Ayan Bhattacharjee

astro_ayan · Postdoctoral Researcher · UNIST · Astro-Ayan

Research Interests

My primary area of research has been the accretion-ejection processes around compact objects.

- **Investigating the role of advective component of accretion around compact objects.**
- **Monte Carlo simulation of non-local radiation processes around black holes, neutron stars.**
- **Analytical spectral modelling of Z and Atoll type Nuetron Star sources.**
- **RHD Simulation of Radio Galaxy Jets, especially focusing on the deceleration of FR-I jets, due to complex interaction between jet and ambient media.**

Employment

Postdoctoral Researcher — **South Korea**
Department of Physics, UNIST — *June 2022 – Present*
NRF Creative and Challenging (창의·도전) Research Fellowship

Researcher — **South Korea**
Center for High-Energy Astrophysics, UNIST — *July 2021 – June 2022*

Visiting Researcher — **India**
Department of Astrophysics and Cosmology, SNBNCBS — *August 2019 – July 2020*

Senior Research Fellow — **India**
Department of Astrophysics and Cosmology, SNBNCBS — *August 2016 – July 2019*

Junior Research Fellow — **India**
Department of Astrophysics and Cosmology, SNBNCBS — *August 2014 – July 2016*

Education

[🎓] Ph.D. in Astrophysics — **India**
[🏛] *S. N. Bose National Centre for Basic Sciences* — *August 2014 – February 2021*†
Thesis: Spectral And Timing Properties Of Black Holes And Neutron Stars In X-Ray Binaries Using Two-Component Advective Flow Solution
Advisor: Prof. Sandip k. Chakrabarti
† Delayed due to COVID19 lockdowns

[🎓] M.Sc. in Physical Sciences — **India**
[🏛] *S. N. Bose National Centre for Basic Sciences* — *August 2012 – July 2014*
Project: Parrondo's Paradox and the Brownian Ratchet
Project Supervisor: Prof. Punyabrata Pradhan
Integrated Ph.D. Program at S. N. Bose National Centre for Basic Sciences

- **80.9%** (1st class, 1st position in University of Calcutta)

[🎓] B.Sc. in Physics — **India**
[🏛] *West Bengal State University* — *2009 – 2012*

- **74.3%** (1st class, 2nd position in University)

Refereed Publications

First Authored: **5** [2 MNRAS†, 2 ApJ†, 1 ASSP†]
Second authored: **3** [1 ApJ†, 1 RAA, 1 AdSpR]
Contributory author: **2** [1 ApSS, 1 AdSpR]
Corresponding Author: **5**
Complete List of Publications: ORCID, Google Scholar, NASA ADS

Selected Publications

1. **A. Bhattacharjee**, I. Banerjee, A. Banerjee, D. Debnath, S. K Chakrabarti, "The 2004 outburst of BHC H1743-322: analysis of spectral and timing properties using the TCAF solution", **MNRAS**, **466**, 1372-1381 (2016)
2. **A. Bhattacharjee**, S. K. Chakrabarti, "Monte Carlo Simulations of Thermal Comptonization Process in a Two Component Advective Flow around a Neutron Star.", **MNRAS**, **472**, 1361-1371 (2017)
3. **A. Bhattacharjee**, "Generalized Flows Around Neutron Stars", in Mukhopadhyay B., Sasmal S. (eds) *Exploring the Universe: From Near Space to Extra-Galactic*, **ASSP**, vol 53. Springer, Cham, 93-107 (2018)
4. **A. Bhattacharjee**, S. K. Chakrabarti, "Timing Properties of Shocked Accretion Flows around Neutron Stars in presence of cooling", **ApJ**, **873**, 119 (2019)
5. A. Banerjee, **A. Bhattacharjee**, D. Debnath, S. K. Chakrabarti, "Spectral Analysis of χ Class Data of GRS 1915+105 Using TCAF Solution", **RAA**, 20(12), 208 (2020)
6. A. Banerjee, **A. Bhattacharjee**, D. Chatterjee, D. Debnath, S. K. Chakrabarti, T. Katoch, & H. M. Antia, "Accretion Flow Properties of GRS 1915+105 During Its θ Class Using AstroSat Data", **ApJ**, 916(2), 68 (2021)
7. D. Chatterjee, D. Debnath, A. Jana, J. R. Shang, S. K. Chakrabarti, H. K. Chang, A. Banerjee, **A. Bhattacharjee**, K. Chatterjee, R. Bhowmik, S. K. Nath, "AstroSat observation of non-resonant type-C QPOs in MAXI J1535-571", **ApSS**, 366(8), 82 (2021)
8. S. Chowdhury, S. Sasmal, J. Brundell, S. Chakraborty, **A. Bhattacharjee**, & S. K. Chakrabarti, "Energetic electron precipitation during lightning activities over Indian landmass as observed from WWLLN and NOAA-15 satellite", **AdSR**, 68(10), 4205 (2021)
9. A. Banerjee, **A. Bhattacharjee**, D. Debnath, S. K. Chakrabarti, "Similarities and differences in accretion flow properties between GRS 1915+105 and IGR J17091-3624: A case study", **AdSR**, 69(7), 2930 (2022)
10. **A. Bhattacharjee**, J. Seo, D. Ryu, & H. Kang, "A Simulation Study of Low-Power Relativistic Jets: Flow Dynamics and Radio Morphology of FR-I Jets", **ApJ** (in press), (2024)

