Gourav Kumawat

PhD (Physics)
University of Alberta, Edmonton, Canada
Phone No.: +1-368-882-3341
E-mail: kumawat1@ualberta.ca

LinkedIn
:GitHub
Research Gate

EDUCATION

- **Doctor of Philosophy (PhD)**
  Physics (Stellar Astrophysics) — Sep 2024 - Aug 2028 (expected)
  Supervisor: Craig Heinke — University of Alberta, Canada
- **BS-MS Dual-degree Programme**
  Major: Physics | Minor: Data Science & Engineering — Aug 2019 - Jun 2024
  CPI: 9.41/10 — IISER Bhopal, India
- **Higher Secondary Education**
  AISSCE(2019), Board: CBSE — Apr 2018 - Jun 2019
  Percentage: 95/100 — Dashpur Vidyalaya, Mandsaur, India

PUBLICATIONS

- Spectral Analysis of X-ray Sources in Terzan 5 Using Chandra Observations
  ***Gourav Kumawat**; Craig O Heinke; Arash Bahramian*;
  In Preparation
- Spectroscopic Study of Blue Straggler Stars in the Globular Cluster Ngc 3201
  ***Gourav Kumawat**; Arvind K. Dattatrey; R.K.S Yadav*;
  Submitted to New Astronomy
- Chandra and HST studies of the X-ray sources in the Globular Cluster NGC 362
  ***Gourav Kumawat**; Craig Heinke; Haldan Cohn; Phyllis Lugger*;
  Monthly Notices of the Royal Astronomical Society, Volume 530, Issue 1, May 2024, Pages 82–94
- GlobULeS – V. UVIT/AstroSat studies of stellar populations in NGC 362: detection of blue lurkers in a globular cluster
  Arvind K. Dattatrey; R. K. S. Yadav; ***Gourav Kumawat**; Sharmila Rani; Gaurav Singh; Annapurni Subramaniam; Ravi S Singh*;
  Monthly Notices of the Royal Astronomical Society: Letters, Volume 523, Issue 1, July 2023, Pages L58–L63

CONFERENCE PRESENTATIONS

- Chandra and HST studies of the X-ray sources in the Globular Cluster NGC 362; In-person poster presentation by **Gourav Kumawat** at the Astronomical Society of India (ASI) Meeting 2024 in Bengaluru, India. This poster was also presented at the GPSA Symposium 2024, Department of Physics, University of Alberta.
- UVIT/AstroSat Studies of Stellar Populations in NGC 362: Detection of Blue Lurkers in a Globular Cluster; In-person poster presentation by **Gourav Kumawat** at the Canadian Astronomical Society (CASCA) Annual General Meeting 2023 in Penticton, BC, Canada.

RESEARCH EXPERIENCE

- **Spectral Analysis of X-ray Sources in Terzan 5**
  Guide: Prof. Craig Heinke, University of Alberta, Edmonton, Canada — Aug 2024 - Present
  This is my first research project in the PhD program at the University of Alberta. Chandra X-ray observations of the globular cluster Terzan 5, spanning decades, have been utilized to study the X-ray sources within it. Extensive spectral fitting has been performed to enable the identification and classification of various types of X-ray sources, such as qLMXBs and CVs. A research paper summarizing the analysis is currently being prepared

- **MS Thesis: Atmospheric and Chemical Analysis of Blue Straggler Populations in NGC 3201**
  Guide: Dr. Ramakant S. Yadav, ARIES Nainital India Aug 2023 - April 2024
  Co-Guide: Prof. Sukanta Panda, IISER Bhopal India
  A spectroscopic study of 39 blue straggler stars (BSSs) in the globular cluster NGC 3201 was conducted. The spectra for these stars were sourced from the literature. Radial velocity, atmospheric parameters (Teff , logg), the abundance of magnesium (Mg), and the metallicity [Fe/H] of the blue straggler population were determined. This study provides the first estimation of [Mg/Fe] for the blue straggler stars in NGC 3201. A research paper summarizing our analysis has been submitted to New Astronomy

