beyond the Schwarzschild radius. Once that happens, the entire mass would be pulled, inevitably, to a singularity. In the diagram, space is stretched to infinity. Time is also stretched to infinity. As objects fall toward the event horizon, we see them approaching ever more slowly, but never reaching the event horizon. As outside observers, we never see objects pass through the event horizon—effectively, time is stretched to a stop.



How gravity actually works

Time Crystals in Quantum Computers

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There is a huge global effort to engineer a computer capable of harnessing the power of quantum physics to carry out computations of unprecedented complexity. While formidable technological obstacles still stand in the way of creating such a quantum computer, today's early prototypes are still capable of remarkable feats.

For example, the creation of a new phase of matter called a "time crystal.

Just as a crystal's structure repeats in space, a time crystal repeats in time and, importantly, does so infinitely and without any further input of energy – like a clock that runs forever without any batteries. "The big picture is that we are taking the devices that are meant to be the quantum computers of the future and thinking of them as complex quantum systems in their own right," said Matteo Ippoliti, a postdoctoral scholar at Stanford and co-lead author of the work. Instead of computation, we're putting the computer to work as a new experimental platform to realize and detect new phases of matter.

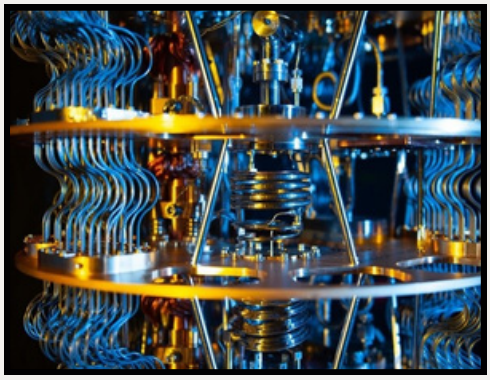
"Time-crystals are a striking example of a new type of non-equilibrium quantum phase of matter," said Vedika Khemani, assistant professor of physics at Stanford and a senior author of the paper. While much of our understanding of condensed matter physics is based on equilibrium systems, these new quantum devices are providing us a fascinating window into new non-equilibrium regimes in many-body physics.

What Are Time Crystals?

Time crystals are a state of matter that, unlike traditional crystals (which have a repeating structure in space), have a structure that repeats in time. They break the symmetry of time by oscillating without consuming energy. They could enhance the stability of qubits, reducing errors caused by decoherence, a major challenge in quantum systems. This inherent stability might lead to more accurate quantum computations and serve as a form of quantum memory. While time crystals are still in the experimental stage, their ability to maintain a stable state over time could revolutionize quantum computing, making it more reliable and scalable for practical applications.

The idea was first proposed by physicist Frank Wilczek in 2012, and it was experimentally confirmed a few years later. In a time crystal, the system's particles are in a state of perpetual motion, but this motion occurs at regular intervals, creating a "time lattice.

How Do Time Crystals Relate to Quantum Computing?



One of the biggest challenges in quantum computing is maintaining qubits in a stable state for long periods, as they are prone to errors due to decoherence (loss of quantum state).

Time crystals could provide a way to create more stable quantum systems because they are inherently stable over time without requiring external energy.

The oscillations of a time crystal could help in reducing the errors in quantum computations. Since time crystals can maintain their state indefinitely, they might be used to design qubits that are less susceptible to noise and other disturbances, leading to more accurate computations. Time crystals could serve as a form of quantum memory that holds information in a stable way over long periods. This stability is crucial for developing quantum computers that can perform long computations without losing information.

Applications in Quantum Computing:

One of the biggest hurdles in quantum computing is creating qubits that are resistant to errors. Time crystals, with their unique properties, could be used to build qubits that are less prone to errors, leading to more robust and fault-tolerant quantum computers. Time crystals could also be used in quantum communication networks. Their ability to maintain a stable, oscillating state over long periods could enable more reliable transmission of quantum information across distances. The study of time crystals intersects with various fields, including condensed matter physics, quantum information theory, and even cosmology.

How Do Google Researchers Use Quantum Computers to Make Them?

Google primarily uses superconducting qubits, which are tiny circuits made from superconducting materials cooled to near absolute zero. These qubits can exhibit quantum properties like superposition and entanglement, essential for quantum computing. The qubits are designed using precise lithography techniques on silicon wafers. Google's fabrication facilities utilize state-of-the-art equipment to create qubits with high coherence times (the duration they can maintain quantum states) and low error rates.

Google focuses on scalable architectures that allow the addition of more qubits without exponentially increasing complexity. This involves modular designs where smaller quantum processors can be interconnected. Google develops sophisticated software to manage quantum operations, calibrate qubits, and optimize quantum algorithms. This software interfaces with the hardware to execute quantum instructions accurately.

One of Google's notable achievements is the Sycamore processor, a 57-qubit chip that demonstrated quantum supremacy by performing a specific task faster than classical supercomputers. Google collaborates with academic institutions, industry partners, and the broader scientific community to advance quantum computing research, share knowledge, and tackle complex challenges. Google rigorously tests quantum processors to measure metrics like coherence time, gate fidelity, and error rates. This involves extensive experimentation and data analysis to validate the performance of quantum systems.

