Avrajit Bandyopadhyay

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Date of birth: 13 January 1990

Education

2014 - 2020 **Ph.D.** Indian Institute of Astrophysics, Bangalore.
Submission: 25 April 2019. *Viva:* 05 October 2020.
Advisor: Prof. Sivarani Thirupathi, Indian Institute of Astrophysics, Bangalore.

2013 - 2014 **Junior Research Fellow** JRF in physics, Bhabha Atomic Research Centre, Mumbai.

2011 - 2013 **Master of Science** M.Sc in Physics, Indian Institute of Technology, Kharagpur.

2008 - 2011 **Bachelor of Science** B.Sc with Physics Honours, University of Calcutta.

Research interests

- Nuclear Astrophysics
- Near field cosmology / Galactic archaeology
- Chemical evolution of the Galaxy
- Globular clusters, dwarf galaxies and Galactic halo
- Chemodynamics / Accetion history of the Halo
- **Thesis title :** Study of Milky Way Halo stars and connection to globular clusters

Research experience

2022- present ***Post Doctoral Research Associate***, Department of Astronomy, University of Florida, USA

2020- 2022 ***Post Doctoral Fellow***, Aryabhatta Research Institute of Observational Sciences, Nainital, India.

2019 ***Post Doctoral Researcher***, Indian Institute of Astrophysics, Bangalore, India.

2014- 2019 ***Doctoral student***, Indian Institute of Astrophysics, Bangalore, India.

Teaching experience

2019 - 2020 ***Lecturer***, Invertis University, Bareilly.

Awards and honours

2021 Recipient of K.D.Abhyankar Best Thesis Award by the Astronomical Society of India, 2021

2019 Recipient of Best Poster Award in the annual meeting of the Astronomical Society of India, 2019

2014 Recipient of IIA graduate fellowship

2011-2013 Recipient of Masters' student fellowship, IIT Kharagpur

Competitively secured observing time (As PI) in last 2 years

Gemini-South GS2023B-FT210 - Probing Stellar Abundance Variations in NGC 2298 to Unravel the Origins of the R-process Among its Multiple Stellar Populations; 13 hours awarded

Gemini-South GS2024B-Q321 - Investigating stellar variations across the multiple populations in NGC 7492; 8 Hours awarded.

GTC GTC1-24AFLO - Spectroscopic survey of metal-poor Galactic globular cluster NGC 6779 with the GTC using OSIRIS; 14 hours awarded

GTC GTC1-23BFLO - Search for stars of globular cluster origin outside the tidal radius of NGC 7078 using GTC and Gaia; 10 hours awarded

GTC GTC3-23BIAFLO - Spectroscopic study of metal-poor Galactic globular cluster Palomar 2 with the GTC; 14 hours awarded

GTC GTC3-23AFLO - Search for stars of globular cluster origin in the cluster neighbourhood using GTC and Gaia; 14 hours awarded

GTC GTC4-23AFLO - A pilot Spectroscopic survey of metal-poor Galactic globular clusters with the GTC using OSIRIS; 8 Hours awarded.

HCT HESP-GOMPA survey of metal-poor stars in the Halo (HCT-2023-C3-P23, HCT-2023-C2-P47, HCT-2023-C2-P44, HCT-2023-C1-P60); 5 nights awarded

Experience with Observing Facilities

- GHOST spectrograph in the 8m-class Gemini South telescope (3 nights).
- OSIRIS (low-resolution) and HORuS (high-resolution) spectrograph data in GTC (2 nights).
- HESP spectrograph in HCT (31 nights).
- Photometric and spectroscopic observations with ADFOSC and IMAGER at 4m-class DOT (8 nights).
- MIKE spectrograph in MAGELLAN (remote).

Service to the community

- Chair of the IRENA online seminar organizing committee from 2023-2025 organized by the Joint Institute of Nuclear Astrophysics.
- Member of the TAC (Time Allocation Committee) for NOIRLAB in Galactic astrophysics for semesters 2023B, 2024A, 2025A.
- Refereed for the AAS journals.
- Mentored REU student Sujay Shankar from UT Austin in the summer of 2023.
- Took part in the evening sky-watch program at the University of Florida and participated in outreach events in the department.

Collaborations

- I am a part of the R-Process Alliance (RPA) collaboration.
- I am collaborating with the scientists at IAC and UF to run an observing program for outer halo globular clusters using the 10.4m Gran Telescope Canarias (GTC).

- I am associated with the Joint Institute of Nuclear Astrophysics (JINA-CEE) at Michigan State University and also serve as the chair of the seminar organizing committee for 2023-2025.
- I am a current member of the International Research Network for Nuclear Astrophysics (IRENA).
- I am working under the SDSS-V collaboration as a current member of SDSS-V.
- I am also involved in the ASTROSAT Globular cluster UVIT Legacy Survey (GlobULeS).

