BISWAJIT JANA

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EDUCATION

University of Hertfordshire, UK: M.Sc Astrophysics with Advanced Research **2022 – 2024**

- Grade: Commendation (2:1)
- *Relevant Modules:* Star Formation and Evolution, Foundations of Cosmology, Physics of Astronomical Spectra, Early Universe and Galaxy Formation, High Energy Astrophysics, Galaxy Structure and Evolution, Statistics and Analysis, Research Techniques in Astrophysics, From Stars to Planets.
- Dissertation Title: "Closed-Loop Feedback Control System for the Exoplanet High Resolution RV Spectrograph (EXOhSPEC) Development"

University of Engineering and Management, India: BTech in Electronics and Communication Engineering **2017 – 2021**

- Grade: First Class with Distinction
- Dissertation Title: "Dimming Controlled Visible Light Communication System using Raspberry Pi"
- Published at Springer

PROJECTS

- **Final Year Project(M.Sc): Closed-Loop Feedback Control System for EXOhSPEC Development** **2023 - Present**
  - Developed a novel approach to high-resolution radial-velocity spectroscopy for exoplanet detection using EXOhSPEC, implementing a closed-loop feedback control system with an Interferometric Displacement Sensor (IDS3010) for picometre-level precision.
  - Quantified environmental dependencies — a 1 hPa pressure change resulted in 0.4 µm optical-path-length variation, while a 1 °C temperature change produced ~6 µm variation. Designed and tested a custom environmental control enclosure, achieving temperature stability within ± 0.3 °C over continuous multi-week operation.
  - Acquired extensive experience in **optical laboratory diagnostics**, **laser alignment**, and **data compensation algorithms** to suppress environmental noise and improve spectrograph stability.
  - Currently extending the system through:
    ▪ **Real-time monitoring** with Grafana + InfluxDB for continuous telemetry and feedback visualisation.
    ▪ **Web-based control interface** built using HTML, CSS, and JavaScript for remote instrument access.
    ▪ **Integration of an Adaptive Optics (AO) correction module** to compensate guider-pixel drift and maintain sub-pixel image stability in real time.
    ▪ Development of **adaptive PID tuning and temperature-to-OPL calibration models** to refine thermal and optical stability performance.
- **Final Year Project(B.Tech): Dimming Controlled Visible Light Communication System using Raspberry Pi**
  - Implemented Multi-Header Hybrid Pulse Position Modulation (MH-HPPM) based VLC system using Raspberry Pi with low-cost commodity hardware. Conducted comprehensive experiments evaluating performance under dimming levels 0.25, 0.5, and 0.75. Results indicate a communication distance of up to 3 m for dimming levels 0.25 and 3.5 m for dimming levels 0.5 and 0.75.
  - Observed that the MH-HPPM-based VLC system maintains better throughput for various incidence angles.
  - Designed prototype demonstrates effective and reliable communication in experimental scenarios.

- **Detection of Pulsars by Image Stacking in larger datasets using Binapprox algorithm**
  - Addressed time and space constraints in handling extensive datasets, focusing on the Binapprox Algorithm for efficient median estimation across 9587 astronomy images in FITS format.
  - Detected pulsars in Binary star systems through precise analysis of gravitational lensing-induced light bending in observations. Academic emphasis on developing computational solutions for optimizing data processing in astronomy, particularly in the context of large-scale FITS image datasets.

RESEARCH EXPERIENCE

Case Studies, University of Hertfordshire **September 2022 – December 2022**

- **Extra-Solar Planets**
  - Analyzed transit dips and radial velocity variations of stars to detect and confirm the presence of exoplanets.
  - Utilized DACE and Python programs (primarily use lightkurve tool) to plot light curves, measure physical parameters such as mass and radius, and explore the properties of planetary systems.

- **Brown Dwarfs (Is it a star, a brown dwarf, or a planet?)**
    - Employed literature surveys and model fitting to conclude that the target is a brown dwarf with a temperature of 1100K and silicate in the atmosphere.
    - Proposed future work involving PICASO 3.0 for enhanced analysis and model fitting, along with trimmed models, to better fit a broad spectrum of data and distinguish between stellar, planetary, and exoplanetary characteristics.

- **Hunting for 'Death Stars' in Gaia**
    - Investigated astronomical events contributing to mass extinctions on Earth, identifying a potential 'Death Star' candidate (GJ710) with calculated perihelion distance for hyperbolic trajectory.
    - Analyzed past stars, including those during the 'Mid-late Eocene' and 'End Cretaceous' periods, measuring error bars and considering five additional interesting star candidates based on thermodynamic values, anticipating their potential role in future mass extinctions.

Additional Experience: INTERNSHIPS/SUMMER/WINTER PROGRAM

- **SEPnet 4-week summer placement** with **LUMI SPACE**, UK, **"*Evaluating Microbolometer Camera Performance for Satellite Laser Ranging*",** 5th August - 4th September 2024. Evaluating microbolometer camera performance for satellite laser ranging. Constructing link budgets to compare various camera systems (microbolometer, CMOS, CCD, quad detector) across metrics like beam divergence and atmospheric effects particular focus on refractive index. Developing empirical models to assess detector performance and exploring strategies to enhance microbolometer efficiency through temperature optimization and material selection.

- Summer Research Project at the University of Hertfordshire, "**Identifying Halo T Dwarf Candidates using VISTA, DES, and WISE Survey Data**", under the supervision of **Professor David Pinfield** from June to July 2023. Contributed to the discovery of potential Halo T dwarf candidates, leading to a telescope proposal submission to CNTAC for Magellan/FIRE spectroscopic follow-up observations in 2025A.

