

## Dr. Kolahal Bhattacharya

Assistant Professor

St. Xavier's College (Autonomous), Kolkata

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### WORK EXPERIENCE

- September 2022 - present – Assistant Professor at **At Xavier's College Autonomous**, Kolkata
- February 2021 - present – Post-doc. visiting fellow at **Homi Bhabha Centre for Science Education (HBCSE)**, Mumbai
- February 2022 - May 2022 – Visiting faculty (Physics), at **UM-DAE Centre for Excellence in Basic Sciences (CEBS)**, Mumbai
- January 2020 - December 2020 – Assistant professor at **Manipal Academy of Higher Education** (Manipal University), Karnataka
- February 2017 - December 2019 – Post-doc. research associate at **Pacific Northwest National Laboratory (PNNL)**, USA
- January 2016 - June 2016 – Visiting fellow at **India Neutrino Observatory**

### EDUCATION

- ★ Ph.D. High Energy Physics (Experiment), December 2015
  - **Tata Institute of Fundamental Research (TIFR)**
  - Advisor: **Prof. Naba K Mondal**
  - Thesis Title: **Event Reconstruction for ICAL Detector and Neutrino Mass Hierarchy Sensitivity Analysis at India-based Neutrino Observatory (INO)**
- ★ CSIR-NET **LS** (Physical Science), June 2011
- ★ M.Sc. Physics, June 2011
  - **Tata Institute of Fundamental Research (TIFR)**, First class
- ★ B.Sc. Physics (Honours), July 2008
  - **Presidency College** (Calcutta University), Second class
- ★ Higher Secondary examination (West Bengal Board), 2005
  - Bidhannagar Government High School, First division
- ★ Madhyamik Examination (West Bengal Board), 2003
  - Bidhannagar Government High School, First division (state rank: 26)

### OTHER COURSES

- ★ **"Coursera Online"** courses on Neural network and Deep Learning (2017).
- ★ **International Neutrino Summer School (INSS)**, Beijing (2013).
- ★ **SERC School** on experimental High Energy Physics in **Variable Energy Cyclotron Centre**, Kolkata (2011).

## AWARDS

- ★ 2021, 2018: “**Outstanding Reviewer**” award from **European Journal of Physics**, IoP Publishing.
- ★ 2020: “**IOP Trusted reviewer**” award from **IOP Publishing**.
- ★ 2018: **Quick starter** research award (\$3200) from PNNL, USA
- ★ 2016: **INSA-CSIR-BRNS/DAE-CICS Travel Grant**, for visiting KEK, Japan
- ★ 2015: Received “**Special prize**” in **33<sup>rd</sup> Young Physicists’ Colloquium**, arranged by **Indian Physical Society**, at **Saha Institute of Nuclear Physics (SINP)**, Kolkata.
- ★ 2013: **DST-International Travel Grant**, for attending International Neutrino Summer School (2013), Beijing.
- ★ 2006-08: Fellow of **National Initiative on Undergraduate Sciences (NIUS)** program at HBCSE.
- ★ 2005: **JBNSTS (Jagadish Bose National Science Talent Search)** award.

## TEACHING EXPERIENCE

- ★ Served as the tutor of Introductory Quantum Mechanics course, February-May semester 2022, at the **UM-DAE Centre for Excellence in Basic Science (Mumbai)**, taught by **Prof. Anwesh Mazumdar** to the IV-th semester students enrolled in integrated M.Sc. program. Instruction in this course was performed both in online as well as in offline mode.  
  
I took one class (offline) in which I discussed problems given in assignments and quiz. My main contribution was to organise the term paper presentation of the students that carried 20% weight of total marks. I selected about 50% of the projects and the necessary resources (papers published in the American Journal of Physics, or European Journal of Physics). In addition, I was responsible for grading and selecting problems for assignments, quizzes and the mid-semester examination.
- ★ Short course on Neutrino Physics to the students of Manipal University.

## RECENT ACADEMIC ACTIVITIES

- ★ Leading role in preparing physics questions for the upcoming **Orientation-cum-Selection-Camp** at HBCSE (13-17 June), aimed towards top 35 students of **Indian Junior Science Olympiad**.
- ★ Online lecture on “*Atomic Structure*”, aimed at top 35 students of **Indian Junior Science Olympiad** (at CBSE X-th level) (May 2022).
- ★ Grading **Indian Physics Olympiad** answer scripts (2022, 2021).
- ★ Offline lecture “*Application of Optics Techniques to Method of Images*” at **Physics Olympiad Teachers’ Training Camp 2022** at HBCSE Campus (March 2022).
- ★ Preparation of a **concept inventory** (a set of carefully designed questions to diagnose misconceptions) on analytical mechanics with Prof. Mazumdar.
- ★ Online lecture “*Concepts in Electricity & Magnetism*” at **Physics Olympiad Teachers’ Orientation Camp** (January, 2022). Covered a set of problems from the concept inventories on electromagnetism e.g. CSEM, BEMA etc.
- ★ Online lecture “*Exploring interesting physics at university level*” in **National Initiative on Undergraduate Science (NIUS)**, 18-th batch (December, 2021).
- ★ Online seminar “*Analogical approaches in university level physics*” in **Thursday Seminar-series at HBCSE** (November 2021).

