



Syed Mehedi Hasan

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About

I am a theoretical physicist working on precision calculations in quantum field theory, with a focus on QCD and electroweak physics, multi-loop techniques, and collider phenomenology. My work combines advanced analytic methods and phenomenological insights, and I have experience in international collaboration, graduate-level teaching, and supervision of student research.

Work Experience

- Apr 2023 - present - *Postdoctoral Research Associate*, University of Regensburg, Germany
- Awarded a competitive **Academic Research Sabbatical (ARSPI)** for Winter Semester 2026/27 – a one-semester release from teaching and administration to advance research and qualification towards a professorship.
 - Published paper on **radiative corrections to elastic lepton-proton scattering**.
 - Published three papers on a novel technique to calculate **phase space integrals using Mellin-Barnes approach**.
 - Published paper on two loop electron vertex correction with **two different masses**
 - Tutored graduate-level Quantum Field Theory, Effective Field Theory and Quantum Chromodynamics, and undergraduate Thermodynamics and Quantum Statistics
 - Co-supervised PhD, Master's and Bachelor's students
- Nov 2019 - Feb 2023 - *Postdoctoral Fellow*, National Institute for Nuclear Physics (INFN), Pavia, Italy
- Published two papers on Muon-Electron scattering in the context of **MUonE experiment**
 - Lectured on multiloop calculation techniques, Differential Equation method and Special functions in QFT for PhD level students
- July 2016 - Sep 2019 - *Research Assistant*, Department of Physics, University at Buffalo, Buffalo, USA
- Published paper on Master Integrals for Mixed QCD-EW corrections to **Drell-Yan processes**
 - Wrote in house code and techniques to calculate low energy electron-proton scattering and neutrino nucleon scattering
- Aug 2013 - Jan 2019 - *Teaching Assistant*, Department of Physics, University at Buffalo, Buffalo, USA

- Worked as course secretary, covered recitation session and lab sessions for undergraduate students

Areas of specialization

Theoretical Particle Physics • Precision calculation for collider physics • Master integral evaluation • Differential Equation Method • Mellin-Barnes Technique • Electroweak renormalization

Education

Aug 2013 - Sep 2019	PH.D. in Physics, University at Buffalo, USA (high distinction) <i>Doctoral Thesis Title: "Mixed QCD-Electroweak Corrections at $O(\alpha\alpha_s)$ to Drell-Yan Processes at Hadron Colliders"</i> <i>Advisor: Prof. Doreen Wackeroth</i>
Dec 2012	MSc in Physics, Jawaharlal Nehru University, India <i>Masters Thesis Title: "Conformal Quantum Mechanics"</i> <i>Advisor: Prof. Debashis Ghoshal</i>
Feb 2010	BSc in Electrical and Electronic Engineering, University of Dhaka, Bangladesh <i>Undergraduate Project Title: "On Theoretical Background of Quantum Computation"</i>
2003	H.S.C., Notre Dame College, Dhaka, Bangladesh
2001	S.S.C., St. Joseph High School, Dhaka, Bangladesh

Research

- Ongoing collaboration with Prof. Hong Liu (MIT) on exploring non-smooth large- N behaviour in quantum field theories using Mellin-Barnes techniques (supported by the MIT Global Seed Funds program).
- Developed novel technique to calculate phase space integrals using Mellin-Barnes approach.
- Developed techniques to calculate phase space integrals using angular decomposition method and apply in the context of Semi inclusive deep inelastic scattering (SIDIS).
- Calculated QCD and Electroweak corrections to Drell-Yan processes for Large Hadron Collider.
- Theoretical calculation of higher order corrections to muon-electron scattering in the context of MUonE experiment.
- Master integral evaluation using differential equations and Mellin Barnes technique for massive Feynman diagrams.
- Higher order calculation for low energy electron-proton scattering and neutrino-nucleon

scattering.

- Work on theoretical aspects of Electron Ion Collider (EIC), titled "New avenues for semi-inclusive scattering at the EIC: SIDIS at high perturbative orders".

Academic Visits

- Brookhaven National Laboratory (BNL), EIC Theory Division
Long-term Visiting Scholar appointment (offered)
- 2025 Institute for Advanced Study, Princeton
Visiting Scholar
- 2024 MITP - Mainz Institute for Theoretical Physics, Johannes Gutenberg University Mainz
Visiting Scientist
Workshop titled "Next Generation Perturbative QCD for Hadron Structure: Preparing for the Electron-Ion Collider"
- 2023 INFN Galileo Galilei Institute for Theoretical Physics
Visiting Scientist
Workshop titled "Theory Challenges in the Precision Era of the Large Hadron Collider"
- 2018 Fermi National Accelerator Laboratory
Visiting Scholar
- 2011 Harish Chandra Research Institute
Summer Project on String Theory
Advisor: Prof. Satchidananda Naik

Awards and Fellowship

- 2026 **MIT Global Seed Funds grant** – "Exploring Non-Smooth Large- N Behaviour in Quantum Field Theories via Mellin–Barnes Techniques" (with Prof. Hong Liu, MIT, Taushif Ahmed, University of Regensburg, and Andreas Rapakoulas, University of Regensburg)
- 2026 **Academic Research Sabbatical Programme (ARSPI)**, University of Regensburg – competitive university-internal award (max. five granted per round) providing a one-semester release from teaching and administrative duties in Winter Semester 2026/27, together with up to €9,000, to concentrate on research and academic qualification towards a professorship
- 2019 **INFN (National Institute for Nuclear Physics) post-doc Fellowship**
- 2017 **Outstanding Teaching Assistant in Physics, University at Buffalo**
- 2015,2017 Silvestro Scholarship, University at Buffalo
- 2013-2019 Tuition Scholarship, University at Buffalo
- 2010-2012 Tuition Scholarship, Jawaharlal Nehru University

