

SOMADUTTA BHATTA

Relativistic Heavy Ion Physics Lab, Stony Brook University, USA 11790

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PERSONAL INFORMATION

Nationality: Indian

Date and Place of birth: 22nd May 1995, India.

EDUCATION

- **Ph.D. Candidate** Expected May 2025
Stony Brook University, (SUNY), USA
Advisor: Prof. Jiangyong Jia
- **Bachelor's and Master's degree in Physics** 2013-2018
National Institute of Science Education and Research, (NISER, HBNI), India
Advisor: Prof. Bedangadas Mohanty
Thesis: [Understanding mechanism of particle production in heavy-ion collisions at \$\sqrt{s_{NN}} = 200\$ GeV.](#)
[Link to thesis](#)

EXPERIMENTAL COLLABORATIONS

1. Active Member of ATLAS Experiment at LHC.
2. Active Member of STAR Experiment at RHIC.

REFEREED PUBLICATIONS

Experimental/Data Papers: 5, Model/Phenomenological Papers: 9, Conference proceedings/Notes: 6.

Further details on my publications are available at these databases: [Google Scholar](#), [Inspire-HEP](#), [ArXiv](#).

A. FIRST/PRIMARY/CORRESPONDING Author

A.i) Data Papers

1. Evidence for the collective nature of radial flow in Pb+Pb collisions with the ATLAS detector.
Contributions: Lead Analyzer, Writing Internal Note, Writing Paper. [ATLAS, \(Submitted to PRL\) arXiv:2503.24125](#)
2. Disentangling sources of momentum fluctuations in Xe+Xe and Pb+Pb collisions with the ATLAS detector.
Contributions: Lead Analyzer, Writing Internal Note, Writing Paper. [ATLAS, PRL 133, 252301 \(2024\)](#)
3. Imaging Shapes of Atomic Nuclei in High-Energy Nuclear Collisions.
Contributions: Running Trajectory simulations to extract deformation parameter, Writing Paper. [STAR, Nature 635, 67–72 \(2024\)](#).
4. Correlations between flow and transverse momentum in Xe+Xe and Pb+Pb collisions at the LHC with the ATLAS detector.
Contributions: Lead Analyzer, Writing Internal Note, Writing Paper. [ATLAS, PRC 105, 054910 \(2023\)](#).
5. Beam-energy dependence of correlations between mean transverse momentum and anisotropic flow of charged particles in Au+Au collisions at RHIC.
Contributions: Analysis, Writing Paper. [STAR, \(Submitted to PLB\) arXiv:2411.12101 \[nucl-ex\]](#).

A.ii) Phenomenological Papers

6. Disentangling the global multiplicity and spectral shape fluctuations in radial flow. [arXiv:2504.20008 \[nucl-th\] \(2025\)](#)
7. Experimental method to constrain preferential emission and spectator dynamics in heavy-ion collisions. [\(Submitted to PLB\) arXiv:2407.06977 \[nucl-th\] \(2024\)](#)
8. Energy dependence of heavy-ion initial condition in isobar collisions. [PLB **858**, 139034 \(2024\)](#)
9. Higher-order transverse momentum fluctuations in heavy-ion collisions [PRC **105**, 024904 \(2022\)](#)
10. An improved method to access initial states in relativistic heavy-ion collisions. [EPJC **82**, 855 \(2022\)](#)

B. Other Papers (as contributing author)

11. Sources of longitudinal flow decorrelations in high-energy nuclear collisions. [\(Submitted to PRL\) arXiv:2408.15006 \[nucl-th\] \(2024\)](#)
12. Thermalization at the femtoscale seen in high-energy Pb+Pb collisions [PRC **109**, L051902 \(2024\)](#)
13. Impact of nuclear shape fluctuations in high-energy heavy ion collisions [EPJA **59**, 45 \(2023\)](#)
14. Ratios of collective flow observables in high-energy isobar collisions are insensitive to final state interactions. [PRC **106**, L031901 \(2022\)](#)
15. Non-flow effects in correlation between harmonic flow and transverse momentum in nuclear collisions. [PLB **822**, 136702 \(2021\)](#)

