

EDUCATION

PhD (1999-2005)

Institution: University of Kansas, Lawrence, Kansas, USA

Subject/focus: Astroparticle Physics

- Worked as a member of the RICE collaboration
- Modeled, formulated, and solved numerically the coupled-integro-differential equations for propagation of all flavors of neutrinos through the Earth and the equations for neutrino event rates.
- Created scientific software using FORTRAN and C++ for neutrino propagation through the Earth and detector simulations for the RICE collaboration.
- Restructured the simulation code to decrease the run-time by a factor of 1000, which helped take simulations to higher energies and enhanced the group research activity.
- Discovered an error of a factor of 15 in the published (phenomenological) neutrino event rates and recalculated and published the corrected rates.
- Contributed/authored/published research papers (involving astroparticle physics).
- Traveled nationally and internationally and presented research work in conferences and workshops.
- Worked individually, in a local team, and in international teams.
- Helped undergrad students in courses and labs.
- Worked as a teaching assistant for physics labs at all levels.
- Won the best Graduate Teaching Assistant of the year award.

Mphil (1996-1998)

Institution: Quaid-I-Azam University, Islamabad, Pakistan

Subject/focus: Particle Physics

- Research involved a review of the solar neutrino problem.

MSc (1993-1995)

Institution: Punjab University, Lahore, Pakistan

Subject/focus: Particle Physics

FSc-BSc (1988-1992)

Institution: Forman Christian College, Lahore, Pakistan

Subject/focus: Physics, Mathematics

EMPLOYMENT

Fulfillment Associate (2021-2024)

Company: [Amazon](#), New Castle, DE, USA

Responsibilities: Buffer, sort, pick, stow.

Associate Professor (2013-2014)

Institution: [Karakoram International University](#), Gilgit, Pakistan

Responsibilities: Astronomy program development and teaching:

- Developed and taught a course in Astronomy for senior level physics majors.
- Initiated and lead the work on an educational astronomical observatory construction. This research involved observatory site search, system and building design, budget calculation, construction site, proposal writing, forming the observatory committee, writing bylaws and constitution for the committee.
- Created [Gilgit and Baltistan Astronomical Society](#) for teachers, students, and amateur astronomers. This involved writing bylaws, constitution, selection and election of initial members, and registration of the Society.
- Promoted astronomy by arranging talks and observation nights with students, teachers, and amateurs.
- Mentored students on astronomy and astrophysics related research projects.

Research Associate (2008-2013)

Institution: [University of Delaware](#), Newark, DE, USA

Responsibilities: Research, simulations, simulation data analysis, data visualization, numerical computation, authoring research papers, writing documentation of software and research activities, presenting in weekly meetings, helping graduate students, traveling nationally and internationally for presentations and participation in conferences and workshops.

- Worked as a member of the [ICECUBE](#) collaboration.
- Created scientific software and scripts for the cosmic ray particle-shower simulations and simulation data analysis using BASH, Python, and C++.
- Performed analytic calculations, fixed the normalization constant for the simulation software.
- Authored research papers in astroparticle physics (individually and in collaboration).
- Traveled nationally and internationally and presented research work in conferences and workshops.
- Worked individually, in a local team, and in international teams.
- Helped graduate students in their research.

Postdoc Researcher (2005-2008)

Institution: [University of Delaware](#), Newark, DE, USA

Responsibilities: Research, simulations, simulation data analysis, data visualization, numerical computation, authoring research papers, writing documentation of software and research activities, presenting in weekly meetings, helping graduate students, traveling nationally and internationally for presentations and participation in conferences and workshops.

- Worked as a member of the Radio Ice Cherenkov Experiment ([RICE](#) neutrino event rate simulations).
- Created scientific software using BASH, Python, and C++ for prototype and design studies of the neutrino experiment [ARA](#).
- Authored research papers in astroparticle physics.
- Traveled nationally and internationally and presented research work in conferences and workshops.
- Worked individually, in a local team, and in international teams.
- Helped graduate students in their research.

