

Tanima Mondal

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Research Experience

Modelling of Gamma-ray Burst afterglow at very high energy June 2020 - Present
Dept. Of Physics, IIT Kharagpur

- Testing our VHE numerical model of GRB Afterglow on real time Data.
- Started developing a model to explain short GRB data for off axis jet. Also in process of developing a hadronic model of GRB to explain the detection probability of high energy neutrino during afterglow phase.

Improving IWCD ν_e event selection with FiTQun and ML techniques to improve sensitivity of CPV for Hver-K(HK) experiment May 2022 - Present

- For HK Canada IWCD software analysis group I've developed a framework based on FiTQun event reconstruction algorithm to measure electron neutrino cross section more precisely in order to improve CP violation.
- With HK-WatChMal international Machine learning group I've replaced all the Likelihood-based FiTQun cuts with Softmax ML cuts to improve the purity and efficiency of electron neutrino signal to further improve CPV sensitivity.

Photometric Observations June 2018 - Nov 2019
Fr. Eugene Lafont Observatory; St. Xavier's College Kolkata

- Executed Observational work for 4 months and successfully observed 3 clusters NGC2301, M35, M45.
- Conducted differential photometry, numerical analysis on the very-large Fits data file to produce a stellar evolution of the different observed cluster.
- Contribute to the setup of the Observation experiments and produced first scientific data from the Eugene Lafont Observatory; St. Xavier's College Kolkata.
- In the paper, we are proposing multiresolution image processing methods on noise polluted astronomical Cluster images along with stellar modelling. Moreover, the primary objective of this paper is to encourage astronomical observation for the institutes located in an urban area. The paper is in the process of publication on a peer-reviewed journal.

Work Experience

Research Intern May 2022 – August 2022
TRIUMF, Canada's Particle accelerator centre

- I improved the sensitivity of event reconstruction for IWCD geometry with FiTQun algorithm.
- Implemented ML algorithm to discriminate e^- , γ like particles with better precession.

Visiting Researcher July 2018 – Nov 2019
Dept. Of Physics, St. Xavier's College Kolkata

- I planed and taught undergrad and grad students on Star Cluster Photometry, details of Hertzsprung Russel diagram and mentored related experimental works.

Summary

I am a PMRF Research Fellow in Indian Institute of Technology, Kharagpur. My broad area of research is on High Energy Astrophysics. I am pursuing my doctoral research on High Energy physics, Astrophysics and AstroParticle Physics.

Details of Education, Workshop, and Awards are mentioned in the website.

Technical Skill

Matlab, Python, C++

Skilful in writing codes for the numerical solution of problems like Root finding, Interpolation, ODEs, PDEs and other.

Machine Learning, CERN ROOT

Proficient in residual neural network (ResNet) model and to write codes for particle event reconstruction in ROOT.

Publication, Poster & Conference

1. Mondal, Tanima, et al. "Probing gamma-ray burst afterglows with the Cherenkov Telescope Array." *Monthly Notices of the Royal Astronomical Society* 522.4 (2023): 5690-5700.
2. Mondal, T., Resmi, L., & Bose, D. (2023). Modeling of Gamma Ray Burst (GRB) Afterglow at Very High Energy (VHE) regime. PoS, ICRC2023, 600. <https://doi.org/10.22323/1.444.0600>
3. K. Abe, P. Adrich, [...], T. Mondal et al, 2021 ApJ 916 15. arXiv preprint arXiv:2101.05269 (2021).
4. S. Chakraborty, T. Mondal, A. Debnath & S. Roychowdhury, J Astrophys Astron 43, 22 (2022). <https://doi.org/10.1007/s12036-022-09807-w>
5. Conference: T. Mondal et al., oral presentation at 38th International Cosmic Ray Conference (ICRC2023) on "Modeling of Gamma Ray Burst (GRB) Afterglow at Very High Energy (VHE) regime", August 2023.
6. Conference: T. Mondal et al., IWCD and WCTE PID studies with ML, July 2022, Hyper-Kamiokande Water Cherenkov Test Experiment Meeting.
7. Conference: T. Mondal, Likelihood and Deep Learning Analyses of the IWCD Electron Neutrino Sample, November 2022, Indo-Japan Workshop on HyperK.