Grants, Fellowships and Achievements

- **Creative and Challenging Research Grant:** "Simulation Study on Low-Powered FR-I Jets from Radio Galaxies", total budget of 210,000,000 KRW, National Research Foundation of Korea, 2022-2025
- **SERB-ITS Grant:** Presenting findings at **FOXT**, API, Amsterdam, DST, India, 2019
- **COSPAR Grant:** A 800 support for 42nd COSPAR Assembly, COSPAR Secretariat, Caltech, USA, 2018
- **Secured Eligibility for Lectureship/Assistant Professorship**: **CSIR-UGC NET**, The Council of Scientific & Industrial Research and University Grants Commission, Department of Higher Education, India, 2015-2016
- **Secured Eligibility for Scientific Officer**: A 99.6 **percentile** in OCES/DGFS 2014, Bhaba Atomic Research Centre, Department of Atomic Energy, India, 2014
- **Secured Eligibility for Engineering M.Tech.**: Ranked **172** in nationwide Graduate Aptitude Test in Engineering (**GATE**), Department of Higher Education, India, 2014
- **Gold Medal: 1st** position in IPhD Programme (2012-2014), Dean (AP) & Director of SNBNCBS, DST, 2014
- **PBIR Fellowship:** Scholarship for Post-B.Sc. Integrated-PhD Scholar, SNBNCBS, DST, India, 2012
- **Gold Medal**: **1st** position in B. Sc.(H) Physics, BRSN College, 2012
- **INSPIRE (Scholarship for Higher Education):** Top 1% in the 10th & 12th standard, DST, India, 2009

Computational Skills

- Programming Languages: **Fortran 77** [Advanced], **Shell** [Advanced], **C/C++** [Good]
- Computing Tools: **Mathematica** [Advanced], **ROOT** [Advanced], **Python** [Proficient], **Matlab** [Good]
- Graphical (plotting) softwares: **GNUplot** [Advanced], **XmGrace** [Advanced], **SuperMongo** [Advanced], **IDL** [Advanced], **ParaView** [Good], **Grapher** [Good], **Origin** [Basic]

Data Reduction & Analysis Skills:

- **HEASOFT/XSPEC** [Proficient]: Spectral analysis, modelling.
- **HEASOFT/XRONOS** [Proficient]: Timing analsis, modelling.
- **RXTE/PCA** [Proficient]: Spectral and Timing Data extraction, analysis.
- **RXTE/HEXTE** [Proficient]: Spectral and Timing Data extraction, analysis.
- **AstroSat/LAXPC** [Advanced]: Spectral and Timing Data extraction, analysis.

Invited and Solicited Talks

Two Component Advective Flows (TCAF): **ICSP, Kolkata, India**
Fitting Procedure and Results for Stellar and supermassive black holes
***T**: X-ray Spectral fitting of BHXRBs by TCAF FITS file* *Sep 25, 2024*

The 2023 September KNAG Meeting **KASI, Daejeon, South Korea**
***T**: A Simulation Study of Low-Power Relativistic Jets:*
Structures and Dynamics of FR-I Jets *Sep 15, 2023*

The 68th GWNR Workshop **APCTP, POSTECH, Pohang, South Korea**
***T**: Numerical Simulations of Accretion-Ejection around Compact Objects:*
What to include (and what not to)? *Mar 15-16, 2023*