- ★ Academic coordinator in several sessions of the **NIUS 2021** (December) and **Vigyan Vidushi 2021** (July) online camps.
- ★ Online lecture “*Problems on Special Theory of Relativity*” to the top 60 students of Indian Physics Olympiad 2021 (**International Physics Olympiad Orientation cum Selection Camp**, May 2021).
- ★ Regular monitoring of radiation level at the Neutron laboratory of **Manipal Centre for Natural Sciences**.

#### ADMINISTRATIVE EXPERIENCE

- ★ Co-invigilation during the mid-semester and final semester examinations and conducting quizzes at **UM-DAE Centre for Excellence in Basic Science**.
- ★ Assisting in the selection of the NIUS 2022 and NIUS 2021 batch students (National Initiative on Undergraduate Sciences).
- ★ Participating in the selection of participants of the Exposure Camp for Physics and Astronomy Olympiads in 2022
- ★ Assisting the invigilation of the Indian Junior Science Olympiad 2021 examination.

#### REVIEWING EXPERIENCE

- ★ Regular referee of the **European Journal of Physics**, *IoP Publishing* since 2018. Also served twice as adjudicator in case of conflicting referee reports.
- ★ Reviewer of **American Journal of Physics**, (*American Association of Physics Teachers, AIP Publishing*); **Journal of Physics: Condensed Matter**, (IOP).

#### MENTORING EXPERIENCE

- ★ My **NIUS students** for 2021-2023 session (selected through **NIUS** program):
  - Mr. Harsh Aggarwal, 2nd year undergraduate student at Physics Dept. of IIT Kharagpur. He is working on “*Monte carlo simulations in Particle Physics*”.
  - Mr. Hemansh Shah, 2nd year undergraduate student at Physics Dept. of IISc Bangalore. His topic is “*Least action principle and semi-classical methods*”.
- ★ Mr. Mainak Pal (IISER, Kolkata), who was a project student with my PhD thesis advisor in TIFR, worked with me for two months. He is currently completing his PhD in Florida State University.

#### ACADEMIC DISTINCTIONS

- ★ **2008: Ranked within top 1% (and top 25) in India in National Graduate Physics Examination conducted by Indian Association of Physics Teachers.**
- ★ 2008: Ranked 58<sup>th</sup> within all India in **IIT JAM** examination (Joint Admission test for pursuing M.Sc. in Indian Institutes of Technology)).
- ★ 2008: Ranked 160<sup>th</sup> within all India among all bachelors and masters students in **Joint Entrance Screening Test (JEST)**.
- ★ 2002: Qualified **Science Talent Search Examination**, conducted by “**Jatiya Vijnan Parishad**” with grade A (2002).
- ★ 2002: Selected in high school for attending **MATHWORX** programme in **IIT Kharagpore** (2002).

