

GANEGAMA LIYANAGE SAHAN SANKALPA LIYANAGE

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EDUCATION

BSc. (Hons) in Physics – Second Class (Upper Division)

Jan 2020 – May 2024

Department of Physics, University of Colombo, Colombo 00300, Sri Lanka

- **Cumulative GPA:** 3.57/4.00 (126 credit hours)
- **Relevant coursework:** Quantum Mechanics I & II, Classical Mechanics, Electromagnetic Fields I & II, Statistical Physics, Advanced Optics, Solid State Physics, Mathematical Physics I & II, Nuclear and Particle Physics, Methods in Computational Physics, Analog and Digital Electronics, Data Acquisition and Signal Processing, General Physics Laboratory I & II, and Advanced Physics Laboratory I & II.

Secondary Education

2015 – 2017

Central College, Anuradhapura, Sri Lanka, 50000

- GCE Advanced Level (2018) in Physical Sciences: Combine Mathematics–B, Physics–B, Chemistry–B.

RESEARCH EXPERIENCE

Undergraduate Research Project

May 2023 – Apr 2024

Title: Determination of the Speed and Source Height of Coronal Shock Waves Using Type II Solar Radio Bursts.

Supervisors: Dr. Janaka Adassuriya, Prof. K. P. S. C. Jayaratne

- Analyzed 25 metric Type II solar radio bursts recorded by the e-CALLISTO network between January 2022 and October 2023.
- Built a Python noise-reduction and burst-isolation pipeline that extracted the fundamental frequency band of each burst from its dynamic spectrum using maximum-intensity points.
- Derived shock speed and source height from plasma-oscillation theory and the Newkirk coronal density model, obtaining 343–1032 km/s and 1.317–1.724 solar radii with a power-law fit of source height against starting frequency ($R^2 = 0.999$).
- Validated the method against Aguilar-Rodríguez et al. (2005), matching the published power-law index to 99.4% (1.45 ± 0.42), and found no correlation between shock speed and associated CME speed.

Raman Spectroscopy Project

Nov 2022 – Mar 2023

Title: Raman Spectroscopic Analysis of Common Minerals in Sri Lanka.

Supervisor: Prof. H. H. E. Jayaweera

- Recorded Raman spectra of eleven Sri Lankan mineral samples (calcite, dolomite, apatite, four quartz varieties, feldspar, amazonite, graphite, and mica) on an Andor Kymera 328i-A spectrograph (532 nm laser, 1200 lines/mm grating, detector at -80°C), optimizing power, accumulations, and exposure per sample and calibrating the shift axis against Sulphur reference peaks.
- Processed the spectra in Python with asymmetric least-squares baseline correction and Savitzky–Golay smoothing, then assigned vibrational modes: $(\text{CO}_3)^{2-}$ stretches at 1075 and 1099 cm^{-1} , the $(\text{PO}_4)^{3-}$ v1 mode at 962 cm^{-1} , SiO_2 modes near 465 cm^{-1} , feldspar bands at 450–515 cm^{-1} , the graphite G band at 1088 cm^{-1} , and mica peaks at 187 and 688 cm^{-1} .
- Conducted with the Geological Survey and Mines Bureau of Sri Lanka, contributing towards a reference Raman dataset for commonly found Sri Lankan minerals.

Mentoring a Final Year Undergraduate Research Project

May 2025 – Apr 2026

Title: Estimating Coronal Magnetic Field Strength from Band Splitting in Type II Solar Radio Bursts.

Department of Physics, University of Colombo, Sri Lanka.

PROFESSIONAL EXPERIENCE

Research Assistant – Astronomy and Space Applications Division

May 2026 – Present

Arthur C. Clarke Institute for Modern Technologies, Katubedda, Moratuwa, Sri Lanka.

- Conduct solar radio observations with the e-CALLISTO antenna system, including receiver calibration, routine performance checks, and maintenance of the antenna and spectrometer hardware.
- Carry out optical solar observations in H-alpha, and record, process, and interpret the resulting solar images.
- Perform astronomical spectroscopy with optical telescopes and reduce and interpret the resulting spectra.
- Develop software and automated data pipelines for the acquisition, processing, and archiving of observational data.
- Support public outreach through workshops and observation sessions on space physics and astronomy.

SKILLS AND TECHNIQUES

- **Programming Languages:** Python, C/C++, MATLAB
- **Scientific Computing:** SunPy, AstroPy, NumPy, SciPy, and Matplotlib; FITS data handling, signal processing, and GUI development with Qt.
- **Software and Tools:** OriginPro, SolidWorks, Microsoft Office, Adobe Photoshop, LaTeX, Arduino, Linux environments, and web development.
- **Laboratory and Instrumentation Skills:** Raman spectroscopy, UV-Vis Spectroscopy, Astronomical Spectroscopy, radio spectrometry (e-CALLISTO), analogue and digital electronics, data acquisition and signal processing, and microcontroller programming.
- **Management and Leadership Skills:** Effective communication, project planning and execution, teaching and mentoring, and team coordination.

