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Research interests:

The broad range of my research interest is *Theoretical Condensed Matter Physics* in which I investigate

- Different aspects of 2D or 3D Dirac-like materials [like graphene, silicene, borophene, Weyl and nodal-line semi-metal etc] including the electronic, transport and topological properties subjected to time-reversal symmetry breaking external time-dependent periodic perturbation or magnetic field.
- Electron-hole conversion phenomena across the interface of normal-superconductor hybrid junction: Andreev Reflection, Crossed Andreev reflection, Cooper pair splitter
- Magnetic exchange interaction (RKKY) between two-magnetic impurities embedded into an fermionic system
- Periodically modulated quantum Hall systems: Weiss oscillation
- Collective excitation: Plasmon
- Spin-Hall effect and it's related phenomena.
- Microscopic theory of superconductivity of 2D Dirac materials, twisted layered materials like twisted bilayer graphene
- Light transmission through photonic graphene

Education and research experience

Postdoctoral Research Associate (01/11/2022-30/04/2023)
North Carolina Central University, Durham-NC
USA

Postdoctoral Fellow (18/02/2019-31/08/2022)
Aalto University, Espoo
Finland

Postdoctoral Fellow (15/09/2016-14/09/2018)
Visitor (15/09/2018-14/10/2018)
Institute of Physics Bhubaneswar
India

Research Associate (01/04/2015-31/07/2016)
National Institute of Science Education and Research,
Bhubaneswar, India

PhD in Physics (21/06/2008-18/06/2014)
Indian Institute of Technology-Kanpur, India

MSc in Physics (01/07/2005-24/12/2007)
Jadavpur University, Kolkata, West Bengal, India

BSc with Physics, Chemistry and Mathematics (01/08/2002-01/06/2005)
Midnapur College (Affiliated to Vidyasagar University), West Bengal, India

10+2 with Physics, Chemistry, Mathematics, Biology, English and Bengali (01/07/2000-02/07/2002)
West Bengal Council of Higher Secondary Education, India

10-th standard with Physical science, Life Science, Mathematics, History, Geography, English and Bengali
(-27/06/2000)
West Bengal Board of Secondary Education, India

List of Publications

- Articles submitted and under preparation:
 1. Theory of light diffusion through disordered amplifying photonic lattice.
[SK Firoz Islam](#) and Alexander. A. Zyuzin
arXiv preprint: 2008.12675
- Articles published in refereed journal:
 2. Volkov-Pankratov states in a driven semimetals for a generic interface
Aiman Rauf, [SK Firoz Islam](#)
Physical Review B 110, 205418 (2024)
American Physical Society
 3. Photoinduced metallic Volkov-Pankratov states in semi-Dirac semimetals
[SK Firoz Islam](#)
Physical Review B 109 (23), 235416 (2024)
American Physical Society
 4. Unconventional superconductivity with preformed Cooper pairs in twisted bilayer graphene.
[SK Firoz Islam](#), A. Yu Zyuzin and Alexander. A. Zyuzin
Physical Review B Letter 107, L060503 (2023)
American Physical Society
 5. Collective modes in an imbalanced nodal line semimetal.
[SK Firoz Islam](#) and Alexander. A. Zyuzin
Physical Review B 104, 245301 (2021)
American Physical Society
 6. Photoinduced spin-Hall resonance in a k^3 -Rashba spin-orbit coupled two-dimensional hole system.
Ankita Bhattacharya and [SK Firoz Islam](#)
Physical Review B Letter 104, L081411 (2021)
American Physical Society
 7. signatures of topological interfacial chiral modes via RKKY exchange interaction in Dirac and Weyl semimetal.
Ganesh C. Paul, [SK Firoz Islam](#), Paramita Dutta and Arijit Saha
Physical Review B 103, 115306 (2021)
American Physical Society
 8. Propagation of light through amplifying honeycomb photonic lattice.
[SK Firoz Islam](#), Pascal Simon and Alexander A. Zyuzin
Physical Review A 102, 043504 (2020)
American Physical Society
 9. Photoinduced interfacial chiral modes in threefold topological semimetal.
[SK Firoz Islam](#) and Alexander. A. Zyuzin
Physical Review B 100, 165302 (2019)
American Physical Society

10. Enhancement of thermoelectric performance of a nanoribbon made of $\alpha - T_3$ lattice.
Mir Waqas Alam, Basma Souayah and [SK Firoz Islam](#)
Journal of Physics: Condensed Matter 31 485303 (2019), ISSN No. 1742-6588
IOP Publisher
11. Fingerprints of tilted Dirac cones on RKKY exchange interaction in 8-Pmmn borophene
Ganesh C Paul, [SK Firoz Islam](#) and Arijit Saha
Physical Review B, 99, 155418 (2019)
American Physical Society
12. Driven conductance of an irradiated semi-Dirac material
[SK Firoz Islam](#), and Arijit Saha
Physical Review B 98, 235424 (2018)
American Physical Society
13. Probing decoupled edge states in zigzag phosphorene nanoribbon via RKKY interaction
[SK Firoz Islam](#), Paramita Dutta, Arijit Saha and A. M. Jayannavar
Physical Review B 97, 235424 (2018), ISSN No. 2469-9969
American Physical Society
14. Magnetotransport properties of 8-Pmmn borophene: effects of Hall field and strain
[SK Firoz Islam](#)
Journal of Physics: Condensed Matter 30 275301 (2018), ISSN No. 1742-6588
IOP Publishing
15. Signature of tilted Dirac cones in Weiss oscillations of 8 - *Pmmn* borophene,
[SK Firoz Islam](#), and A. M. Jayannavar
Physical Review B 96, 235405 (2017), ISSN No. 2469-9969
American Physical Society
16. Enhancement of crossed Andreev reflection in a normal-superconductor-normal junction of thin topological insulator,
[SK Firoz Islam](#), Paramita Dutta and Arijit Saha
Physical Review B 96, 155429 (2017), ISSN No. 2469-9969
American Physical Society
17. Valley polarized magnetoconductivity and particle-hole symmetry breaking in a periodically modulated α - T_3 lattice
[SK Firoz Islam](#) and Paramita Dutta
Physical Review B 96, 045418 (2017), ISSN No. 2469-9969
American Physical Society
18. Amplification of Cooper pair splitting current in a graphene based Cooper pair beam splitter geometry,
[SK Firoz Islam](#), and Arijit Saha
Physical Review B 96, 125406 (2017), ISSN No. 2469-9969
American Physical Society