Cybersecurity in the Age of IoT: Navigating the New Frontier

Internet of Things (IoT) has made a great impact in both socialization and work. IoT devices have permeated into everyday life from smart homes to cars being joined for a quick ride, thereby increasing ease in doing things, accelerating processes, and enhancing efficiency.

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However with such rapid evolution comes a problem, Cyber Security. They have increased in scale tremendously due to the increasing number of devices being connected to the network, so is the number of probable cyber attacks, and preserving the security of IoT has become one of the hottest issues today.

The Challenge of Cyber Security

Vulnerabilities of IoT devices are further compounded by the fact that they are networked and that's why they are made of a sash. Each smart appliance in the house such as a mobile phone, wearable tracker or a wireless sensor is an opening to the arms of hackers. Common Inbuilt Mobile Threats. IoT devices tend to be embedded with weak security features as they have very few CPUs. Many IoT devices do not have any patch or update systems.

One of the major issues in this regard is that cyber terrorists are able to orchestrate massive attacks by chaining multiple cyber attacks because of these weaknesses. A good case that illustrates this is the botnet attack dubbed Mirai where thousands of internet connected digital video recorders were used to pump traffic to targeted websites, and this rendered many sites and services inaccessible. This is how unprotected and poorly designed IoT infrastructures can inflict extraordinary havoc.

Why IoT Security is a Challenge

1. **Diverse Device Ecosystem:** IoTs are a struck by a huge device diversity from smart bulbs to sensors embedded in a machine. This diversity proves to be a bottleneck in developing a comprehensive security understanding that operates in all purposes. Most devices are more functional with little to no regard for security as most of them are designed without even basic security features.

2. **Lack of Standards:** At this time, there are no security or privacy requirements that are mandatory for the IoT device manufacturers. As these risks are managed differently leading to some devices being secured while others are completely exposed to the risk. In the absence of such standards, manufacturers will disregard internal acceptable and appropriate practices resulting in differences in the security of various devices.

3. **Worry on Protection of Personal Data:** The IoT devices have been authors in requiring lots of information than what the users understand and amass a lot of information. This becomes a major concern for privacy. If intruders are able to obtain this information, such information could lead to identity crimes and or surveillance.

Steps Towards Strengthening IoT Security:

Manufacturers have to move to a more secure paradigm of designing therefore construction mechanisms that are in place. This means that there exist some measures such as encryption communication channels, secured boot, and frequent changing of the embedded programs.

Regular Software Updates: It is one of the remedies to improve IoT security because the devices must be regularly updated from time to time . These replaces increase, remedies also, as they can fix the repairs are made after a vulnerability has been found so that 1.the individual with a malicious intent do not take advantage of the known vulnerabilities.

User Education: Consumers play an important and sometimes the most important role in IoT security. Simple things like: changing the default password, segmenting the device to a different network and using up to date firmware for the device, can be effective in prevention of an attack. For a stronger IoT security architecture, there is a need to train users on the aspects of security and its role in the IoT.

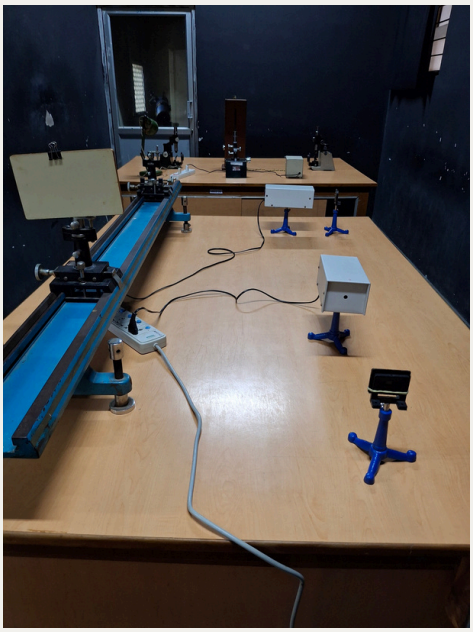
Regulatory Frameworks: Lenders must engage with their borrowers to construct legislative regimes that impose minimum protection requirements on IoT devices. Countries like the UK and the US have already made proposals suggesting the kinds of frameworks mentioned above where such laws would make implantations of basic security procedures like unique passwords for each of the devices the manufacturer made fundamental.

The Road Ahead

With the growing IoT ecosystem, it is self-evident that security requirements are even more demanding. As impressive as the IoT is and can be, it does come with serious drawbacks in terms of its security. It has to be a collaborative effort, manufacturers, consumers and regulators, such that the future of IoT security can protect the flood of our interconnected world.

In summary, cyber security in the IoT era presents a complex and ongoing challenge. The rapid growth of connected devices creates new opportunities. For cybercriminals But with proactive security measures and strict regulations. We can reduce these risks and reap the benefits of a more connected future.

PHOTO-GALLERY



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