1. **Kolahal Bhattacharya**, “A complement to the scalar wave theory of light”. **European Journal of Physics**, Vol. 43 No. 3 (035305) 2022.
2. **Kolahal Bhattacharya**, Debapriyo Syam, “Unexplored aspects of a variational principle in electrostatics”. **American Journal of Physics**, Vol. 90(3). February 2022.
3. **Kolahal Bhattacharya** “Demystifying the nonlocality problem in Aharonov-Bohm effect”. **Physica Scripta**, *IoP Publishing* as Special Issue Article, Vol 96(8): pp. 11, 2021.
4. “Triplet lifetime in gaseous argon”. **European Physical Journal A**, *Springer*, Vol. 55, No. 176 (2019)-as co-author of **MiniCLEAN** collaboration.
5. “First Measurement of Inclusive Muon Neutrino Charged Current Differential Cross Sections on Argon at  $E_\nu \sim 0.8$  GeV with the MicroBooNE Detector”. **Physical Review Letters**, *APS Publishing*, Vol. 123, No. 131801 (2019)-as co-author of **MicroBooNE** collaboration.
6. “Rejecting cosmic background for exclusive charged current quasi elastic neutrino interaction studies with Liquid Argon TPCs; a case study with the MicroBooNE detector”. **European Physical Journal C**, *Springer*, Vol. 79, issue 673 (2019)-as co-author of **MicroBooNE** collaboration.
7. “First Measurement of Muon Neutrino Charged Current Neutral Pion Production on Argon with the MicroBooNE LAr TPC”. **Physical Review D**, *APS Publishing*, Vol 99, Issue 9, 2019-as co-author of **MicroBooNE** collaboration.
8. “A deep neural network for pixel-level electromagnetic particle identification in a liquid argon time projection chamber”. **Physical Review D**, *APS Publishing*, Vol 99, Issue 9, 2019-as co-author of **MicroBooNE** collaboration.
9. “Design and construction of the MicroBooNE Cosmic Ray Tagger system”. **Journal of Instrumentation**, *IoP Publishing*, Vol 14, 2019-as co-author of **MicroBooNE** collaboration.
10. “Comparison of  $\nu_\mu - Ar$  multiplicity distributions observed by MicroBooNE to GENIE model predictions”. **European Physical Journal C**, *Springer*, Vol. 79, issue 248 (2019)-as co-author of **MicroBooNE** collaboration.
11. “Ionization electron signal processing in single phase LArTPCs: I. algorithm description and quantitative evaluation with MicroBooNE simulation”. **Journal of Instrumentation**, *IoP Publishing*, Vol 13, 2018-as co-author of **MicroBooNE** collaboration.
12. “Ionization electron signal processing in single phase LArTPCs: II. data/simulation comparison and performance in MicroBooNE”. **Journal of Instrumentation**, *IoP Publishing*, Vol. 13, 2018-as co-author of **MicroBooNE** collaboration.
13. “Physics Potential of the ICAL detector at the India-based Neutrino Observatory (INO)”. **Pramana - Journal of Physics**, *Springer*, 88(5):pages 79, 2017 -as co-author of **INO-ICAL** collaboration.
- 14 **Kolahal Bhattacharya**, Sudeshna Banerjee, Naba K. Mondal “Analytical computation of process noise matrix in Kalman filter for fitting curved tracks in magnetic field within dense, thick scatterers” **European Physical Journal C**, *Springer*,76(382):1–13, 2016.

- 15 **Kolahal Bhattacharya** “On the Dependence of Charge Density on Surface Curvature of an Isolated Conductor”. **Physica Scripta**, *IoP Publishing*, Vol. 91(3): 1–8, 2016.
- 16 **Kolahal Bhattacharya**, A. Pal, Gobinda Majumder, Naba Mondal “Error Propagation of the Track Model and Track Fitting Strategy for the Iron CALorimeter Detector in India-based Neutrino Observatory” **Computer Physics Communications**, *Elsevier*, 185(12):3259–3268, 2014.
- 17 **Kolahal Bhattacharya** “A novel variational principle in electrostatics and its consequences” **Journal of Electrostatics**, *Elsevier*, Vol. 71(5):926–930, 2013.
- 18 **Kolahal Bhattacharya** “Analogy of the grounded conducting sphere image problem with mirror optics” **European Journal of Physics**, *IoP Publishing*, Vol. 32(5): 1163–1170, 2011.
- 19 **Kolahal Bhattacharya** “Scope of Centre of Charge in Electrostatics” **Physics Education Journal**, *Indian Association of Physics Teachers*, ISSN:0970-5953, 27(3): 1–3, 2010.

NON-REFEREED WORKS

1. **Debapriyo Syam**, Kolahal Bhattacharya, “Radiation from an accelerated point charge”, **Academia Letters**. October 2021

CONFERENCE PROCEEDINGS

1. **A Hagen**, E Church, J Strube, K Bhattacharya, and V Amatya “Scaling the training of particle classification on simulated MicroBooNE events to multiple GPUs” - Published as the Proceeding of ACAT 2019 conference (**Journal of Physics: Conference Series**, **1525 (2020) 012104**)
2. **Kolahal Bhattacharya**, Christopher Jackson “Supervised learning of photoelectron counting in scintillator-based dark matter experiments” - **SLAC eConf C1907293**, as Proceeding of the DPF 2019 conference. ([arXiv: 1910.00442](https://arxiv.org/abs/1910.00442))
3. **Jan Strube**, Kolahal Bhattacharya, Eric Church, Jeff Daily, Malachi Schram, Charles Siegel, Kevin Wierman: “Scaling studies for deep learning in Liquid Argon Time Projection Chamber event classification”, CHEP 2018. **EPJ Web of Conferences**, 214, 06016 (2019).
4. **Kolahal Bhattacharya**, Sudeshna Banerjee, Naba K Mondal “Computation of process noise matrix for track fitting with Kalman filter”. **The XX International Scientific Conference of Young Scientists and Specialists (AYSS-2016)**, Joint Institute of Nuclear Research, Dubna, Russia. (ISBN 978-5-9530-0416-9).
5. Kolahal Bhattacharya, Gobinda Majumder, **Asmita Redij** “Simulation Studies for ICAL Detector at India-based Neutrino Observatory.” **Proceedings of the DAE Symposium on Nuclear Physics**, Department of Atomic Energy, India, Volume 56(G55): 1140–1141, 2011.

