Mahtab Ahmad Khan

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Education

Ph.D. Physics, University of Central Florida, 2018.

M.Phil. Physics, Quaid-i-Azam University, 2008.

M. Sc (16th year). Physics, University of the Punjab, 2004.

Professional Experience

1. Currently, working as Assistant Professor of Physics at Federal Urdu University of Arts, Science and Technology Islamabad, **May 2018 to date**.
2. Worked as visiting research scholar at Dr. Michael N Leuenberger's research group at NanoScience and Technology Center, Orlando Florida USA, October 2023 to December 2023.
3. Worked as Lecturer of Applied Physics at Federal Urdu University of Arts, Science and Technology Islamabad,
   July 2009 to May 2018.
4. Worked as Lecturer of Physics at University of Wah, December 2008 to July 2009.

Research and Teaching Assistant

1. University of Central Florida August 2012 to August 2013.Teaching and grading assignments for undergraduate physics courses on classical mechanics, electrodynamics, and quantum mechanics.

2. Worked as research assistant at University of Central Florida August 2013 to April 2018.

3. Worked as research assistant at Quaid-i-Azam University, August 2007 to December 2008.

Research Interests

I am interested in a variety of problems in the arena of theoretical condensed matter physics. The major focus of my research has been on unique properties of two dimensional (2D) materials, such as graphene single-layer (SL) transition metal dichalcogenides (TMDCs) such as MoS_2, WS_2, $MoSe_2$, WSe_2 and newly discovered SL transition metal monodichalcogenides such as GaSe and GaS. When materials are thinned down to the atomic dimensions, rich and intriguing properties emerge that have been impossible to extract from their 3D counterparts. Atomically thin materials are of interest for a wide range of properties: electrical and thermal conduction, mechanical reinforcement of composites, membranes and filters, battery electrodes, biocompatible materials, and more. Researchers are discovering new fundamental properties of atomically thin materials, and using these properties for new technological applications.
I am interested in the fundamental physics that emerges from 2D materials. I use computational techniques such as density functional theory and analytical modeling to investigate the electronic, optical and magnetic properties of 2D materials. I am currently working on:

1. Electronic, optical and magnetic properties of Lanthanum substitutional defects in single-layer TMDCs.
2. Single photon emission in single-layer WSe_2.
3. Spin transport in 2D materials
4. Electron-phonon interaction in 2D materials
5. Influence of structure defects on the magnetic properties of atomically thin VS_2 and VSe_2.