PROJECTS

Solar Observer: Space Weather Monitoring Dashboard

2026 – Present

- **Website:** <https://solarobserver.org/>
- **Repository:** https://github.com/SaanDev/Solar_Monitoring_Dashboard
- **Description:** Full-stack web dashboard combining e-CALLISTO dynamic spectra with GOES XRS and proton flux, SDO/AIA and HMI imagery, SOHO/LASCO C2 and C3 frames, Kp and Dst indices, and solar wind and IMF parameters, with event alerts, a combined event timeline, and archive search.
- **Machine Learning:** ResNet-18 classifiers running natively in the backend, giving burst detection at a test F1 score of 0.932 and three-class burst typing (Type II, Type III, Other) at 0.966 validation accuracy with a macro F1 of 0.889.
- **Tools and Technologies:** Next.js 14, TypeScript, Tailwind CSS, Plotly.js, and ShadCN UI on the frontend; FastAPI, Python 3.11, Pydantic v2, Astropy, NumPy, SciPy, and Pandas on the backend; PostgreSQL with TimescaleDB, Redis, PyTorch, and Docker Compose.

ecallistolib: Open-source Python Library for e-CALLISTO Data

2025 – Present

- **Repository:** <https://github.com/SaanDev/ecallistolib>
- **PyPI:** <https://pypi.org/project/ecallistolib/>
- **Description:** Author and maintainer of an MIT-licensed Python library (v1.3.1, Python 3.10 to 3.14) that downloads, reads, processes, and plots e-CALLISTO FITS dynamic spectra, covering archive download, metadata-preserving parsing, noise reduction, median-filter and MAD-based RFI mitigation, background subtraction, cropping, segment combination in time and frequency, and publication-quality plotting.
- **Additional Features:** An ecallisto command-line interface for download and plotting, optional dependency groups for accelerated RFI mitigation, and a pytest test suite.
- **Tools and Technologies:** Python, NumPy, SciPy, Astropy, Matplotlib, and packaging for distribution.

e-CALLISTO FITS Analyzer: Software Framework for Solar Radio Data

2024 – Present

- **Institution:** Astronomy and Space Science Unit, University of Colombo, Sri Lanka.
- **Repository:** https://github.com/SaanDev/e-Callisto_FITS_Analyzer
- **Paper:** <https://doi.org/10.1093/rasti/rzag056>
- **Website:** <https://www.ecallistoanalyzer.org/>
- **Description:** Lead developer and first author of an open-source, cross-platform desktop application (Windows, macOS, and Linux) for event-level analysis of e-CALLISTO dynamic spectra, published as a peer-reviewed software framework in RAS Techniques and Instruments (Oxford University Press). It retrieves and previews archive FITS data, merges fragmented 15-minute frames in time and frequency and cleans the spectra with a deterministic RFI pipeline of median filtering, hot-channel detection and repair, percentile clipping, and background subtraction.
- **Tools and Technologies:** Python, PySide6 (Qt), NumPy, SciPy, Astropy, SunPy, Matplotlib, PyQtGraph, netCDF4 for GOES data, OpenPyXL for spreadsheet export, and Requests/BeautifulSoup for archive retrieval.

Spectral Analysis of Fluids to Determine the Effects of Temperature

2021

- **Institution:** Department of Physics, University of Colombo, Sri Lanka.
- **Description:** Group project for General Physics Laboratory II (PH-2020) that measured the temperature of a liquid from its absorbance spectrum, using a home-made spectrometer, DSLR camera, white-light source, and induction cooker, and testing kerosene, coconut oil, battery acid, and distilled water.
- **Results:** Distilled water at 462 nm gave the best thermometric response, yielding $T = 73 \cdot A + 230$ with a gradient of 73 ± 3 K, an intercept of $(2.3 \pm 0.1) \times 10^2$ K, and model errors of 4–12%. The method was then extended to measure the effective power of an unknown heat source.
- **Skills Used:** Optical spectroscopy, absorbance and image-based spectral analysis, apparatus design, data analysis and error analysis.