PROCEEDINGS/ CONFERENCE NOTES

1. Measurement of collective dynamics in small and large systems with the ATLAS detector. [PoS EPS-HEP2023 **202**](#)
2. Measurement of $[p_T]$ Fluctuations in Xe+Xe and Pb+Pb Collisions with ATLAS. [ATLAS-CONF-2023-061](#)
3. Deciphering initial states of high energy heavy-ion collisions using spectators. [Submitted to IJMPCS, 2022](#)
4. Flow and transverse momentum correlation in Pb+Pb and Xe+Xe collisions with ATLAS: assessing the initial condition of the QGP. [APPB Proc. Suppl. \(2022\)](#)
5. Measurements of collective behavior in pp, Xe+Xe, and Pb+Pb collisions with the ATLAS detector. [PoS EPS-HEP2021 **305**](#)
6. Measurement of flow and transverse momentum correlations in Pb+Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV and Xe+Xe collisions at $\sqrt{s_{NN}} = 5.44$ TeV with the ATLAS detector. [ATLAS-CONF-2021-001](#)

INTERNAL NOTES

1. *ATLAS Collaboration*: Transverse dynamics of mean transverse momentum fluctuations in Pb+Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV with the ATLAS detector.
2. *ATLAS Collaboration*: Measurement of the mean transverse momentum fluctuations of charged particles in Xe+Xe collisions at $\sqrt{s_{NN}} = 5.44$ TeV and Pb+Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV with the ATLAS detector.
3. *ATLAS Collaboration*: Measurement of flow and transverse momentum correlations in Xe+Xe collisions at $\sqrt{s_{NN}} = 5.44$ TeV and Pb+Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV with the ATLAS detector.
4. *STAR Collaboration*: Imaging Shapes of Atomic Nuclei in High-energy Nuclear Collisions.
5. *STAR Collaboration*: Beam-energy dependence of transverse momentum-flow correlations in Au+Au collisions.

A.) Invited Talks

1. **CERN-TH Seminar 2025**, Insights into Nuclear Geometry and Initial Conditions of Heavy-Ion Collisions from ATLAS [Invited-Talk link](#)
2. **HENPIC Seminar 2024**, Insights into Nuclear Geometry and Initial Conditions of Heavy-Ion Collisions from ATLAS [Invited-Talk link](#)
3. **SBU HEP Seminar 2024**, Leveraging Ultra-Central Collisions to Constrain Shape of the Nucleus and Initial State [Invited-Talk link](#)
4. **Nuclear Physics Seminars at BNL 2024**, Disentangling sources of momentum fluctuations in heavy-ion collisions with the ATLAS detector [Invited-Talk link](#)
5. **LHCP 2024**, Probing medium properties in ultra-central collisions (ATLAS+ALICE+CMS talk). [Invited Talk-link](#)
6. **INT-Program 2023** Intersection of nuclear structure and high-energy nuclear collisions, Energy dependence of initial condition from isobar. [Invited-Talk link](#)
7. **Nuclear Physics Seminars at BNL 2022**, Flow and transverse momentum correlations at LHC: a probe of the heavy-ion initial state and nuclear deformation [Invited-Talk link](#)