Mentoring

- Sujay Shankar, REU (PhD student BU) 2023 - 2024
- Ethan M. Bhula, UF (undergrad) 2022 - 2024
- John Dixon, UF (PhD student Texas A&M) 2022 - 2023
- Nima Aria, UF (Department of Defense) 2022 - 2024

Media Coverage

2022 Interviewed by the lead editor of the *AAS Journals* about my work on the production of Li and the origin of Li-rich stars in the Galactic halo (AAS YouTube link)

2020 Interviewed by the lead editor of the *AAS Journals* on my research on the r-process enhanced stars from HESP-GOMPA survey. (AAS YouTube link)

Computational skills

Languages	IDL,Python
Operating System	Windows xp/7, Linux (Ubuntu)
Software packages	IRAF, Topcat, Ispec, FSPS, SMHr, etc.

Astronomical tools

- Low, medium and high resolution optical spectroscopic data reduction using IRAF/Pyraf/customised pipelines.
- Optical photometry.
- IDL and python.
- State of the art software for astronomical spectroscopy like SMHr, SME, ispec, etc.
- Stellar atmospheric models: Kurucz, MARCS, ATLAS models
- Stellar spectrum synthesis: Turbospectrum, MOOG, linemake, FERRE
- Synthetic grids- Extensive spectral grids generated for Li, Ba, Sr, Na and Mg abundances for different resolutions.
- Nuclear astrophysics tools - NuPyCEE, Pynucastro

First author publications in refereed journal

1. *Tracing globular cluster escapees: Probing the extratidal stellar population of metal-poor globular cluster M15 using OSIRIS/GTC (expected submission: January 2025; A&A)*
   Avrajit Bandyopadhyay; David Aguado; Rana Ezzeddine; Prasanta K Nayak; Carlos Allende Prieto

2. *Probing abundance variations in the multiple population of metal-poor globular cluster NGC 2298 using Gemini South (The Astronomical Journal; under review; 2024c)*

   Avrajit Bandyopadhyay; Rana, Ezzeddine; Vinicius Placco; Anna Frebel; David S Aguado; Ian U Roederer

3. ** The* R*-Process Alliance: Fifth Data Release from the Search for R-process-enhanced Metal-poor Stars in the Galactic Halo with the GTC; 2024b, The Astrophysical Journal Supplement, 274, 2, 39**
   Link : ADS link

   Avrajit Bandyopadhyay; R. Ezzeddine; C. A. Prieto; A. Frebel; I.U. Roederer; T.T. Hansen; T.C.Beers et al.

4. ** A chemodynamical analysis of bright metal-poor stars from the HESP-GOMPA survey – Indications of a non-prevailing site for light r-process elements; 2024a, MNRAS, 529, 3, 2191-2207*
   Link : ADS link

   Avrajit Bandyopadhyay; T.C.Beers; R. Ezzeddine; T. Sivarani et al.

5. ** Li distribution, kinematics and detailed abundance analysis among very metal-poor stars in the Galactic halo from the HESP-GOMPA survey; 2022, ApJ, 937,52*
   Link : ADS link

   Avrajit Bandyopadhyay; T.Sivarani; T.C.Beers; A.Susmitha; P.K.Nayak; J.C. Pandey

6. *Abundance Analysis of New R-Process-Enhanced stars from the HESP-GOMPA Survey ; 2020, ApJ, 899, 1, 22*
   Link : ADS link

   Avrajit Bandyopadhyay; Sivarani Thirupathi; Timothy C. Beers;

7. *A high-resolution spectroscopic study of two new Na- and Al-rich field giants – likely globular cluster escapees in the Galactic halo; 2020, MNRAS, 494,1, 36-43* Link : ADS link

   Avrajit Bandyopadhyay; Sivarani Thirupathi; Timothy C. Beers, Susmitha Antony

8. *Chemical Composition of Two Bright, Extremely Metal-poor Stars from the SDSS MARVELS Pre-survey; 2018, ApJ, 859, 114* Link : ADS link

   Avrajit Bandyopadhyay; Sivarani Thirupathi; Susmitha Antony; Timothy C. Beers; Sunetra Giridhar; Arun Surya; Thomas Masseron

Major contributor/student publications in refereed journal

9. *Novel Dynamical Tagging of Globular Cluster Escapee Candidates Back to their Sources (submission expected in October 2024)*
   Link : ADS link

   Sujay Shankar; **Avrajit Bandyopadhyay**, Rana Ezzeddine

10. *Near-UV and optical spectroscopic investigation of late-type stars from MIRA/Oliver Observing Station (BSRSL)*
    Link : ADS link

    S.Karmakar, **A. Bandyopadhyay**; B.Weaver; J.C.Pandey et al.

Co-author publications in refereed journal

11. *Stars and stellar populations in Milky Way and the nearby galaxies (JAA - under review)*
T. Sivarani, S. Smitha, **A. Bandyopadhyay** et al.

12. *Decoding the compositions of four bright r-process-enhanced stars (MNRAS)*
Link : ADS link

P.Saraf, C.A.Prieto, **A. Bandyopadhyay** et al.

13. *Globular Cluster UVIT legacy Survey (GlobUleS) III. Omega Centauri in Far-Ultraviolet (ApJL)*
Link : ADS link

D.Prabhu,.., **A. Bandyopadhyay**; T.Sivarani; et al.