EXPERIENCE AND SKILLS

Research

- 10+ years of research experience in astroparticle physics involving simulations and event rate calculations of ultrahigh energy neutrinos and cosmic rays

Writing

- Research papers, technical documents, lectures, and presentations

Teaching

- University physics labs, astronomy course, grading assignments and exams

Simulations

Simulations in astroparticle physics:

- Neutrino propagation through the Earth
- Cosmic ray air showers
- Radio Cherenkov signal in South Pole ice
- Neutrino event rates
- Radio signal detector trigger

Analysis

- Simulated data, research papers, jupyter notebooks

Languages

- Fluent in English, Urdu/Hindi, native Punjabi

Coding Languages

- Javascript, NodeJS, html, css, python, java, c++, fortran

Technology Development

- CI/CD using GitHub workflows and actions
- Frontend web development using javascript, html, css, react, and aws-amplify
- serverless web apps using aws s3, cloudfront, route53, ec2, lambda, dynamodb
- Jupyter notebooks using python libraries

PUBLICATIONS (PHYSICS)

Complete List: [Google Scholar](#)

Ph. D. Dissertation

Title: [Phenomenology of ultrahigh energy neutrino interactions and fluxes](#)

Advisor: [Professor Douglas W. McKay](#)

Selected Journal Publications

1. "Cosmic Ray Composition and Energy Spectrum from 1-30 PeV Using the 40-String configuration of IceTop and IceCube", IceCube collaboration, in press for publication in *Astroparticle Physics*, 42 (2013), p. 15; arXiv: 1207.3455.
2. "IceTop: The surface component of IceCube", IceCube collaboration, to be published in *Nuclear Instruments and Methods A700* (2013) 188-220, 1 February 2013.
3. "Lateral Distribution of Muons in IceCube Cosmic Ray Events", IceCube collaboration, *Physical Review D*, 11 December 2012.
4. "All-particle cosmic ray energy spectrum measured with 26 IceTop stations", IceCube collaboration, arXiv: 1202.3039.
5. "Upward shower rates at neutrino telescopes directly determine the neutrino flux", S. Hussain, D. Marfatia, D.W. McKay *Phys. Rev D* 77, 107304 (2008).
6. "Cross section dependence of event rates at neutrino telescopes", S. Hussain, D. Marfatia, D. W. McKay, D. Seckel, *Phys. Rev. Lett.*, 97, 161101 (2006).
7. "Updated limits on the ultra-high energy (UHE) neutrino flux from the RICE experiment", I. Kravchenko et al, *Int. J. Mod. Phys. A21S1*, 153 (2006).
8. "RICE limits on the diffuse ultra-high energy neutrino flux", I. Kravchenko et al, *Phys. Rev. D* 73, (2006).
9. "Bounds on Low Scale Gravity from RICE data and Cosmogenic Neutrino Flux Models", *Phys. Lett. B* 634 (2006) 130-136. Shahid Hussain and Douglas W. McKay.
10. "Comparative study of radio pulses from simulated hadron-, electron-, and neutrino-initiated showers in ice in the GeV-PeV range", Shahid Hussain and D. W. McKay, *Phys. Rev. D* 70, 103003 (2004).
11. "Energy and Angular Distribution of Upward UHE Neutrinos and Signals of Low Scale Gravity: Role of Tau Decay", Shahid Hussain and D. W. McKay, *Phys. Rev. D* 69, 085004 (2004).

