Atul Kedia

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Research Positions

2021-Present **Postdoctoral Researcher**, *Rochester Institute of Technology*, Center for Computational Relativity and Gravitation, Supervisor: Dr. Richard O'Shaughnessy.

Education

2016-22 **Ph.D.**, *University of Notre Dame*, Physics, Dissertation title "Relativistic Matter in Neutron Star Mergers and Big Bang Nucleosynthesis", Advisor: Prof. Grant Mathews.

2016-20 **M.S.**, *University of Notre Dame*, Physics.

2012-16 **B.Tech.**, *Indian Institute of Technology Bombay*, Engineering Physics with Honors.
Exchange Semester - Spring 2015 at *University of Toronto*.

Research publications

[12] **AK**, M. Ristic, R. O'Shaughnessy, et al., Surrogate light curve models for kilonovae with comprehensive wind ejecta outflows and parameter estimation for AT2017gfo, Phys. Rev. Res. 5, 013168 (2023).

[11] **AK**, H.I. Kim, I.-S. Suh, G.J. Mathews, Binary neutron star mergers as a probe of quark-hadron crossover equations of state, Phys. Rev. D 106, 103027 (2022).

[10] Y. Zlochower, S.R. Brandt*,...*, **AK***, et al., The Einstein Toolkit (Version: The "Riemann" release, ET_2022_05), (2022, May 31). (*=co-second authors)

[9] **AK**, G.J. Mathews, H.I. Kim, I.-S. Suh, Binary neutron star mergers of quark matter based nuclear equations of state, EPJ Web of Conf. 260, 11004 (2022).

[8] M. Kusakabe, **AK**, G.J. Mathews, N. Sasankan, Distribution function of nuclei from $e^{\pm}$ scattering in the presence of a strong primordial magnetic field, Phys. Rev. D 104, 123534 (2021).

[7] **AK**, N. Sasankan, G.J. Mathews, M. Kusakabe, Simulations of multicomponent relativistic thermalization, Phys. Rev. E 103, 032101 (2021).

[6] G.J. Mathews, I.S. Suh, N.Q. Lan, **AK**, Conformally flat, quasi-circular numerical simulations of the gravitational wave chirp from binary neutron star merger GW170817, arXiv:2103.05082 [gr-qc] (2021).

[5] Z. Etienne, S.R. Brandt*,...*, **AK***, et al., The Einstein Toolkit (Version: The "Lorentz" release, ET_2021_05), (2021, May 31). (*=co-second authors)

[4] N. Sasankan, **AK**, M. Kusakabe, G.J. Mathews, Analysis of the multicomponent relativistic Boltzmann equation for electron scattering in big bang nucleosynthesis, Phys. Rev. D 101, 123532 (2020).

[3] G.J. Mathews, **AK**, et al, Cosmological solutions to the Lithium problem, JPS Conf. Proc. 31, 011033 (2020), Mem. S.A.It. Vol. 91, 29-34 (2020).

[2] S.R. Brandt, B. Brendal*,...*, **AK***, et al., The Einstein Toolkit (Version: The "Turing" release, ET_2020_05), (2020, May 30). (*=co-second authors)

[1] P. Sarkar, S. Majumdar, B. Pandey, **AK**, S. Sarkar, The many scales to cosmic homogeneity: Use of multiple tracers from the SDSS, arXiv:1611.07915 [astro-ph.CO] (2016).

Talks and Presentations

April 2023 "Neutron star merger ejecta estimation with kilonova light curve surrogates" at the APS April Meeting, Minneapolis.

March 2023 "Multi-messenger Astrophysics: Gravitational waves of quark matter EOSs and ejecta parameter estimation with Kilonova modelling" at the CCRG lunch talk, Rochester Institute of Technology.

June 2022 "Neutron star merger gravitational waves for quark matter equation of state" at the North American Einstein Toolkit Workshop, University of Idaho (Hybrid).

April 2022 "Postmerger evolution of neutron star mergers as a probe of quark matter equation of state" at the APS April Meeting, New York City.

November 2021 "Neutron star mergers of quark matter based equations of state" at the Midwest Relativity meeting, UIUC (Hybrid).

October 2021 "Binary neutron star mergers of quark matter based equations of state" at the APS - DNP Fall meeting (Virtual).

July 2021 "Binary neutron star initial data creation using LORENE" at the North American Einstein Toolkit Workshop (Virtual). **(invited)**

July 2021 "Binary neutron star mergers of quark matter based equations of state" at the North American Einstein Toolkit Workshop (Virtual).

July 2021 "Binary neutron star mergers of quark matter based equations of state." at the 16^{th} Marcel Grossmann meeting (Virtual).

April 2021 "Binary neutron star mergers and the nuclear equations of state." at APS April Meeting (Virtual).

April 2021 Poster titled "Monte-Carlo simulations of multi-specie relativistic thermalization for Big bang nucleosynthesis." at APS April Meeting (Virtual).

November 2020 "Monte-Carlo simulations of multi-specie relativistic thermalization and Analysis of Boltzmann Equation for Big bang nucleosynthesis" at APS-DNP Fall meeting (Virtual).

October 2020 "Full GR simulations of Neutron star binaries at large separations" at Midwest Relativity Meeting (Virtual).

September 2020 "Relativistic thermodynamics in Big Bang Nucleosynthesis" at U Notre Dame Astrophysics Seminar. (Virtual)**(invited)**

April 2019 "Relativistic electron scattering and Big Bang Nucleosynthesis" at APS April Meeting.

Dec 2018 Poster titled "Relativistic particle scattering and Big Bang Nucleosynthesis" at College of Science and Engineering - Joint Annual Meeting 2018.

