Jaglul Hasan

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OVERVIEW

Graduate Student in Physics, APS Graduate Student Member, Condensed Matter Theory.

EDUCATION

PhD Candidate in Physics 2019-present
University of Wisconsin-Madison

Major: Condensed Matter Physics Theory
Minor: High Energy Physics Theory (Particle Physics, Advanced Quantum Mechanics I and II)
PhD Thesis: "Anomalous, topological, non-reciprocal and quantum-critical effects in superconductors"
Advisor: Prof. Alex Levchenko

Master of Science in Physics 2019-2022
University of Wisconsin-Madison

GPA: 3.967 (Out of 4.00)
Completed Credits: 63 (30 GPA Credits, 33 Non-GPA Credits)
MS Thesis: "Anomalous Josephson effect in planar noncentrosymmetric superconducting devices"
Advisor: Prof. Alex Levchenko

Bachelor of Science in Electrical and Electronic Engineering (EEE) 2013-2017
Bangladesh University of Engineering and Technology (BUET)

CGPA: 3.74 (out of 4.00)
Top Position in Dean's List in two levels
BS Thesis: "Multi-valued logic circuit design using memristor MOS hybrid architecture"
Advisor: Prof. A. B. M. Harun-Ur-Rashid

JOURNAL PUBLICATIONS [statistics][arXiv]

4. Jaglul Hasan, Daniel Shaffer, Maxim Khodas, and Alex Levchenko, "Supercurrent diode effect in helical superconductors", *Physical Review B* **110**, 024508 (2024).

3. Jaglul Hasan, Konstantin N Nesterov, Songci Li, Manuel Houzet, Julia S Meyer, and Alex Levchenko, "Anomalous Josephson effect in planar noncentrosymmetric superconducting devices", *Physical Review B* **106**, 214518 (2022). An article within the collection: **"Emmanuel Rashba: Breaking New Ground in Solid-State Exploration"**, published in the year of his 95th birthday.

2. Hong-Yi Xie, Jaglul Hasan, and Alex Levchenko, "Non-Abelian monopoles in the multiterminal Josephson effect", *Physical Review B* **105**, L241404 (2022).

1. Jaglul Hasan, Maxim Dzero, Maxim Khodas, and Alex Levchenko, "Thermodynamic properties of nodal superconductors close to a magnetic quantum critical point", *Physical Review B* **105**, 054510 (2022).

CONFERENCE PRECEEDINGS

2. Jaglul Hasan, Konstantin N Nesterov, Songci Li, Manuel Houzet, Julia S Meyer, Alex Levchenko, "Anomalous Josephson effect in planar noncentrosymmetric superconducting devices", *Bulletin of the American Physical Society* , (APS March Meeting 2023).

1. Jaglul Hasan, Songci Li, Alex Levchenko, "Thermoelectric magnetotransport in superconducting interferometers", *Bulletin of the American Physical Society* , (APS March Meeting 2024).

AWARDS

- 2023 American Physical Society Division of Condensed Matter Physics (DCMP) Graduate Student Travel Award: "*to assist the professional development and careers of graduate student researchers.*"
- 2023 Student Research Grants Competition (SRGC) Conference Presentation Award at the University of Wisconsin-Madison: Funding for these awards generously comes from the Vilas Trust and the Wisconsin Alumni Research Foundation.
- 2013-2017 Bangladesh Education Board-Talent Pool Scholarship to support undergraduate studies in BUET
- 2013 & 2015 Undergraduate Dean's list Scholarship for outstanding academic achievement at BUET.

TALKS AND PRESENTATIONS

6. **University of Wisconsin-Madison Dept. of Physics Student Research Colloquium 2024** on "Theory of superconducting diode effect in helical superconductors", Madison, April 5, 2024

5. **APS March Meeting talk** on "Thermoelectric magnetotransport in superconducting interferometers", Minnesota, March 5, 2024

4. **APS March Meeting talk** on "Anomalous Josephson effect in planar noncentrosymmetric superconducting structures", Las Vegas, March 6, 2023

3. **UW-Madison Dept. of Physics Board of Visitors student research presentation** on "Anomalous Josephson effect", Madison, October 13, 2023

2. **Hybrid Quantum Architectures and Networks (HQAN) research coordination talk** on "Anomalous Josephson effect in planar noncentrosymmetric superconducting structures", Madison, Feb 9, 2023

1. **Poster presentation** on "Topological Superconducting Circuits for Control of Majorana Bound States and Anomalous Josephson Effect" at the National Science Federation-Quantum Leap Challenge Institutes-Hybrid Quantum Architectures and Networks (NSF-QLCI-HQAN) All-hands Meeting, Madison, June 14-15, 2021 (Virtual)