- **AMUSING ourselves with the secrets of galaxies using Integral Field Spectroscopy** Jul 2023
  Guide: Dr. Ana Paulino-Afonso, Centre for Astrophysics of the University of Porto (CAUP), Porto, Portugal
  Using IFS data from the MUSE instrument of the VLT, local properties have been analyzed compared to global properties for 21 SN Ia host galaxies. Trends between parameters have been established to test the precision of global data. (Project Presentation)

- **X-ray binaries in the globular cluster NGC 362** May 2023 - Jul 2023
  Guide: Prof. Craig Heinke, University of Alberta, Edmonton, Canada
  Analysed a *Chandra* observation of NGC 362, finding X-ray sources within the cluster. One quiescent low-mass X-ray binary was found using spectral analysis of the brightest source. Used HUGS photometry to identify 15 potential optical/UV counterparts to these X-ray sources, including AGNs, sub-subgiants, red stragglers and active binaries. **First author** of the article published in MNRAS.

- **Automatic solar flare detection algorithm using Ch2-XSM data** Jul 2022 - Aug 2022
  Guide: Krittika (IIT Bombay Astronomy Club), Mumbai, India
  Studied solar flares using the data from Chandrayaan-2 XSM. Replicated previous solar flare detection models to analyze different types of stellar flares. Additionally, identified potential issues with the existing models and proposed our own amendments to enhance their accuracy and reliability. (Project Report)

- **Analysis of UV-bright Stars in the Cool Stellar Populations of Globular Cluster NGC 362** May 2022 - Jul 2022
  Guide: Dr. Ramakant S. Yadav, Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital, India
  Utilized multi-wavelength data obtained from the MPG/ESO 2.2-m telescope, AstroSat's UVIT, and Swift UVOT to perform spectral energy distribution (SED) analysis using the VO SED Analyzer tool on cool stellar population selected from Optical and UV-optical CMDs. Our analysis led to the discovery of blue lurkers for the first time in a Globuler Cluster. **Third author** of the article published in MNRAS Letters.

- **Photometry and Supernovae - A case study** Jul 2021 - Aug 2021
  Guide: Krittika (Indian Institute of Technology Bombay Astronomy Club), Mumbai, India
  Gained knowledge and expertise in various techniques including Image Data Reduction, Aperture Photometry, PSF Photometry, and Supernova theory. Using SExtractor and PSFEx, conducted PSF photometry on GROWTH India Telescope Data. Subsequently, generated a light curve for the supernova event SN2018hna in the r, g, and i bands. Through careful analysis, examined the different characteristics exhibited by the plotted light curve. (Project Report)

COURSE PROJECTS

- **Stellar Collisions and Exotic Populations in a Globular Cluster** Oct 2024 - Dec 2024
  Course: Stellar Astrophysics II
  A study of the stellar populations and collision products in a simulated globular cluster with an age of 10 Gyr was presented, modeled using MESA. The isochrone of the cluster was constructed to trace various evolutionary stages, including the main sequence, subgiant branch, red giant branch, horizontal branch, and white dwarfs. Exotic objects such as blue stragglers (BSSs), blue lurkers (BLs), and yellow stragglers (YSSs) were added by considering single-single stellar collisions, with collision products evolved from the zero-age main sequence. The resulting BSSs, BLs, and YSSs were found to exhibit properties consistent with observational studies. (Project Report)

- **Exoplanet Orbital Semi-Major Axis Prediction using Regression Approach** Feb 2022 - Apr 2022
  Course: Data Science and Machine Learning
  Employed various methods and techniques to extract relevant parameters from the Kepler dataset provided by the NASA Exoplanet Archive. Specifically, utilized different regression models to predict the semi-major axis of exoplanet orbitals. Among these models, the Random Forest regression model demonstrated the highest performance with an impressive $R^2 score$ of 0.989 on the test dataset, which consisted of 1997 exoplanets. (Project Report)

- **Morphological Classification of Galaxies using Artificial Intelligence** Sep 2021 - Nov 2021
  Course: Artificial Intelligence
  Developed a set of models based on the Convolutional Neural Network (CNN) architecture that were evolutionary and chronologically constrained. These models were optimized for n-index classification and adaptable to the computational power of the machine being used. Achieved an accuracy of 82.7 % for three-class classifications of galaxies, demonstrating the effectiveness of our approach. Project Report