Oct 2018 "Relativistic particle scattering and Big Bang Nucleosynthesis" at the Biophysics group led by Prof. Vural at iCeNSA, University of Notre Dame. **(invited)**

Oct 2018 "Relativistic particle scattering and Big Bang Nucleosynthesis" at Interplay between Particle and Astroparticle physics 2018 hosted by University of Cincinnati.

April 2018 Poster titled "Proton distribution function during Big Bang Nucleosynthesis" at APS April Meeting.

June 2017 "Probing homogeneity of the Cosmos using Quasars" at Fourth Azarquiel School of Astronomy.

Nov 2016 Poster titled "Probing homogeneity of the Cosmos using Quasars" at GPS Annual Conference.

Awards, Grants and Scholarships

April 2023 Travel award by American Physical Society (APS)-Division of Astrophysics (DAP) to present at APS April meeting ($600).

April 2022	Travel award by American Physical Society (APS)-Division of Gravitational Physics (DGRAV) and DAP to present at APS April meeting ($300×2).
October 2021	Downes Memorial Award of Notre Dame ($100).
June 2021	Recipient of the **Center of Research Computing Graduate Award** for Computational Science and Visualization 2021 ($1000 and a plaque) at Notre Dame.
April 2021	Travel award by APS-DAP to present at APS April meeting ($110).
April 2021	Travel award by Graduate Student Union (GSU) of University of Notre Dame to present at APS April meeting ($149).
April 2020	Travel award by GSU to attend APS April meeting ($500).
April 2019	Travel award by APS-DAP to present at APS April meeting ($500).
April 2019	Travel award by GSU to present at APS April meeting ($350).
May 2018	Full funding support from organizers to attend Neutron Star Merger summer school at FRIB, Michigan State University.
April 2018	Travel award by APS-Division of Nuclear Physics to present at APS April meeting ($400).
Sept 2017	Full funding support from organizers to attend Midwest Theory Get-Together at Argonne National Laboratory.
July 2017	Partial funding support to attend National Nuclear Physics Summer School at University of Colorado Boulder (registration, accommodation, and meals).
June 2017	Partial Funding support from organizers to attend Fourth Azarquiel School of Astronomy, on Nuclear Astrophysics and Astroparticle physics at Sicily, Italy (registration, accommodation, and meals).
October 2014	Full tuition scholarship to attend University of Toronto as a semester exchange for spring 2015($\approx$ $14000).

Professional memberships

2022-present	LIGO Scientific Collaboration (www.ligo.org)
2018-present	American Physical Society (www.aps.org)

Outreach and Services

2022	Popular science magazine *New Scientist* published an article on my Ph.D. research paper Phys. Rev. D 106, 103027 (2022). Article: K. Padavic-Callaghan, "Gravitational waves could reveal the existence of quark matter", *New Scientist*, Issue 3411 (2022), newscientist.com/article/2344898-gravitational-waves-could-reveal-the-existence-of-quark-matter/.
2020-present	Active member of the Einstein Toolkit community, and contributor to the the May 2022 release "Riemann", the May 2021 release "Lorentz", and the May 2020 release "Turing".
2020	Session Chair for the session on "Physics of Neutron Stars and Black Holes" at the Midwest Relativity Meeting 2020.
2020	Core-member of the Local Organizing Committee for the Midwest Relativity Meeting 2020.
2019-20	Physics Department Representative at the Graduate Student Union, University of Notre Dame.
2017-18	Graduate International Students committee member at the Physics Department, University of Notre Dame.
March 2017, 2019	Judge for high school and elementary school students' physics projects at the Northern Indiana Regional Science & Engineering Fair(NIRSEF).
2016-18	Volunteer for Our Universe Revealed events and Stargazing events at the University of Notre Dame.

Teaching Experience

Summer 2019 Instructor of Record for Physics 2 Electromagnetism labs at the Department of Physics and Astronomy, Indiana University South Bend.

2017-2021 Delivered five lectures as part of Teaching Practicum for graduate students at Notre Dame.
- General Relativity for Prof. Mathews (April 2021)
- Engineering Physics I for Prof. Howk (Feb 2019) (x2)
- Math Methods for Physics II for Prof. Vural (March 2018)
- Elementary Cosmology for Prof. Jessop (Jan 2017)

2016-present Teaching Assistant in the Physics department for:
- Special and General Relativity (spring 19, 20, 21)
- Graduate Classical Mechanics (fall 18)
- Particles and Cosmology (spring 18)
- Descriptive Astronomy (fall 17)
- Elementary Cosmology (fall 17, 21)
- Physics 1 : Mechanics course Lead tutor (fall 19)
- Physics 1 : Mechanics course tutor (summer 17, 18, spring 20, fall 21)
- Physics 1 : Mechanics lab for pre-med students (fall 16, spring 18)
- Physics 2 : Electromagnetism course tutor (summer 18, fall 18, 20 spring 19), received Course Instructor Feedback composite score of upto 5.0/5.0.
- Physics 2 : Electromagnetism lab for pre-med students (spring 17, summer 17)
- Physics 2 : Electromagnetism lab for engineering students (fall 20)

2015 Teaching Assistant for online course on Engineering physics by IIT Bombay and *Teach 10k Teachers* for physics teachers at engineering colleges in India.

Skill Set

Softwares :- Einstein Toolkit, LORENE, MATLAB, Mathematica, and LaTeX.

Programming Languages :- Python, C, C++, and Arduino.

Operating Systems :- Windows, Ubuntu (Linux) (primarily via WSL lately) and Red Hat Enterprise Linux.

Languages :- Fluent in English and Hindi. Novice in French, German, and Bengali.

References

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