OTHER CONFERENCES & WORKSHOPS

- (Attendee) **University of Minnesota William I. Fine Theoretical Physics Institute (FTPI) March Meeting** (March 1 - 3, 2024) sponsored by the Simons Foundation.
- (Attendee) **Non-Fermi Liquids: Recent Developments and Future Prospects** (October 27 - 29, 2023) sponsored by: Kadanoff Center for Theoretical Physics and James Franck Institute
- Successfully completed the Laboratory for Physical Sciences (LPS) Qubit Collaboratory's Summer of Quantum Short Course (July 24, 2023 - August 4, 2023)
- Completed a certified course in Teaching and Learning in Fall 2018 session from Green University of Bangladesh (GUB)
- Completed a short course on Supply Chain Management from Directorate of Continuing Education(DCE), BUET in March 2018.

APPOINTMENTS

Graduate Research Assistant 2020-present
University of Wisconsin-Madison

- Research on Condensed Matter Physics Theory, Superconductivity, Electron Hydrodynamics with Prof. Alex Levchenko

Graduate Teaching Assistant 2019-2024
University of Wisconsin-Madison

- TA for the Semesters: Fall 2019, Fall 2020, Fall 2023, Spring 2020, Spring 2021, Spring 2022, Spring 2023, Spring 2024
- TA for the Courses: Physics 201, Physics 202, Physics 208 (General Physics), Physics 715 (Statistical Mechanics).

Lecturer of Electrical and Electronic Engineering (EEE) 2018-2019
Green University of Bangladesh

- Research on Memristor device theory, Image processing from live traffic footage to extract vehicle information funded by Bangladesh Road Transport Corporation (BRTC)
- Teaching courses on Electromagnetism, Computer Programming, and Electric Circuits
- Mentor Moderator of Green University Student Mentorship Program (GUSMP)

RESEARCH

@ University of Wisconsin-Madison, Dept. of Physics:

- 2023-2024: **Superconducting diode effect in helical Rashba superconductors**
  - Advisor: Prof. Alex Levchenko
  - We studied the superconducting diode effect (SDE) in a Rashba superconductor where both parity and time reversal symmetries are broken. SDE occurs when a superconducting sample is superconducting in one direction and normal resistive metal in the opposite direction.

- 2023-2024: **Thermoelectric magnetotransport in superconducting interferometers**
  - Advisor: Prof. Alex Levchenko
  - We studied galvanomagnetic and thermoelectric responses in mesoscopic normal metal-superconductor interferometers and develop a detailed theory of the thermoelectric magnetotransport phenomena in the framework of the quasiclassical approach extended to the case of noncentrosymmetric devices.

- 2022: **Anomalous Josephson effect in planar noncentrosymmetric superconducting devices**
  - Advisor: Prof. Alex Levchenko
  - We studied anomalous Josephson effect (AJE) in ballistic SINIS structures where superconducting (S) and normal (N) regions are separated by weakly transparent insulating (I) potential barriers.

- 2022: **Thermodynamic properties of nodal superconductors close to a magnetic quantum critical point**
  - Advisor: Prof. Alex Levchenko
  - We studied thermodynamic manifestations of the quantum criticality in multiband unconventional superconductors and corroborated our finding with recent experimental results.

- 2021: **Non-Abelian monopoles in the multiterminal Josephson effect**
  - Advisor: Prof. Alex Levchenko
  - We theoretically analyzed the spectral properties of Andreev bound states in the topological multiterminal Josephson junctions by employing a symmetry constrained scattering matrix approach.

- 2020: **Hydrodynamic magnetoresistance in a Corbino disk**
  - Advisor: Prof. Alex Levchenko
  - As a first summer project, we analyzed the magneto-transport properties in the Corbino-disk geometry in the electron hydrodynamic regime which is relevant to experiments.

@ Bangladesh University of Engineering and Technology (BUET), Dept. of EEE:

- 2017: **Multi-valued logic circuit design using Memristor MOS hybrid architecture**
  - Advisor: Dr. A. B. M. Harun-Ur-Rashid, Professor, EEE, BUET
  - We designed a multi-valued logic circuit using fourth circuit element " Memristor" (other three being resistor, capacitor, and inductor) along with complementary MOSFET. Its performance was compared with the conventional binary 10 nm process and was found to be faster and occupying less area on a chip.