IT Skills

Programming: C++, FORTRAN, Python

Symbolic Tools: Mathematica, FORM, MBtools

Reduction Packages: LiteRed, FIRE, KIRA, REDUZE

Diagram and Symbolic Packages: FeynArts, FeynCalc, Qgraf, Tracer

Additionally I have written in-house codes for higher order QFT calculations. Some of these are following:

- Mathematica code to calculate master integrals using differential equation method
- Mathematica code to convert Generalized Harmonic Polylog Functions to Goncharov Polylogs.
- Mathematica code to convert Goncharov Polylogs into Classical Polylogs avoiding heavy-side theta or sgn function in the region of interest.
- Mathematica code suitable to calculate low energy processes which involve non-trivial vertex functions.
- Code to connect GINAC library with FORTRAN environment for effective transition.

Teaching

University of Regensburg, Germany:

- 2026 Course Tutor - Thermodynamics and Quantum Statistics (undergraduate)
– Covered problem classes and tutorials for undergraduate students

- 2023-2025 Course Tutor - Quantum Field Theory, Effective Field Theory, Quantum Chromodynamics
– Covered problems on Quantum Field Theory and QCD for graduate students

University of Pavia, Italy:

- 2021 Lecturer on special topics in QFT
– Lectured on multiloop calculation techniques, Differential Equation method and Special functions in QFT for PhD level students

University at Buffalo, USA:

- 2017,2018 Course Secretary - Physics 108 (General Physics 2)
– Worked as head TA, covered problems on electricity and magnetism through recitation session and graded exams.
- 2017 Course Secretary – Physics 118 (Honors Physics 2)
– Covered problems on electricity and magnetism through recitation session and graded homeworks.
- 2016 Teaching Assistant (Summer) – Physics 257 (General Physics Lab 3)
– Delivered introductory lecture before each lab session, helped student during setup, graded lab reports and all exams.
- 2016 Course Secretary - Physics 107 (General Physics 1)
– Worked as head TA, covered problems on Newtonian Mechanics through recitation session and graded exams.
- 2015,2014 Teaching Assistant (Summer) – Physics 101 (College Physics)
– Covered problems of each chapters through recitation session, made question papers and graded exams.
- 2015,2014,2013 Teaching Assistant – Physics Lab 158

– Delivered introductory lecture before each lab session, helped student during setup, graded lab reports and all exams.

Mentoring and Supervision

- Co-supervising PhD student on higher-order calculations in the context of SIDIS.
- Mentored Master's students on Higher-order ϵ -Expansion of the Appell Function in Angular Phase Space Integrals.
- Co-supervising a Bachelor's thesis titled "Why Birds Fly in V-Formations: A Minimal Nearest-Neighbor Potential Model".

Professional Service

- Referee for Journal of High Energy Physics (JHEP)

Selected Talks

2026	Meeting of FOR 2926, DESY, Hamburg A Symbolic Bootstrap for the Linearization of Generalized Harmonic Polylogarithms
2026	Seminar Speaker, University at Buffalo Radiative Corrections in Elastic Electron-Proton Scattering: The Role of Two-Photon Exchange
2025	Seminar Speaker, University at Buffalo NNLO phase-space integrals for semi-inclusive deep-inelastic scattering
2024	Seminar Speaker, University at Buffalo Angular integrals in D-dimensions using Mellin-Barnes techniques
2023	Meeting of FOR 2926, DESY, Hamburg Second-order massive form factors for the MUonE experiment
2023	Seminar Speaker, University of Regensburg Muon- electron scattering in the context of MUonE
2022	Special HEP-COS Seminar Speaker, University at Buffalo Muon-electron scattering at the next to next leading order for the MUonE experiment
2021	2021 Meeting of the Division of Particles and Fields of the American Physical Society (DPF21), Florida State University Muon-electron scattering at NNLO for the MUonE experiment
2021	Phenomenology 2021 Symposium (online) (24-26 May), University of Pittsburgh Towards Mixed QCD-EW corrections to Drell-Yan processes beyond resonance region

- 2021 RADCOR-LoopFest 2021 (online) (17-21 May), Florida State University
Towards NNLO corrections to muon-electron scattering
- 2020 Phenomenology 2020 Symposium (online) (4-6 May), University of Pittsburgh
Master Integrals for the mixed EW-QCD corrections to the Drell-Yan production of a massive lepton pair
- 2019 Loopfest XVIII (12-14 Aug), Fermilab
Mixed QCD×EW corrections to Drell Yan production of W and Z bosons
- 2019 Phenomenology 2019 Symposium (6-8 May), University of Pittsburgh
Mixed QCD×EW double virtual corrections $\mathcal{O}(\alpha\alpha_s)$ to Drell Yan production of W and Z bosons

Attended Schools

- 2018 Amplitudes 2018 Summer School
UC Davis
- 2017 2017 CTEQ School
University of Pittsburgh
– QCD and Electroweak Phenomenology

References

- **Dr. Taushif Ahmed**
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University of Regensburg
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- **Dr. Fulvio Piccinini**
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Contract Professor at University of Pavia
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- **Dr. Doreen Wackerroth**
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