Selected Proceedings Publications

1. "Measurements of the cosmic ray spectrum and average mass with IceCube", Shahid Hussain for the IceCube collaboration, submitted to *Advances in Space Research*, arXiv:1301.6619.
2. "Measurements of the Air Shower Parameters with IceTop", Shahid Hussain, Todor Stanev, and Serap Tilav; the proceedings of 32st International Cosmic Ray Conference –Beijing, China, August 10-19, 2011.
3. "Small air showers in IceTop", Bakhtiyar Ruzybayev, Shahid Hussain, Chen Xu, Thomas Gaisser, arXiv:0912.0896v1 [astro-ph.HE]; to be published in the proceedings of 31st International Cosmic Ray Conference –Łódź July 7-15, 2009.
4. "Event rates vs. cross sections at neutrino telescopes", Shahid Hussain, hep-ph/0610417, proceedings of the "TeV Particle Astrophysics II", Madison, Wisconsin; *J. Phys. Conf. Ser.* 60:207-210 (2007).
5. "Updated limits on the ultra-high energy (UHE) neutrino flux from the RICE experiment", I. Kravchenko et al, Zeuthen 2005, *Acoustic and radio EeV neutrino detection activities** 153-157.
6. "Using RICE Data and GZK Neutrino Flux Models to Bound Low Scale Gravity" in *proceedings of the 29th ICRC, August 3-10, 2005, Pune, India*.
7. "RICE: Constraining new physics with ultrahigh energy neutrinos" in proceedings of the *6TH international workshop on neutrino telescopes, February 22-25, 2005, Venice, Italy*.
8. "Simulation of the radio signal from ultrahigh energy neutrino-initiated showers", Shahid Hussain and D. W. McKay, Published in **Lake Louise 2004, Fundamental interactions** 190-194, *Lake Louise, Alberta, Canada*.
9. "Constraining low scale gravity with ultrahigh energy neutrinos", Shahid Hussain and D. W. McKay, Published in **Lake Louise 2004, Fundamental interactions** 185-189, *Lake Louise, Alberta, Canada*.

SELECTED PRESENTATIONS (PHYSICS)

Description: Most of the research papers were presented by invitation in international meetings and conferences

Presentations

1. 2013-Karakoram International University
2. 2012-COSPAR, Mysore, India (paper only; visa issues)
3. 2011-ICRC, Beijing
4. 2011-Chesmont Astronomical Society, Pennsylvania
5. 2011-International Scientific Spring, NCP, Islamabad; 2011- Gujrat University
6. 2010-Cosmic ray backgrounds in dark matter searches, Stockholm
7. 2007-Midwest Theory Conference, Lawrence, Kansas
8. 2007-NCP, Islamabad;
9. 2007-COMSATS, Islamabad;
10. 2006-TeV particle Astrophysics II, Madison, Wisconsin;
11. 2006-Pennsylvania State University;
12. 2005-CAM, San Diego;
13. 2005-APS April meeting in Tampa
14. 2004- APS meeting Denver(2004);
15. 2004-Lake Louise Winter Institute at Lake Louise, Canada;
16. 2004-APS Multi-Divisional Study of the Physics of Neutrinos, Snowmass, Colorado;
17. 1999-International Nathiagali Summer College, Pakistan;
18. 1998-School on non-accelerator particle astrophysics, Abdus Salam ICTP, Trieste, Italy.
19. 1997-National Symposium on Frontiers in Physics, Quaid-i-Azam University, Islamabad, Pakistan;
20. 1997-International Nathiagali Summer College in Physics, Nathiagali, Pakistan.
21. IceCube meetings held internationally at least twice a year.

REFERENCES AND NETWORKS

Advisors

[Professor Douglas W. McKay](#) (PhD dissertation advisor)

[Professor David Seckel](#) (postdoc advisor)

[Professor Thomas K. Gaisser](#) (postdoc advisor)

Principal Investigators (for the collaborations I have been a member)

[Professor Dave Z. Besson](#) (RICE --radio ice cherenkov experiment)

[Professor Thomas K. Gaisser](#) (ICECUBE --neutrino and muon observatory, ICETOP --cosmic ray observatory)

[Professor Francis Halzen](#) (ICECUBE neutrino observatory)

Other references (selected members of the collaborations I have been a part)

[John P. Ralston](#), [Todor Stanev](#), [Hermann Kolanoski](#), [Subir Sarkar](#), [Klas Hultqvist](#), [Spencer Klein](#), [Hagar Landsman](#), [Serap Z. Tilav](#),

[Xinhua Bai](#), [Paolo Desiati](#), [Martin Merck](#), [Takao Kuwabara](#), [Fabian Kislak](#), [Bakhtiyar Ruzybayev](#), [Chen Xu](#)

Networks and Links

[LinkedIn](#)

[Google scholar](#)

[GitHub](#)

[GitHub blog](#)

[GitHub \(archived\)](#)

[cosmicd](#) (archived aws serverless apps I have developed)

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