PUBLICATIONS

- **Liyanage, G. L. S. S.,** Adassuriya, J., Jayaratne, K. P. S. C., Monstein, C., & Manoharan, P. K. (2026). *e-CALLISTO FITS Analyzer: A software framework for CALLISTO solar radio data. RAS Techniques and Instruments, rzag056.* <https://doi.org/10.1093/rasti/rzag056>
- **Liyanage, G. L. S. S.,** Adassuriya, J., Jayaratne, K. P. S. C., & Monstein, C. (2025). *Determination of speed and source height of coronal shock waves using Type II solar radio bursts.* Proceedings of the Technical Sessions, 41, 59–67. Institute of Physics, Sri Lanka. <https://doi.org/10.48550/arXiv.2504.00622>

SCIENTIFIC PRESENTATIONS

Oral Presentation – 41st Technical Sessions, Institute of Physics, Sri Lanka

22 Mar 2025

Title: Determination of Speed and Source Height of Coronal Shock Waves Using Type II Solar Radio Bursts.

Venue: University of Colombo, Colombo, Sri Lanka.

Delivered an on-site oral presentation of undergraduate research findings to the national physics research community.

Oral Presentation – Physics Society, University of Colombo

20 Nov 2024

Title: Solar Radio Bursts and Space Weather.

Delivered an on-site oral presentation to physics undergraduates on solar radio bursts and their space-weather implications.

Online Presentation – Astronomical Society, Rajarata University of Sri Lanka

18 Jul 2024

Title: Introduction to Solar Physics.

Delivered an online introductory lecture on solar physics to university students.

AWARDS AND HONOURS

- Recipient of the Dean's List

Academic Year 2019/2020

ACADEMIC ENGAGEMENTS

Instructor – COSPAR Capacity Building Workshop 2026

31 Aug – 11 Sep 2026

National Research Institute of Astronomy and Geophysics (NRIAG), Cairo, Egypt.

- Served as an instructor at the COSPAR (Committee on Space Research) Capacity Building Workshop on Earth-Affecting Solar Transients, teaching students the analysis of solar radio data using Python.

Participant – COSPAR Capacity Building Workshop 2024

19 – 30 Aug 2024

Samarkand State University, Samarkand, Uzbekistan.

- Completed the COSPAR (Committee on Space Research) Capacity Building Workshop on Coronal and Interplanetary Shocks, gaining practical skills in data analysis using SOHO, SDO, and STEREO satellite data alongside ground-based observations, with SolarSoft and Python libraries such as SunPy and AstroPy.

Designing Physics Laboratory Experiments – General Physics Laboratory II

Department of Physics, University of Colombo, Sri Lanka.

- Designed the laboratory sheet on the optical spectrometer for first-year undergraduates, integrating theoretical background, pre-lab questions, and experimental procedures covering ray optics, prisms, determination of refractive index, diffraction gratings, and the emission spectra of hydrogen, helium, and mercury lamps.

TEACHING EXPERIENCE

Academic Appointments:

Visiting Lecturer – Department of Physics, University of Colombo

Oct 2026 – Present

- Visiting lecturer for the Certificate in Astronomy course.

Teaching Assistant – University of Colombo School of Computing

Aug 2025 – Mar 2026

- Instructor for the 1st year Probability and Statistics course for Computer Science majors.
- Instructor for the 2nd year Digital Signal Processing course for Computer Science majors.
- Instructor for the 2nd year Cryptography and Information Security course for Computer Science majors.

Teaching Assistant – Department of Physics, University of Colombo

May 2024 – May 2025

- Instructor in charge of the 4th year Computational Electrodynamics course for computational physics majors. (10 students)
- Instructor in charge of the 3rd year Advanced Physics Laboratory I for physics majors. (10 Students)
- Instructor for the 2nd year Analogue and Digital Electronic Principles Laboratory. (120 Students)
- Instructor for the 1st year General Physics Laboratory I & II. (120 and 77 Students)

LEADERSHIPS & EXTRACURRICULAR ACTIVITIES

Vice President

2022 – 2023

Astronomical Society, University of Colombo, Sri Lanka.

Coordinator

2020 – 2022

Astronomical Society, University of Colombo, Sri Lanka.

Music Director
Music Society, University of Colombo, Sri Lanka.

2022 – 2023

Marketing Director
Leo Club, University of Colombo, Sri Lanka.

2020 – 2021

VOLUNTEERING EXPERIENCE

Project “Science Bus” – Phases I, II, and III **2021 – 2023**
Physics Society, University of Colombo, Sri Lanka.

- Contributed to a travelling science outreach project, funded by SPIE, the International Society for Optics and Photonics, which brought hands-on science activities to science-enthusiastic school students in rural areas of Sri Lanka.

Project “Star Quest” – All-Island Astronomical Quiz **2022 – 2025**
Astronomical Society, University of Colombo, Sri Lanka.

- Contributed to organizing the quiz, covering question creation, participant handling on the day, and grading, for school students across Sri Lanka.

Project “Naada Nu 23” – Annual Musical Concert **2023**
Music Society, University of Colombo, Sri Lanka.

- Served as music director for the society’s annual musical concert and contributed to event organization and performed on stage.

REFERENCES

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