NITIN KAUSHAL

PERSONAL DATA:

PRESENT ADDRESS:	6315 Kingstone Pike, Apt. no. 1511, Knoxville, TN-37919, USA
PERMANENT ADDRESS:	GH-8 Himprastha Society, Sector-24, Panchkula, Haryana, India
BIRTH DATE:	August 1, 1990
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EDUCATION:

PH.D. PHYSICS (2014-2020):	In Theoretical Condensed Matter Physics at University of Tennessee under the supervision of Prof. Elbio Dagotto. GPA : 3.78
August, 2013 -July, 2014:	Graduate student, University of Tennessee.
Integrated BS-MS (2008-2013):	Indian Institute of Science Education and Research, Kolkata, India. Supervisor: Prof. Amit Ghosal, Department of Physical Sciences.

RESEARCH AND LEARNING EXPERIENCE:

Oak Ridge National Laboratory (2020-Present)
Postdoctoral fellow in Computational Science and Engineering Division.

University of Tennessee (2014-2020)
Graduate Advisor: Prof. Elbio Dagotto

- I have primarily studied the electronic and magnetic properties – both static and dynamic – of strongly correlated electronic systems using multi-orbital Hubbard models, with and without atomic spin-orbit coupling. The main computational techniques I have employed are the Density Matrix Renormalization Group (DMRG) and the Lanczos Algorithm. Both are numerically exact methods. I have also vast experience with Hartree-Fock calculations in two dimensional lattices. Most of my studies have focused on materials where the orbital degree of freedom plays an important role such as in transition metal oxides (particular examples include Iron-based superconductors, Iridates, Rhutenates, etc.).

- Contributed in the development of open source DMRG code (DMRG++) for studying spin-orbit coupling in multi-orbital Hubbard models.
- I have also developed my own codes employing the following technniques: DMRG, Lanczos, multi-orbital unrestricted Hartree-Fock, and Monte-Carlo mean field. The results of my own codes, as well as open source codes such as DMRG++, have been used to conduct my published research.

University of Tennessee (2013-2014): I performed the duties of teaching assistant and conducted various undergraduate level labs.

IISER-Kolkata (2012-2013): Developed the pairing theory formalism for strongly correlated d-wave disordered superconductors.

TECHNICAL SKILLS:

PROGRAMMING: I have primarily coded in languages C++, python, Fortran, bash. I have used OpenMP and MPI to parallelize the codes. Most of the codes written by me are available on https://github.com/nkphys.

CLUSTERS: ACF (Advanced Computing Facility) provided by NICS at University of Tennessee.

SYSTEMS: Ubuntu(Linux), Windows, macOS, High Performance Computing (HPC) enviroments.

LANGUAGES: English and Hindi.

PROFESSIONAL SERVICES AND HONORS:

PEER REVIEWER: Physical Review Letters and Physics Review B (APS)

ACADEMIC HONORS:

- Selected for Chancellor's Citation Award-2020 for extraordinary professional promise in research.
- I obtained All India Rank-24 in Joint Entrance Screening test (JEST) in 2012.
- I obtained All India Rank 235 in National Eligibility Test (CSIR-NET), 2012 December. I was awarded Junior Research Fellowship (JRF). This exam is conducted by Council of Scientific and Industrial Research (CSIR) and University Grants Commission, India.

- I was selected in Extended merit list of IIT-JEE exam 2008, leading to admission in Indian Institute of Science Education and Research Kolkata.
- I received Inspire-fellowship to pursue BS-MS in IISER Kolkata.

PUBLICATIONS:

[23] '*Magnetic ground states of honeycomb lattice Wigner crystals*', **N. Kaushal**, N. M.-Durán, A. H. MacDonald, and E. Dagotto, arXiv:2206.10024 (2022).
[22] '*Estimation of biquadratic and bicubic Heisenberg effective couplings deduced from multiorbital Hubbard models*', R. Soni, **N. Kaushal**, C. Sen, F. A. Roboredo, A. Moreo , and E. Dagotto, New Journal of Physics, Vol. 24 (2022).
[21] '*Magnetization dynamics fingerprints of an excitonic condensate* $(t_{2g})^4$ *magnet*', **N. Kaushal**, J. Herbrych, G. Alvarez, and E. Dagotto, Phys. Rev. B 104, 235135 (2021).
[20] '*Multitude of topological phase transitions in bipartite dice and Lieb lattices with interacting electrons and Rashba coupling*', R. Soni, A. B. Sanyal, **N. Kaushal**, S. Okamoto, A. Moreo, and E. Dagotto, Phys. Rev. B 104, 235115 (2021).
[19] '*Oxygen magnetic polarization, nodes in spin density, and zigzag spin order in oxides*', L. F. Lin, **N. Kaushal**, C. Sen, A. D. Christianson, A. Moreo, and E. Dagotto, Phys. Rev. B 103 (18), 184414 (2021).
[18] '*Orbital ordering in the layered pervoskite material* $CsVF_4$*',* L. F. Lin, **N. Kaushal**, Y. Zhang, A. Moreo, and E. Dagotto, Phys. Rev. Materials 5 (2), 025001 (2021).
[17] 'Origin of the magnetic and orbital ordering in α-Sr_2CrO_4', B. Pandey, Y. Zhang, **N. Kaushal**, R. Soni, L.F. Lin, W. J. Hu, G. Alvarez, and E. Dagotto, Phys. Rev. B 103 (4), 045115 (2021).
[16] 'Intrinsic ferromagnetism in atomically this two-dimensional organic-inorganic vanderwaals crystals', D. Sen, G. Jana, **N. Kaushal**, A. Mukherjee, and T. S. Dasgupta, Phys. Rev. B 102 (5), 054411 (2020).
[15] '*Prediction of exotic magnetic states in the alkali metal quasi one-dimensional iron selenide compound* Na_2FeSe_2', B. Pandey, L.F. Lin, R. Soni, **N. Kaushal**, J. Herbrych, G. Alvarez, and E. Dagotto , Phys. Rev. B. 102, 035149 (2020).
[14] '*BCS-BEC crossover in the* $(t_{2g})^4$ *Excitonic magnet* ', **N. Kaushal**, R. Soni, A. Nocera, G. Alvarez, and E. Dagotto, Phys. Rev. B 101, 245147 (2020).
[13] '*Emergence of Superconductivity in Doped Multiorbital Chains*', N. D. Patel, **N. Kaushal**, A. Nocera, G. Alvarez, and E. Dagotto, NPJ Quantum Materials 5, 1-9 (2020).
[12] '*Flat Bands and Edge Currents in Dice-Lattice Ladders*' , R. Soni, **N. Kaushal**, S. Okamoto, and E. Dagotto, Phys. Rev. B 102, 045105 (2020).
[11] '*2D ferromagnetism in layered inorganic-organic hybrid perovskites*' , D. Nafday, D. Sen, **N. Kaushal**, A. Mukherjee, and T. S. Dasgupta, Phys. Rev. Research **1**, 032034 (2019).
[10] '*Block Excitonic Condensate at n=3.5 in a Spin-Orbit Coupled* t_{2g} *Multiorbital Hubbard Model*' , **N. Kaushal**, A. Nocera, G. Alvarez, A. Moreo, and E. Dagotto, Phys. Rev. B **99**, 155115 (2019).