- **The Stellar Trilogy: An Ontology, HR Diagram and ML Harvard Classification** Sep 2021 - Nov 2021
  Course: Advanced Programming in Python
  Developed an ontology using Owlready2 for the classification of stars based on their temperature, color, and dominant spectrum lines, following the Harvard Spectral Classification Scheme. For the two-class classification of a stellar dataset, employed KNN, SVM, and Logistic regression models. Among these models, achieved the highest accuracy of 88.33 %. Additionally, for the seven-class classification of another stellar dataset, used the KNN algorithm and obtained an accuracy of 58.5 %. (Project Report)

DISTINCTIONS & FELLOWSHIPS

- Recipient of the **MITACS Globalink Research Internship Fellowship 2023**, a competitive program that pairs top-ranked students from around the world with faculty at Canadian institutions. Projects are funded for a duration of 3 months during the summer.
- Recipient of the **IASc-INSA-NASI Summer research fellowship 2022**, a presitigious program that funds meritious students from India to work with researchers at top Indian research institutions for a period of 2 months during the summer.
- Recipient of the **Smt. Gouri Mukherjee Senior Academic Fellowship 2022**, a fellowship given to academically bright students of IISER Bhopal.

TECHNICAL SKILLS

- **Programming and Scripting Languages**
  Python, MATLAB, Wolfram Mathematica, C, C++, LaTeX
- **Packages**
  Python: Scikit-learn, NumPy, SciPy, Matplotlib, AstroPy, Pandas, Seaborn
- **Tools and Softwares**
  SAOImageDS9, Aperture Photometry Tool, TOPCAT, Aladin, VOSA, CIAO, Sherpa, MS Office, ISpec
- **OS**
  Windows, Linux, macOS

ACHIEVEMENTS / AWARDS

- Gold Honour, International Astronomy and Astrophysics Competition 2021.
- Zonal Topper, Mimamsa 2021, a national-level annual Science Quiz organized by IISER Pune, India.
- City Topper, 19th SOF National Science Olympiad (2016-17)

TEST SCORES

- **TOEFL iBT:** 103/120 (Reading 28, Listening 26, Speaking 24, Writing 25) Oct 2023

POSITIONS OF RESPONSIBILITY

- **Graduate Teaching Assistant**
  PHYS130: Conducting physics labs for first-year engineering students. Sep 2024 - Present
- **Astronomy Tutor & Mentor**
  HipHab, a startup enriching kids' hobbies with lectures and projects. Apr 2022 - March 2024

Gourav Kumawat kumawat1@ualberta.ca

- **Event Coordinator**
  Singularity 2021, Annual Science Fest of IISER Bhopal — Sep 2021 - Oct 2021
- **Computational Team Member**
  IISER Bhopal Astronomy Research Group — Aug 2021 - Present
- **Coordinator**
  IISER Bhopal Astronomy Club — May 2021 - May 2022

SCHOOLS, WORKSHOPS & CONFERENCES

- **ASI Meeting 2024 (In-person)** — Feb 2024
  Hosted jointly by Indian Institute of Science (IISc), Indian Space Research Organisation (ISRO) and Jawaharlal Nehru Planetarium (JNP) at Bengaluru, India.
- **Aditya-L1 Support Cell Workshop (In-person)** — Sep 2023
  Organized at Indian Institute of Technology (IIT) Kanpur, India.
- **ZTF Summer School on Transients (Online)** — Jul 2023
  Hosted by University of Minnesota, Twin Cities, USA.
- **CASCA Annual General Meeting (In-person)** — Jun 2023
  Organized by Canadian Astronomical Society (CASCA) at Penticton, BC, Canada.
- **IIA Summer School (Online)** — Jul 2022
  Organised by Indian Institue of Astrophysics (IIA), Bangalore, India.

MOOCS

- **Astronomy: Exploring Time and Space**
  Offered on Coursera by University of Arizona — Aug 2020
- **Applied Plotting, Charting & Data Representation in Python**
  Offered on Coursera by University of Michigan — Aug 2020
- **Introduction to Data Science in Python**
  Offered on Coursera by University of Michigan — Sep 2020
- **From the Big Bang to Dark Energy**
  Offered on Coursera by The University of Tokyo — Sep 2020

LANGUAGES

- English, Hindi — *Native or Bilingual proficiency*