B.) International-Level Conference Talks

1. **Quark Matter 2025**, Evidence for the collective nature of radial flow in Pb+Pb collisions with the ATLAS detector. [Talk-link](#)
2. **ATHIC 2025**, Unveiling initial state fluctuations using $[p_T]$ cumulants with ATLAS. [Talk-link](#)
3. **EPS-HEP 2023**, Measurement of collective dynamics in small and large systems with the ATLAS detector. [Talk-link](#)
4. **Initial Stages 2023**, Probing initial state using higher order fluctuations: $v_n - [p_T]$ and $[p_T]$ correlations in ATLAS. [Flash-Talk-link](#)
5. **Quark Matter 2022**, Flow and transverse momentum correlation in Pb+Pb and Xe+Xe collisions with ATLAS: assessing the initial condition of the QGP [Talk-link](#)
6. **EPS-HEP 2021**, Measurements of collective behavior in pp, Xe+Xe, and Pb+Pb collisions with the ATLAS detector [Talk-link](#)
7. **ATLAS TDAQ week at CERN 2020**, MinBias and Forward Detector [Talk-link](#)

C.) National-Level Conference Talks

1. **Fall Meeting for APS DNP-2022**, Probing nuclear deformation at LHC energies using AMPT. [Talk-link](#)
2. **APS April Meeting 2022**, Higher order transverse momentum fluctuations in heavy ion collisions. [Talk-link](#)
3. **Fall Meeting for APS DNP-2021**, Flow and transverse momentum correlations in Pb+Pb and Xe+Xe collisions with ATLAS [Talk-link](#)
4. **APS April Meeting-2021**, Cumulant analysis of deformed systems using AMPT model [Talk-link](#)

D.) Conference Posters

1. **Quark Matter 2023**, Exploring the origin of $[p_T]$ fluctuations in ultra-central heavy ion collisions: Higher order $[p_T]$ correlations in ATLAS. [Poster-link](#)
2. **SQM-2022**, Flow and transverse momentum correlations in Pb+Pb and Xe+Xe collisions with ATLAS: assessing the initial condition of the QGP [Poster-link](#)
3. **Initial stages 2021**, Measurement of flow and transverse momentum correlations in Pb+Pb collisions at $\sqrt{s_{NN}}=5.02$ TeV and Xe+Xe collisions at $\sqrt{s_{NN}}=5.44$ TeV with the ATLAS detectors. [Poster-link](#)
4. **APS Fall Meeting 2020**, Flow cumulants for multi-particle azimuthal correlations in heavy-ion Collisions. [Poster-link](#)

REVIEWER FOR JOURNALS

I am a reviewer for **Physical Review C (PRC, APS)** and **Physical Review D (PRD, APS)** journals.

TECHNICAL CONTRIBUTIONS AND SERVICE WORK

1. **Efficiency Tool for ATLAS Heavy-Ion group:** Developed and Maintained a general-purpose Efficiency calculation tool for calculation of tracking efficiency and fraction of fake tracks in reconstructed data for Heavy-Ion datasets in ATLAS, CERN. [GitLab Link](#) 2023-2024
2. **Trigger Upgrade to Multi-thread framework for ATLAS:** Upgraded MinBias, MBTS, and HMT Triggers to Athena Multi-thread framework for ATLAS.
Upgraded Minbias High-Level Trigger, including SpacePoints/Tracks/Vertex counters.
Translated related feature reconstruction algorithms, and completely rewrote the related Hypothesis algorithms. Tested the High-Level trigger code for physics performance. [Jira-Links](#) 2019-2022
3. **STAR Experimental Shifts:** Regularly took experimental shifts for STAR collaboration as a “Detector Operator”. The duties involved the operation of the STAR detector components and solving the issues during the run to ensure smooth data taking. 2019-2023
4. **Organization of DIS-2021 Conference:** Volunteered to ensure smooth organization of XXVIII International Workshop on Deep-Inelastic Scattering held at SUNY, Stony Brook, USA. [Event-link](#) 2021

TECHNICAL SKILLS

Experienced in analysis framework used in STAR experiment at RHIC and ATLAS, CMS experiments at LHC.