CHEA Special Seminar **CHEA, UNIST, Ulsan, South Korea**
***T**: Could There Be a Unified Spectral Model for Black Holes and Neutron Stars?* *Jul 22, 2021*

Selected Talks from International Conferences

The 45th COSPAR Assembly, Session E1.2 **BEXCO, Busan, South Korea**
[🎙] *: What is the Origin of Jets in Accreting Neutron Stars?*
A Unified Accretion-Ejection Mechanism for Compact Objects *Jul 13 - 21, 2024*

The 45th COSPAR Assembly, Session E1.8 **BEXCO, Busan, South Korea**
[🎙] *: A Simulation Study on Relativistic Jets:*
Impact of the Central kpc Region on Jets across Different Scales *Jul 13 - 21, 2024*

The $XXXI^{st}$ IAU GA Meeting, Focus Meeting 1 **BEXCO, Busan, South Korea**
[🎙] *: A Simulation Study on the Morphological Dichotomy of FR-I and FR-II Jets* *Aug 2-11, 2022*

The 43rd COSPAR Assembly, Session E1.5 **Online, Sydney, Australia**
[🎙] *: What is the Origin of QPOs in Accreting Neutron Stars?* *Jan 28 - Feb 4, 2021*

The 43rd COSPAR Assembly, Session E1.8 **Online, Sydney, Australia**
[🎙] *: Can there be a Unified Spectral Model for Black Holes and Neutron Stars?* *Jan 28 - Feb 4, 2021*

The Future of X-Ray Timing **API, Amsterdam, Netherlands**
[🎙] *: Can a Two-Component paradigm explain the spectral and*
timing properties of neutron stars? *Oct 22 - 25, 2019*

EXPUNIV2018: Black Holes & High Energy astrophysics **SNBNCBS, Kolkata, India**
[🎙] *: The Formation of Two Component Advective Flow around Neutron Stars* *Nov 14 - 17, 2018*

The 42nd COSPAR Assembly, Session E1.13 **Caltech, Pasadena, CA, USA**
[🎙] *: Formation of Two-Component Advective Flows around Neutron Stars*
and the Possibility of Super-Eddington Accretion Rates *Jul 14 - 22, 2018*

The 42nd COSPAR Assembly, Session E1.10 **Caltech, Pasadena, CA, USA**
[🎙] *: Formation and Stability of Oscillating Shocks in Inviscid Avective Flows around Neutron*
Stars in Presence of Cooling using Smoothed Particle Hydrodynamics Simulations *Jul 14 - 22, 2018*

The 42nd COSPAR Assembly, Session E1.4 **Caltech, Pasadena, CA, USA**
[🎙] *: The Formation of Two Component Advective Flow around Neutron Stars* *Jul 14 - 22, 2018*

The 15th Marcel Grossmann Meetings, S. AC1 **University of Rome, Italy**
[🎙] *: The Formation of Two Component Advective Flows around Neutron Stars* *Jul 1 - 7, 2018*

INTEGRAL Symp., S. 4: Accretion and Ejection: Galactic and Extragalactic **INAF, Venice, Italy**
[🎙] *: Is neutron star spectrum also an outcome of TCAF?* *Oct 15 - 20, 2017*

INTEGRAL Symp., S. 2: Outbursting sources: BHC, NS, AGN/Blazars **INAF, Venice, Italy**
[🎙] *: Outburst of BHC H1743-322: Analysis of Spectral and Timing Properties Using*
TCAF Solution *Oct 15 - 20, 2017*

Wide Band Spectral and Timing Studies of Cosmic X-ray Sources **TIFR Mumbai, India**
[🎙] *: Is Neutron Star Spectrum also an Outcome of TCAF?* *January 10 - 13, 2017*

Organizational Skills

- **Workshop Coordinator**: Two Component Advective Flows (TCAF): Fitting Procedure and Results for Stellar and supermassive black holes, ICSP, India, (**2024**)
- **Conference Volunteer**: International Astronomical Union General Assembly Meeting, at BEXCO, South Korea, (**2022**)
- **Conference Volunteer**: EXPUNIV: Black Hole and High Energy Astrophysics, at SNBNCBS, India, (**2018**)
- **Workshop Coordinator**: X-ray Observations and Data Analysis of Compact Objects at 35^{th} Annual Meeting of Astronomical Society of India held at Jaipur, India (**2017**)
- **Conference Coordinator**: Indian Science Congress [Children Wing] held at SNBNCBS, India (**2013**)