- 2016: **Automated multi-lane Vehicle Speed Detection System using Image Processing from feeds obtained from the Traffic surveillance camera**
  - Facilitator: Bangladesh Road Transport Authority (BRTA)
  - We designed an automated vehicle speed and number plate detection system using image processing and Artificial Intelligence modeling of different vehicles in Dhaka, Bangladesh.

TEACHING

@ University of Wisconsin-Madison, Dept. of Physics:

- Fall 2023: **PHY 202 General Physics**
  "Joy was an amazing TA that helped me a lot in my Physics 202 course. He is a great teacher that made difficult material easy to understand. Joy is one of the best TAs I have had so far." "Joy was one the the best TAs I have ever had. He is wonderful at explaining the material and is passionate about physics. He made discussions and labs more enjoyable and I would not have done as good in the class without him." "I really enjoyed going to Joy's TA section this semester. It was clear that he understood the material and was passionate about the subject. He went above and beyond and was always there to answer questions (outside of class) and create a great learning environment." "Great TA. I think the best one I've met."

- Spring 2022: **PHY 202 General Physics**
  "One of the best TAs I have had, Joy was awesome." "Joy's communication and teaching ability was impeccable; he made the concepts from lecture much clearer. He was engaged with the class and seemed like he really cared. Best TA I've ever had." "Joy was a great TA who was pretty much the sole reason I understood the concepts in class. He was great at explaining the discussion sheets and was a great recourse being full of useful information. I would recommend Joy to friends taking Physics 202 in the future." "Joy was always very willing to help and was always available to help if you reached out." "I learned more from Joy then I did from my professors. Joy was able to teach the topics and help with any problems we had with any topics. Overall, the best TA I have ever had, and I would even say better than most professors I have had. Definitely, top of the top." "I enjoyed having Joy as my TA, he was helpful and enthusiastic about what he was teaching." "Joy is awesome, positive guy who knows his stuff and communicates very clearly."

- Spring 2021: **PHY 208 General Physics**
  "Jaglul is literally one of the best TAs I've ever had. I feel like he teaches this better than the course instructors. For real, Jaglul Hasan is fantastic, I rate him 10/10."

- Fall 2020: **PHY 201 General Physics**
  "Probably my favorite TA so far, he always explained things very clearly and was very welcoming to us."

- Spring 2020: **PHY 201 General Physics**
  "Jaglul has been one of the best TAs I've had at UW. He always gave us mini lectures that were very helpful, all his thoughts were very concise and clear, and never left a question unanswered. The discussion worksheets he provided were very relevant to the class. Some other friends in the same class with different TAs didn't receive good discussion worksheets, but Jaglul's were always top quality. I rate him a 10/10." "My TA was vital for me to succeed in this class. His preparation and materials made the material covered in class easy to understand and grasp." "This TA puts in more than enough effort to help his students get more practice and learn the material faster. He is always open to helping others whether virtually or in person, and I am glad to have been one of his students this year." "Joy was a great resource for Physics 201, both during in-class instruction and during the remote transition. His method of teaching remotely was the most effective I experienced this semester."

- Fall 2019: **PHY 201 General Physics**
  "I am very lucky to have had Jaglul as a TA, he does an exceptional job at keeping a knowledgeable and comfortable environment." "Jaglul did a nice recap of the lectures during discussions and wrote very clearly on the board. Responded to emails very promptly and was very accommodating." "One of the best TAs."

UNDERGRAD PROJECTS

- An engineering project on AM (Amplitude Modulated) radio receiver.
- Vision based object tracking and blocking system using image processing.
- GPS based robot for remote operation.
- Airport Automatic Baggage Separation Implementation Using Field Programmable Gate Array (FPGA).
- An engineering project on smart Traffic Signal system using FPGA.
- 8 bit Simple Architecture Personal Computer design using hardware.
- Prototype Power Factor Improvement (PFI) plant.

PROGRAMMING SKILLS

- Programming Languages: C, C++, Python, Assembly, MATLAB
- Hardware Description Language: Verilog, PSpice, LTSpice
- Hardware: PCB design, FPGA, Microcontroller, Arduino, Microprocessor

LEADERSHIP SKILLS

- Secretary at the Bangladesh Student Organization at University of Wisconsin- Madison from 2019-2023.
- Assistant Manager in Toys R Urs initiative by the Ex-Cadets of all Cadet Colleges in Bangladesh for financially deprived children.
- President in BUET Relief Collection and Distribution Club (2017-2018)
- President in BUET Literary Club (2016-2017)
- President in BUET Debating Club (2015-2016)
- Assistant House Prefect in Jhenidah Cadet College (2011-2012)