I have studied heavy-ion collisions using following models for my papers:

1. **Initial State models:** Glauber, Trento
2. **String-based models:** HIJING, AMPT
3. **Full Hydrodynamic model:** TRAJECTUM
4. **Others:** DPMJET

Proficient in:

1. **For data analysis:** ROOT, Mathematica
2. **Programming Language:** C++, Python

AWARDS AND SCHOLARSHIPS

1. **Distinguished Travel Award** (Stony Brook University) 2025
2. **Young Scientist Award** (Initial Stages Conference) 2023
3. **CSIR-NET (Physics) Exam + Fellowship: All India Rank - 39** 2018
The National Eligibility Test (NET) is a test being conducted to determine the eligibility of Indian nationals for Junior Research Fellowship (JRF), Assistant Professor and admission to Ph.D. In Indian universities.
From an average of 0.2 million participants, 0.5% qualify for JRF+Assistant professorship.
I obtained an All India Rank of 39 for JRF+Assistant professorship in the NET exam and was offered the fellowship.
4. **INSPIRE Fellowship:** 2013-2018
“Innovation in Science Pursuit for Inspired Research (INSPIRE)” is a program sponsored and managed by the Department of Science & Technology (DST, Govt. of India) for attraction of talent to Science.
Maximum of 12000 students nation-wide are provided with monetary fellowship to carry out B.Sc and M. Sc across different fields in India, fulfilling certain academic requirements.
I was awarded this fellowship for 5 years.

5. **Best project student in Department of High Energy Physics** (TIFR, India) 2016
Selected as Best project student among all pre-selected students in the Department of High Energy Physics based on my work on “Using an optimized TMVA technique to extract single Top events at CMS” carried out in Tata Institute of Fundamental Research, Mumbai, India during the Visiting Student Research Program.
6. **NIUS Scholar** (HBCSE, TIFR, India) 2014-2015
National Initiative on Undergraduate Science (NIUS) is a 2 year scholarship offered to selected students in India to carry out research under supervision of a researcher at Homi Bhabha Centre for Science Education, TIFR, Mumbai, India. Out of about 100 pre-selected students, **I was one of the 4 students selected** for the scholarship to work on Neutrino Oscillations for a duration spanning 2 years.
7. **NTSE Scholar** (NCERT, Govt. of India) 2009-2013
National Talent Search Examination (NTSE) is conducted by National Council of Educational Research and Training (NCERT) to identify and nurture the talented students by providing them scholarships in India. Out of about 1 Million applicants nationwide, 1 Thousand students are selected per year for a 4 year scholarship. **I qualified all rounds of exam and interviews and was offered the scholarship.**

RELEVANT EXPERIENCE AND INTERNSHIPS

1. **Summer Research Internship at SINP**, Kolkata, India. May-July 2017
Title: Simulation of Gaseous Detectors using Garfield++. [Link to Report](#)
Simulated RPC and GEM detectors using Garfield++ to study interaction of charged particles within the gaseous volume. The RPC was simulated using CST and ComponentAnalyticalField classes, GEM was simulated using ANSYS. A detailed study of the the algorithms behind HEED, Magboltz++, and the Finite Element Method subroutines was carried out. Both RPC and GEM detectors were simulated with the requisite geometric and field configurations, and gas mixture. The distributions of Primary ionisation electron per cluster and per event, gain distributions, and signals were analyzed.
2. **Summer Research Internship at TIFR**, Mumbai, India. May-July 2016
Title: Optimized TMVA technique to extract single Top events at CMS. [Link to Report](#)
Used TMVA to separate the signal region from the background region in single top events from the t-channel in pp collisions at $\sqrt{s_{NN}}=13$ TeV collected with CMS. Several weakly discriminating input variables were chosen for the training of the MVA based on their separation properties. Performance parameters such as Significance, Separation, and ROC curves were used to evaluate each set of variables. After achieving maximal separation, a cut was chosen from the dependence of signal significance vs. applied cut to maximize the separation between signal and background.
3. **Semester Project at NISER**, Bhubaneswar, India Jan-May 2016
Title: Study of the elliptic flow of light nuclei using Coalescence method. [Link to Poster](#)
Mechanism of production of light-nuclei such as deuteron and ^3He was studied using AMPT simulated Au+Au collisions at $\sqrt{s_{NN}}=200$ GeV. The coalescence mechanism of nucleon formation implemented within the AMPT model was found to provide a good description of elliptic flow (v_2) vs p_T for the light nuclei measured using STAR data. The v_2 of light nuclei from AMPT simulated events displayed a mass number scaling for intermediate p_T , whereas a mass ordering was observed for low p_T region. It was concluded that nucleon-coalescence provides a reasonable explanation for the mechanism of light-nuclei formation in heavy-ion collisions at $\sqrt{s_{NN}}=200$ GeV.
4. **NIUS Research program at HBCSE, TIFR**, Mumbai, India: 2013-2015
Title: Solar and Reactor neutrino oscillation. [Link to Report](#)
Studied two- and three-flavored neutrino oscillations in vacuum and matter (MSW effect). Discussed the MSW triangle and the four alternative solutions (LMA, SMA, LOW, VAC), as well as the confirmation and refinement of the LMA solution by KamLAND. The potential for pinpointing the third mixing angle and refining the value of the CP-violating phase with future experiments was also studied.

