Mahmudul Hasan Anik

Contact: anik@vols.utk.edu, (740) 818-9294
Website: anikmh.github.io, Google Scholar Profile

Research Area

- **Nuclear Physics**: Constraining the dense-matter equation of state and examining its impact on observational signatures of neutron stars.
- **Astrophysics**: Using multi-messenger observations to study compact astrophysical objects and phenomena, including gravitational-wave sources.

Education

- **Doctor of Philosophy** (Ph.D.) in Physics — August 2020 – Present
  University of Tennessee, Knoxville, TN, USA.
- **Master of Science** (M.S.) in Mathematics — August 2018 – May 2020
  Ohio University, Athens, OH, USA.
- **Master of Science** (M.S.) in Physics — August 2016 – May 2018
  Ohio University, Athens, OH, USA.
- **Bachelor of Science** (B.S.) in Physics — January 2011 – November 2015
  University of Dhaka, Dhaka, Bangladesh.

Thesis

- **Ph.D.**: "Constraining the Nuclear Equation of State and Population of Neutron Star Mergers Through Observations of Transient and Persistent Phenomena" *(in progress)*.
  Advisor: Dr. William R. Hix, University of Tennessee, Knoxville, TN.
- **M.S. (Physics)**: "Further Development of a Data Analysis Framework for the MOLLER Experiment at Jefferson Lab," http://rave.ohiolink.edu.
  Advisor: Dr. Paul M. King, Ohio University, Athens, OH.

Publications

- R. Kumar, V. Dexheimer, J. Jahan, J. Noronha, J. Noronha-Hostler, C. Ratti, N. Yunes, A. R. Nava Acuna, M. Alford, **M. H. Anik**, *et al.*, "Theoretical and Experimental Constraints for the Equation of State of Dense and Hot Matter," *Living Reviews in Relativity* 27, 3 (2024).
- **M. H. Anik**, A. W. Steiner, and R. O'Shaughnessy, "Inference of Neutron Star Mass Distributions and the Equation of State from Multi-messenger Observations," (manuscript in preparation), 2025.
- **M. H. Anik**, A. W. Steiner, and R. O'Shaughnessy, "Constraining the Equation of State with Gravitational-wave Signals from Low-mass Binary Neutron Stars," (in preparation), 2025.
- **M. H. Anik** and A. W. Steiner, "Machine-learning Accelerated Bayesian Inference Framework," (in preparation), 2025.

Talks

- **GravNu 2025 Workshop** – oral presentation July 2025
  Combining electromagnetic and gravitational-wave observations of neutron stars
  California State University, Fullerton, CA.

- **Division of Nuclear Physics Fall Meeting** – oral presentation October 2024
  Neutron star mass distributions and the equation of state of dense matter
  American Physical Society, Boston, MA.

- **NP3M Collaboration Meeting** – poster presentation January 2024
  Constraining the Equation of State using Observations from Multi-Messenger Astronomy
  University of Tennessee, Knoxville, TN.

Academic Positions

- **Graduate Research Assistant** May 2021 – Present
  Physics and Astronomy, University of Tennessee, Knoxville, TN.
  - Conducted research in theoretical nuclear astrophysics, focusing on the behavior of cold and dense matter in neutron stars.

- **Graduate Teaching Assistant** August 2020 – May 2021
  Physics and Astronomy, University of Tennessee, Knoxville, TN.
  - Demonstrated experiments in the electromagnetism lab and evaluated reports.

- **Teaching Assistant** August 2019 – May 2020
  Mathematics, Ohio University, Athens, OH.
  - Taught college algebra as an instructor, graded exams, and held office hours.
  - Supported and mentored students in departmental help sessions.

- **Graduate Assistant** August 2018 – May 2019
  Mathematics, Ohio University, Athens, OH.
  - Graded assignments in introductory calculus and assisted instructors in proctoring exams.

- **Teaching Assistant** August 2016 – May 2018
  Physics and Astronomy, Ohio University, Athens, OH.
  - Led several general physics lab sessions, graded lab reports and assignments.
  - Designed and coded online homework problems in introductory physics.

Skills

- **Programming Languages**: C++, C, Python, MATLAB, Mathematica, Shell scripting.

- **Data Analysis**: Numerical analysis, Monte Carlo algorithms, HDF5 data management.

- **Machine Learning**: Supervised machine learning, deep learning neural network, Gaussian process, decision tree, kernel density estimation (using TensorFlow and Scikit-learn).

- **High Performance Computing**: Parallel programming, MPI and OpenMP, GPU computing with CUDA.

- **Software Development**: Open-source code development, version control (e.g. Git, Subversion), debugging tools (e.g., GDB, Valgrind).
- **Systems & Tools**: Debian- and Arch-based Linux systems, Bash scripting, cluster management tools (e.g., Slurm).

Trainings

- **NP3M Summer School** June 2025
  Indiana University, Bloomington, IN.
  - Covered current topics in nuclear astrophysics and multi-messenger astronomy, with an emphasis on gravitational-wave observations.
- **National Nuclear Physics Summer School** July 2023
  University of California, Riverside, CA.
  - Covered advanced topics in theoretical and experimental nuclear physics and astrophysics, including recent advances and future directions.
- **Teaching College Mathematics** August 2018 – December 2018
  Department of Mathematics, Ohio University, Athens, OH.
  - Participated in training sessions on effective teaching methods and student engagement strategies for college-level mathematics courses.
- **Responsible Conduct of Research** December 2016
  Collaborative Institutional Training Initiative (CITI) Program
  - Trained in ethical research practices, including authorship, data management, and compliance with institutional policies.

Scholarships & Awards

- **Robert Birkhoff Fellowship** August 2021 – May 2023
  Physics and Astronomy, University of Tennessee.
  - Awarded for academic excellence and outstanding research potential in graduate physics.
- **Graduate Recruitment Scholarship** August 2018 – May 2019
  Mathematics, Ohio University.
  - Merit-based scholarship granted to qualified graduate students.
- **Honorable Mention Award** April 2016
  Physics Department Career Club, University of Dhaka.
  - Recognized for outstanding contributions to the club's activities and initiatives.

Leadership

- **Vice President**, Graduate Physics Society July 2022 – June 2023
  Physics and Astronomy, University of Tennessee.
  - Organized academic events, seminars, and networking opportunities.
- **Executive Committee Member**, Math Club August 2019 – May 2020
  Mathematics, Ohio University.
  - Coordinated workshops and events to promote engagement in mathematics.

- **Activity Coordinator**, Physics & Astronomy Open House November 2017
  Physics and Astronomy, Ohio University.
  - Executed interactive exhibits for public outreach, showcasing physics to a diverse audience.

- **Vice President**, Physics Department Career Club July 2015 – June 2016
  Physics, University of Dhaka.
  - Facilitated professional development workshops and oversaw club activities.