Publications

Papers

1. Wajid Joyia, Khalid Khan, Asif Ilyas, and **M. A. Khan**, Robustness of quantum coherence and quantum criticality in spin-1 many-body system, Open Physics, 15, 100149, (2023).
   (https://doi.org/10.1016/j.physo.2023.100149)
2. **M. A. Khan** Michael N Leuenberger, First-principles study of the electronic and optical properties of Ho_W impurities in single-layer tungsten disulfide, Scientific Reports 12 (1), 1-10, (2022). (https://www.nature.com/articles41598-022-14499-x)
3. Wajid Joyia, Salman Khan Khalid Khan and **Mahtab Ahmad Khan**, Exploring the Koch Fractal with Quantum renormalization group method, Physica A: Statistical Mechanics and its Applications, 593, 126948 (2022) (https://doi.org/10.1016/j.physa.2022.126948)
4. **M. A. Khan** and Michael N. Leuenberger, Ab-initio calculations for electronic and optical properties of Er_W defects in single-layer tungsten disulfide, J. Appl. Phys. 130, 115104 (2021).
5. Chandriker K. Dass, **M. A. Khan**, G. Clark, J. A. Simon, R. Gibson, S. Mou, X. Xu, M. N. Leuenberger, and J. R. Hendrickson, Ultra-Long Lifetimes of Single Quantum Emitters in Monolayer WSe2/hBN Heterostructures, Adv. Quantum Technol., 1900022 (2019).
6. **M. A. Khan**, and Michael N. Leuenberger, Optoelectronics with single layer group-VIB transition metal dichalcogenides, Nanophotonics, 7(10), pp. 1589-1600 (2018).
7. **M. A. Khan**, and Michael N. Leuenberger, Room-temperature superparamagnetism due to giant magnetic anisotropy in Mo_S defected single-layer MoS_2, J. Phys.: Condens. Matter **30** 155802 (2018).
8. **M. A. Khan**, Mikhail Erementchouk, Joshua Hendrickson, and Michael N. Leuenberger, Electronic and optical properties of vacancy defects in SL TMDCs, Phys. Rev. B **95**, 245435 (2017).
9. Mikhail Erementchouk, Pinaki Mazumder, **M. A. Khan**, and Michael N. Leuenberger, Dirac electrons in the presence of a matrix potential barrier: application to graphene and topological insulators, J. Phys.: Condens. Matter **28** 115501 (2016).
10. Mikhail Erementchouk, **M. A. Khan**, and Michael N. Leuenberger, Optical signatures of states bound to vacancy defects in monolayer MoS_2, Phys. Rev. B **92**, 121401(R) (2015).
11. **M. A. Khan** and Michael N. Leuenberger, Two-dimensional fermionic Hong-Ou-Mandel interference with massless Dirac fermions, Phys. Rev. B **90**, 075439 (2014).
12. R. Nasir, **M. A. Khan**, M. Tahir, and K. Sabeeh, Thermodynamic properties of a weakly modulated graphene monolayer in a magnetic field, J. Phys: Condens. Matter **22**, 025503 (2010).

Talks and Posters

1. *"Room-temperature superparamagnetism due to giant magnetic anisotropy in Mo_S defected SL MoS_2"* Talk. APS March Meeting, Los Angeles, California, March 5, 2018.
2. *"Defect induced magnetism in TMDCs."* Talk. APS March Meeting, New Orleans, Louisiana, March 15, 2017.
3. *"Electronic and optical properties of TMDCs in the presence of vacancy defects."* Talk. The electronic and optical properties of 2D and Dirac materials, Jacksonville Beach, Florida, December 13, 2016.
4. *"Two-dimensional fermionic Hong-Ou-Mandel interference with massless Dirac fermions."* Poster. Quantum Criticality and Topology in Itinerant Electron Systems, Albuquerque, New Mexico, August 15, 2016-, August 19, 2016.
5. *"Opticl signature of states bound to vacancy defects in monolayer MoS_2."* Invited Talk. Air Force Research Lab Dayton Ohio, July 26, 2016.
6. *"Electronic and Optical properties of Vacancy Defects in two dimensional monolayer TMDCs"* Talk. APS March Meeting, Baltimore, Maryland, March 15, 2016.
7. *"Defect states in monolayer TMDCs"* Talk. APS March Meeting, San Antonio, Texas, March 5, 2015.
8. *"Two-dimensional fermionic Hong-Ou-Mandel interference with massless Dirac fermions."* Talk. 13th OSA Student Chapter Graduate Research Symposium, 21 January 2015 in The College of Optics and Photonics.
9. *"Coulomb scattering of Weyl fermions through a potential barrier"* Talk. APS March Meeting, Denver, Colorado, March 4, 2014.

References

1. Dr. Michael N. Leuenberger (Doctoral Advisor),
   Professor of Theoretical Physics,
   NanoScience Technology Center, Department of Physics,
   and College of Optics and Photonics (CREOL),
   PHONE: 407-882-2846,
   FAX: 407-882-2819,
   EMAIL: michael.leuenberger@ucf.edu.
2. Winston V. Schoenfeld, (Doctoral committee member)
   Associate Vice President for Research,
   College of Graduate Studies, Professor of Optics Photonics,
   Director, Solar Technologies Research Division/FSEC,
   PHONE: 407-823-0824
   EMAIL: winston@creol.ucf.edu