SCHOOLS/TRAINING PROGRAMS ATTENDED

1. **Exploring Nuclear Physics across Energy Scales 2024** *Apr 2024*
China Center of Advanced Science and Technology, Beijing, China.
Participated in two-week long program+workshop focused on the intersection between nuclear structure and high-energy nuclear collisions, with a focus on the manifestation of low-energy structure of nuclei in high-energy collisions.
2. **INT-23-1a “Intersection of nuclear structure and high-energy nuclear collisions”** *Feb 2023*
University of Washington, Seattle, Washington.
Selected to participate in the workshop and presented my work on “Energy dependence of initial condition from isobar collisions”.
3. **National Nuclear Physics Summer School** *July 2022*
Selected to participate in the school held at MIT, Cambridge, USA.
Presented poster on “ATLAS measurement on Triaxiality of ^{129}Xe nucleus using $V_n - [p_T]$ correlation”.
4. **ATLAS HLT Upgrade Hackathon** *June 2019*
CERN
Participated in Hackathon for implementing Athena-Multi-thread for High-Level Trigger (HLT) in ATLAS.
5. **Visiting Student’s Research program (VSRP).** *May 2016*
Tata Institute of Fundamental Research (TIFR), Mumbai, India
Shortlisted to do summer research on isolating single-Top events at CMS with Multi-Variate Analysis technique
6. **National Initiative on Undergraduate Science (NIUS) Physics Program** *2014-2015*
HBCSE, TIFR, Mumbai, India
One of 20 students selected nationwide to carry out 2 year project on “Solar and Reactor Neutrino oscillations”

TEACHING EXPERIENCE

Teaching Assistant: *Spring 2018, Fall 2018, Spring 2019 semesters*
Taught Lab courses for 3 semesters at Stony Brook University.

Typical Strength: 20 students on average in each class.

Official Duration: 3 hours each, twice per week.

Duties: Led lab sessions, conducted weekly evaluations, and held doubt-clearing sessions, earning excellent student feedback.

REFERENCES

1. Prof. Jiangyong Jia
Professor, Department of Chemistry (Joint with Brookhaven National Laboratory)
Adjunct Professor, Department of Physics and Astronomy
Stony Brook University (SUNY),
John S. Toll Drive, Stony Brook, NY 11794, USA.
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2. Prof. Bedangadas Mohanty
Professor, School of Physical Sciences,
National Institute of Science Education and Research (NISER),
Jatni, Odisha 752050, India.
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3. Dr. Prithwish Tribedy
Staff Scientist,
Brookhaven National Laboratory, Physics Department, Bldg. 510A, Upton, NY-11973-5000, USA
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