TECHNICAL REPORTS

- ★ **Kolahal Bhattacharya**, Eric Church, Thomas Mettler, David Lorca, Igor Kreslo: “Merging Datastream from Cosmic Ray Tagger System with LArTPC Events in MicroBooNE” MicroBooNE docDB#:14598-v2.
- ★ **Kolahal Bhattacharya** “Proposal on track fitting in muon g-2/EDM measurement experiment at J-PARC” g-2/EDM internal note: E34-NOTE-0020 in g-2/EDM technical note database.

SELECTED  
SEMINARS  
AND TALKS

- ★ “Demystifying locality problem in Aharonov-Bohm effect” at **9th International Conference on New Frontiers in Physics**, Crete (Greece) on 5th September 2020.
- ★ “Supervised learning of photoelectron counting in scintillator-based dark matter experiments” at **DPF 2019**, in Northeastern University, Boston on 31st July 2019.
- ★ “Determination of neutrino mass hierarchy in INO-ICAL experiment” at **J-PARC**, Tokyo, on 12<sup>th</sup> May 2016.
- ★ “General formulation of process noise matrix for track fitting with Kalman filter” at **Joint Institute for Nuclear Research (JINR)**, Dubna (Russia), on 16<sup>th</sup> March 2016.
- ★ “Method of Images in the Light of Geometrical Optics” at **33<sup>rd</sup> Young Physicists’ Colloquium**, at **Saha Institute of Nuclear Physics (SINP)**, Kolkata, on 20-21 August, 2015.
- ★ “Neutrino Mass Hierarchy Sensitivity Analysis In INO-ICAL Experiment With Reconstructed Data” at **DAE-BRNS HEP Symposium, IIT Guwahati**, 2014.
- ★ “An Improved Muon Reconstruction Algorithm for INO-ICAL Experiment” at **DAE-BRNS HEP Symposium, Santiniketan**, 2013. (for INO-ICAL detector).
- ★ “A Matrix Approach towards Charged Particle Beam Optics” at **Jagadish Bose Centre**, Kolkata (2007) - an attempt to develop a matrix method for charged particle beam optics in electromagnetic field under paraxial approximation.

INVITED  
TALKS

- ★ “Event reconstruction methods in INO-ICAL and neutrino mass hierarchy sensitivity analysis” at **CAPSS, Salt Lake Campus, Bose Institute, Kolkata**, 18th September (2015) - A talk on doctoral thesis works.
- ★ “Reconstruction methods in high energy physics experiments” at **TIFR ASET colloquium**, 31st July (2015) - public lecture. Covered classical and recent methods (cellular automaton and Hough transform) of pattern recognition, Kalman filtering.
- ★ “INO-ICAL Detector and Detection of Atmospheric Neutrinos” at **Barasat Government College, Kolkata**, 2013 (explaining charged particle detection techniques with R.P.C. detectors to the target audience comprised of M.Sc. students and College Teachers).

RESEARCH &  
TRAVEL  
FUNDING

- ★ 2016: Awarded full return trip travel fare from hometown in India and all local costs and per diem to attend on-site post-doc. interview at PNNL.
- ★ 2016: **JPY 90,000** by **KEK-IPNS** to attend **Muon g-2/EDM workshop at KEK (Japan)**.
- ★ **2016: Awarded \$500 and accommodation for attending AYSS 2016 conference in JINR, Dubna (Russia)**.
- ★ 2006-08: Return travel fare from home for attending summer and winter camps at HBCSE (Mumbai) and contingency grant worth Rs. 5,000/- to purchase books under NIUS program to support the undergraduate research project on *Solar Neutrino Anomaly* under (late) Prof. D P Roy.
- ★ 2005-10: JBNSTS scholarship (Rs. 500/- per month) and excursion to IUCAA, NCRA, GMRT, TIFR and BARC to encourage research career in science.