[9] '*Spin dynamics of the block orbital-selective Mott phase*', J. Herbrych, **N. Kaushal**, A. Nocera, G. Alvarez, A. Moreo, and E. Dagotto, Nature Communications **9**, 3736 (2018).
[8] '*Computing Resonant Inelastic X-Ray Scattering Spectra Using The Density Matrix Renormalization Group Method*', A. Nocera, U. Kumar, **N. Kaushal**, G. Alvarez, E. Dagotto, and S. Johnston, Scientific Reports **8**, 11080 (2018).
[7] '*Prospects of Anderson's theorem for disordered cuprate superconductors*', A. Ghosal, D. Chakraborty, **N. Kaushal**, Physica B **536**, 867 (2018).
[6] '*Density matrix renormalization group study of a three-orbital Hubbard model with spin-orbit coupling in one dimension*' , **N. Kaushal**, J. Herbrych, A. Nocera, G. Alvarez, A. Moreo, F. A. Reboredo, E. Dagotto, Phys. Rev. B **96**, 155111 (2017).
[5] '*Spin-orbit interaction driven dimerization in one dimensional frustrated magnets*', S. S. Zhang, **N. Kaushal**, E. Dagotto, and C. D. Batista, Phys. Rev. B **96**, 214408 (2017).
[4] '*Non Fermi liquid behavior and continuously tunable resistivity exponents in the Anderson-Hubbard model at finite temperature*', N. D. Patel, A. Mukherjee, **N. Kaushal**, A. Moreo, and E. Dagotto, Phys. Rev. Lett. **119**, 086601 (2017).
[3] '*Effective pairing theory for strongly correlated d-wave superconductors*', D. Chakraborty, **N. Kaushal**, A. Ghosal, Phys. Rev. B **96**, 134518 (2017).
[2] '*Non-local correlations in the orbital selective Mott phase of a one-dimensional multiorbital Hubbard model*' , S. Li, **N. Kaushal**, Y. Wang, Y. Tang, G. Alvarez, A. Nocera, T. A. Maier, E. Dagotto, and S. Johnston, Phys. Rev. B **94**, 235126 (2016).
[1] '*Orbital-selective Mott phases of one-dimensional three-orbital Hubbard model studied using computational techniques*', G. Liu, **N. Kaushal**, S. Li, C. B. Bishop, Y. Wang, S. Johnston, G. Alvarez, A. Moreo, E. Dagotto, Phys. Rev. E **93**, 063313 (2016).

PRESENTATIONS :

- **Invited talk** at International Conference on Recent Progress in Many-Body Theories XX1, Chapel Hill, NC, USA, Sep-2022:
  '*Magnetic ground states of honeycomb lattice Wigner crystals*'.
- APS March Meeting 2022: '*Magnetization dynamics fingerprints of an excitonic condensate $(t_{2g})^4$ magnet* '.
- **Invited talk** at Worclaw University of Science and Technology, Poland, May-2021:
  '*Spin-orbit excitonic magnetism in multiorbital systems*'.
- APS March Meeting 2021: '*BCS-BEC crossover in the $(t_{2g})^4$ Excitonic magnet*'.
- Presented Poster on '*BCS-BEC crossover in the $(t_{2g})^4$ Excitonic magnet'* at University of Tennessee in March-2020.

- Presented tutorial on Density matrix renormalization group technique, and DMRG++ in December 2018, and co-instructed tutorial session on infinite-DMRG (with Hitesh J. Changlani) in Dec-2019 at IISER-Kolkata.
- **Invited talk** at IISER Kolkata-December 2018: '*Spin dynamics of the block orbital-selective Mott phase*'.
- APS March Meeting 2018: '*Quantum Phase Transitions in a Multi-orbital Hubbard Model with Spin-Orbit Coupling*'.
- APS March Meeting 2017: '*Study of a one-dimensional three-orbital Hubbard model and effect of spin orbit coupling using the Density Matrix Renormalization Group method*'.
- APS March Meeting 2016: '*Density Matrix Renormalization Group Study of a One Dimensional Three-Orbital Hubbard Model: The role of pair hopping and spin-flip interactions*'.

REFERENCES :

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