19. A scheme to realize quantum spin-valley Hall effect in graphene,
[SK Firoz Islam](#) and Colin Benjamin
CARBON 110, 304 (2016), ISSN No. 0008-6223
Elsevier

20. Topologically induced fractional Hall steps in integer quantum Hall regime of monolayer of MOS_2 , [SK Firoz Islam](#) and Colin Benjamin
Nanotechnology 27, 385203 (2016), ISSN No. 0957-4484
IOP Publishing

21. Adiabatically twisting a magnetic molecule to generate pure spin current in graphene,
[SK Firoz Islam](#) and Colin Benjamin,
Journal of Physics: Condensed Matter 28 035305 (2016), ISSN No. 1742-6588
IOP Publishing

22. Beating pattern in quantum magnetotransport coefficients of spin-orbit coupled Dirac fermions in gated silicene,
[SK Firoz Islam](#) and Tarun Kanti Ghosh,
Journal of Physics: Condensed Matter 26 335303 (2014), ISSN No. 1742-6588
IOP Publishing

23. Thermoelectric properties in an ultra-thin topological insulator.
[SK Firoz Islam](#) and Tarun Kanti Ghosh,
Journal of Physics: Condensed Matter 26 165303 (2014), ISSN No. 1742-6588
IOP Publishing

24. In-plane electric field effect on a spin-orbit coupled two-dimensional electron system in presence of magnetic field.
[SK Firoz Islam](#) and Tarun Kanti Ghosh,
Journal of Applied Physics 113 183710 (2013), ISSN No. 0021-9002
American Institute of Physics

25. Modulation effect on spin Hall resonance.
[SK Firoz Islam](#),
Modern Physics Letters B 27 1350129 (2013), ISSN No. 0217-9849
World Scientific

26. Thermoelectric probe of Rashba spin-orbit interaction strength in a two dimensional electron gas.
[SK Firoz Islam](#) and Tarun Kanti Ghosh,
Journal of Physics: Condensed Matter 24 345301 (2012), ISSN No. 1742-6588.
IOP Publishing

27. Magnetotransport properties of a magnetically modulated two dimensional electron gas with spin-orbit interaction.
[SK Firoz Islam](#) and Tarun Kanti Ghosh,
Journal of Physics: Condensed Matter 24 185303 (2012),ISSN No. 1742-6588.
IOP Publishing

28. Zero-field spin splitting in a two dimensional electron gas with spin-orbit interaction revisited.
[SK Firoz Islam](#) and Tarun Kanti Ghosh,
Journal of Physics: Condensed Matter **24** 035302 (2012), ISSN No. 1742-6588.
IOP Publishing
29. Thermodynamic properties of magnetically modulated monolayer graphene.
[SK Firoz Islam](#), Naveen Kumar Singh and Tarun Kanti Ghosh,
Journal of Physics: Condensed Matter **23** 445502 (2011), ISSN No. 1742-6588.
IOP Publishing

Students and Research scholars

Master project students

1. [Aiman Rauf](#) [2023-24]
Thesis title: Volkov-Pankratov states in a driven semimetal
2. [Muhammad Usman](#) [2024-25 (ongoing)]
Thesis title: Spin transport in a Rashba spin-orbit coupled square lattice
3. [Aryan Pandita](#) [2024-25 (ongoing)]
Thesis title: Integer Quantum Hall phenomena in a periodically driven multifold semimetal

PhD students

1. [Suhel Mullick](#) [2023-]
Research area: Transport properties of a periodically driven two band semimetals

Conferences and Schools attended

- International Conference on Material Science and Technology, Kochi, India, June 06th to June 14th, 2012
- Emerging Trends in Advanced Functional Materials, Institute of Physics, Bhubaneswar, India, January-18th to January-22nd, 2016
- School on Nanoscale Electronic Transport and Magnetism, Harish-Chandra Research Institute, Allahabad, India, February-22nd to March-02nd, 2016
- XXIV International Summer School 'Nicolás Cabrera'. Quantum Transport in Topological Materials, Instituto Nicolas Cabrera, Madrid, SPAIN, September-4th to September-8th, 2017
- Young Investigator Meet on Quantum Condensed Matter Theory, S. N. Bose Institute for Basic Science, Kolkata, INDIA on 26-17 Oct., 2017.
- Summer School "Quantum Connection-2019" (10.06.2019-22.06.2019), NORDITA, Stockholm, Sweden

Teaching Experience

- Classical Mechanics in MSc [Semester-I], Sessions 2023-24 and 2024-25.
- Condensed Matter Physics-II, MSc [Semester-IV], Session 2023-24.
- Statistical Mechanics, BSc (Phys. Hons) [Semester-VI], Session 2023-24.
- Electricity and Magnetism-I, BSc (Pass) [Semester-III], Session 2023-24 and 2024-25.

Software Skills

- Mathematica, Matlab
- Writing reports and other scientific documents with Latex

References

- Dr. Tarun Kanti Ghosh
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