- A Radio Astronomy Summer School Program 2022 project at the Gauribidanaur Radio Observatory, Raman Research Institute conducted by Naxxatra, the project entitled – "**Demonstrating two element Radio Interferometer and observed the transits of the Sun**", under the supervision of **Dr. Ramesh Balasubramanyam** from February to May 2022.

- An online Internship with the Society for Space Education Research and Development (SSERD) - "**Cross-matching between Optical and Radio catalogues for classification of Elliptical Galaxies using Machine Learning techniques**" under the guidance of **Mr. Sundar M N** from 11th October 2020 to 21st November 2020.

- Winter Internship (2019-20) at IIT Kharagpur under the supervision of **Professor Sudip Misra** from the Department of Computer Science – Worked on two research-oriented projects, 1st was designing a Low-cost High frequency detecting circuits, and 2nd was Calibrating and synchronization of multiple drones simultaneously from 22nd December 2019 to 23rd January 2020.

- "**Analysis of Diseases and Symptoms**" using Python at **Foxmula** under Inversion Consultancy LLP from 27th August 2019 to 27th September 2019, developed data analysis skills, using different python libraries (LINK).

PUBLICATIONS

- Biswajit Jana et al., "**Implementation of Dimming controlled visible light communication using Raspberry Pi**", Optical and Quantum Electronics 53, 725(2021), Springer.
  DOI: 10.1007/s-11082-021-03362-4

- Biswajit Jana et al., **"GSM controlled location specific garbage collecting Smart bin",** 2019, 9th Annual Information Technology Electromechanical and Microelectronics Conference (IEMECON), Jaipur, India.
  DOI: 10.1109/IEMECONX.2019.8877007

- Biswajit Jana et al., **"Priority encoder using reversible logic gates in QCA,"** 2017 8th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), Vancouver, BC, 2017, pp. 319-323.
  DOI: 10.1109/IEMCON.2017.8117242

TRAININGS

- **9 Robots in 8 days (Winter Training 2017-18 from MYWBUT) -**

- Mastered Arduino and sensor applications in "Introduction to Embedded System in Arduino Environment" class.
- Constructed diverse robots, such as PC Controlled, Photovore, Edge Detecting, Obstacle Mapping, Line Follower, Differential Speed, Gesture Controlled, and Sumo.
- Demonstrated adaptability and competence in embedded systems through practical application.

- **MATLAB Fundamentals with Arduino Integration (Summer Training 2018-19 from MYWBUT) –**
  - Proficient use of the MATLAB platform for solving engineering and scientific problems.
  - Acquired skills in Simulink, a powerful tool within MATLAB, and applied it to design basic control system circuits.
  - Course objective: Introducing students to fundamental concepts of Scientific Programming using MATLAB, with emphasis on Arduino integration.

- **IoT (Internet of Things) (Summer Training 2019-20 from MYWBUT) –**
  - Explored Internet of Things (IoT) by integrating internet connectivity into physical devices and everyday objects.
  - Acquired skills in HTML, CSS, PHP programming, and utilized NodeMCU to build a comprehensive IoT architecture with various sensors and accessories.
  - Demonstrated practical application through a home automation project at the end of the training, showcasing proficiency in IoT implementation.

- **Introduction to Programming using Python (FOXMULA) –**
  - Completed basic Python programming language training, gaining foundational knowledge. Attained a Microsoft-certified certificate by participating in and passing the Microsoft certification exam.

ONLINE COURSES

- "First Order Optical System Design" by University of Colorado Boulder – In Progress
- "Basic course in Astronomy – Introduction to Stars", conducted by Breakthrough Science Society in association with Public Outreach and Education Committee, Astronomical Society of India, 19th September 2021 – 3rd January,2022.
- Data-driven Astronomy (Coursera)
- Astrobiology and the Search for Extra-terrestrial Life (Coursera)
- Astronomy: Exploring Time and Space (University of Arizona | Coursera)
- AstroTech: The Science and Technology behind Astronomical Discovery (University of Edinburgh | Coursera)

Some of TALKS/POSTER PRESENTATIONS

- State of Art: Radial Velocity Spectrograph, November 9th, 2023 (Link)
- Advancement in Precision: LASER Interferometer Control System, December 8th, 2023 (Link)
- Optimizing Path Length Stability in LASER Interferometers using air refractive index, February 8th, 2024 (Link)
- High Resolution RV Spectrographs: ANDES and PID Loop Implementation in EXohSPEC, 7th March, 2024 (Link)
- Testing Performance of Microbolometer Detector for Satellite Laser Ranging Application, SEPNET Poster presentation, 20th November, London, United Kingdom

COMPUTING SKILLS

- Programming Language: C, C++, HTML, CSS, PHP, PYTHON.
- Software/Hardware : RSpec, Aperture Photometry Tool, MaximDL, Arduino, Programmable System on Chip(PSOC 5LP development board), MATLAB, Raspberry Pi, QCA Designer, Pspice, PSOC Creator, NODEMCU ESP8266, and different kinds of embedded boards.
- Other Technical Skills: LASER Optics (Class 2 Laser Certified) - Interferometer, Instrumentation R&D like RV Spectrograph, Radio/Optical Telescopes, LaTeX, Internet of Things.

REFEREES

Professor Hugh Jones Department of Physics, Astronomy and Mathematics, University of Hertfordshire, UK
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Professor Bill Martin Department of Physics, Astronomy and Mathematics, University of Hertfordshire, UK
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