14. *Horizons: Nuclear Astrophysics in the 2020s and Beyond. (JPG)*
Link : Arxiv link

H. Schatz; ...; A. Bandyopadhyay;...

15. *Globular Clusters UVIT Legacy Survey (GlobULeS) I. FUV-optical Color-Magnitude Diagrams for Eight Globular Clusters (MNRAS)*
Link : ADS link

S. Sahu, **A. Bandyopadhyay**; T.Sivarani; et al.

16. *Optical and NIR spectroscopy of cool CEMP stars to probe the nucleosynthesis in low mass AGB binary system ; (MNRAS)*
Link : ADS link

A. Susmitha; T. Sivarani; D.K. Ojha; J.P. Ninan; **A. Bandyopadhyay**; A. Surya; U. Athira

17. *UVIT-HST-Gaia-VISTA study of KRON 3 in the Small Magellanic Cloud: A cluster with an extended red clump in UV; 2021, MNRAS, 503,4, 5291-5309*
Link : ADS link

P. K. Nayak; A. Subramaniam; Subramanian; S. Sahu; C. Mondal; Maria-Rosa L. Cioni; Cameron P. M. Bell; **A. Bandyopadhyay**; Chul Chung

18. *Oxygen abundances of carbon enhanced stellar population in the halo; 2020, JoAA, 40, 51*
Link : Springer link

A. Susmitha; T. Sivarani; D.K. Ojha; J.P. Ninan; **A. Bandyopadhyay**; A. Surya; U. Athira

Conference proceedings

1. An abundance study of faint and Extremely Metal-Poor stars from the R-Process Alliance Using the GTC
Link : ADS link

Avrajit Bandyopadhyay; Rana Ezzeddine

2. *Probing the distinct chemical history of the Milky Way halo and old thick disk through HESP-GOMPA survey*
Link: EPJ link

Pallavi Saraf; T. Sivarani; **A. Bandyopadhyay**

Selected Talks

2024 **Invited Talk** presented at the *Instituto de Astrofísica de Canarias* on "Tracing the Origin and Evolution of Halo Stars and Globular Clusters: Insights from the R-Process Alliance".

2024 Contributed Talk presented at the *CeNAM Frontiers in Nuclear Astrophysics Meeting* at the University of Notre Dame on "Challenging the Paradigms of Type II Supernovae's Role in the Production of Light r-process Elements".

2023 Contributed Talk presented at *Metal Production and Evolution in the Hierarchical Universe - II* at the European Southern Observatory on "An Abundance Study of Faint and Extremely Metal-Poor Stars from the R-Process Alliance Observed by the GTC".

2023 Contributed Talk presented at the *BRIDGCE IRENA Conference* at the University of Edinburgh on "An Abundance Study of Extremely Metal-Poor Stars from the R-Process Alliance".

2023 Contributed Talk presented at the *Non-LTE Radiative Transfer Meeting* at the University of Chicago on "Tracing the Evolution of Metal-Poor Stars in the Halo Using Li and Heavy Elements".

2021 Contributed Talk presented at the *39th Annual Meeting of the Astronomical Society of India* on my thesis "Study of Milky Way Halo Stars and Connection to Globular Clusters".

2020 Contributed Talk presented at *20 Years of Himalayan Chandra Telescope* at the Indian Institute of Astrophysics, Bangalore on "Origin and Abundances of r-process Rich Stars in the Galaxy".

2019 **Invited Talk** presented at *150 Years of the Periodic Table - Chemical Elements in the Universe: Origin and Evolution* at the Indian Institute of Astrophysics, Bangalore on "Anomalies, Abundances, and Origin of Globular Clusters".

2018 Contributed Talk presented at *Chemical Evolution and Nucleosynthesis Across the Galaxy* at Max-Planck-Haus, Heidelberg, Germany on "First Results from HESP-GOMPA Survey".

2018 Contributed Talk presented at *Exploring the Universe: Near Earth Space Science to Extragalactic Astronomy* at S. N. Bose National Centre for Basic Sciences, Kolkata, India on "Study of Globular Cluster Escapees and Exploring the Common Origin of GCs and Halo Using n-capture Elements".

2018 Contributed Talk presented at *36th Annual Meeting of the Astronomical Society of India* at Osmania University, Hyderabad, India on "Connection between Globular Clusters and the Galactic Halo".

2017 Contributed Talk presented at *Thirty Meter Telescope Science Forum* at Infosys Campus, Mysore, India on "Connecting Globular Clusters and the Galactic Halo".

References

1. **Rana Ezzeddine**
   Assistant Professor,
   University of Florida, USA
   e-mail: rezzeddine@ufl.edu

2. **Timothy C Beers**
   Grace-Rupley Professor of Physics
   University of Notre Dame, USA
   e-mail: tbeers@nd.edu

3. **Prof. Sivarani Thirupathi**
   Professor,
   Indian Institute of Astrophysics, India.
   e-mail: sivarani@iiap.res.in