

Dr Mohammed Ahsanul Hoda Ahsan, PhD(Physics)

Professor, Department of Physics, Jamia Millia Islamia, New Delhi 110025, India.

Research Interests: Exact Diagonalization studies on Hubbard model, Heisenberg Spin model, Bose-Einstein Condensation in weakly interacting Bose gas, High Temperature Superconductivity, BEC-BCS Crossover, Transport in Double Quantum Dot system, Theoretical Physics, Electromagnetic Theory

Educational Qualifications

1. MSc(Physics), IIT Kanpur, India.

MSc Experimental Project Thesis 'Fabrication of Indium Plasma recombination Laser' under Prof R K Thareja, former Deputy Director, IIT Kanpur.

Elective papers in MSc: High Energy Physics, Gravitation and General Relativity

2. PhD(Physics), IIT Bombay, Powai, Mumbai, India.

Thesis title 'Configuration Interaction Studies on Model Hamiltonians' under Prof C R Sarma and Prof Dipan K Ghosh (former Deputy Director, IIT Bombay).

Post-PhD Experience

1. Post Doctoral Fellow(1998-2000), Raman Research Institute, Bengaluru, India.

Mentor: (Late) Prof N Kumar, the then Director, RRI, Bengaluru.

2. Research Associate(2000-2002), Department of Physics, IISc, Bengaluru, India.

Mentor: Prof T V Ramakrishnan, FRS.

Regular Employment

1. Assistant Professor(August 2002-August 2014), Department of Physics, Jamia Millia Islamia, New Delhi, India.

2. Associate Professor(August 2014-August 2017), Department of Physics, Jamia Millia Islamia, New Delhi, India.

3. Professor(since August 2017), Department of Physics, Jamia Millia Islamia, New Delhi, India.

Academic Visits abroad

1. May-June, 1995, Participant, College on Computational Physics, International Centre for Theoretical Physics(ICTP), Trieste, Italy.

2. September 2004-January 2005, Visiting Scientist in the group of Prof Erio Tosatti (former Acting Director, ICTP), International School of Advanced Studies(SISSA), Trieste, Italy.

3. August 2008-August 2009, Visiting Scientist in the group of Prof Jamal Berakdar, Institute of Physics, Martin-Luther University, Halle-Wittenberg, Germany.

Research Fellowships

1. DAAD Study and Research Fellowship 2008

2. GATE 1990

3. JRF-CSIR

Courses taught

Undergraduate: Statistical Mechanics, Electricity and Magnetism, Electromagnetic Theory, Classical Mechanics

Postgraduate: Condensed Matter Physics II, Quantum Field Theory, Classical Electrodynamics, Statistical Mechanics, Atomic and Molecular Physics, Numerical Analysis and Programming, Mathematical Physics I, Particle Physics.

Pre-PhD: Advanced Classical Electrodynamics, Advanced Condensed Matter Physics, Research Methodology.

Other Academic Achievements

Editorial Board Member of *Indian Journal of Pure and Applied Physics* (IJPAP).

PhD Thesis supervision

Supervised-6, Co-Supervised-2, Ongoing-6

Research Publications

1. Novel phases in rotating Bose condensed gas: vortices and quantum correlation, Mohd. Imran, M. A. H. Ahsan, M. Rafat, *arXiv:2206.14543 [cond-mat.quant-gas]*, (2022).

2. Vortices in rotating Bose gas interacting via finite range Gaussian potential in a quasi-two-dimensional harmonic trap, Md Hamid and M. A. H Ahsan, *arXiv:2205.12614 [cond-mat.quant-gas]*, (2022).
3. Two trapped particles interacting by a finite-ranged two-body potential in two spatial dimensions, Md Hamid and M. A. H Ahsan, *arXiv:2205.11958 [cond-mat.quant-gas]*, (2022).
4. Effects of discrete topology on quantum transport across a graphene npn junction: A quantum gravity analog, Naveed Ahmad Shah, Alonso Contreras-Astorga, Francois Fillion-Gourdeau, M. A. H. Ahsan, Steve MacLean, and Mir Faizal, *Phys. Rev. B*, **105**, L161401, (2022).
5. High Precision Capacitive Sensors for Intravenous Fluid Monitoring in Hospitals, Uzma Salmaz, M. A. H. Ahsan and Tarikul Islam, *IEEE Transactions on Instrumentation and Measurement*, Vol. **70**, (2021).
6. Quantization of non-Abelian Gauge Theory in Graphene, Naveed Ahmad Shah and M. A. H. Ahsan, *International Journal of Geometric Methods in Modern Physics*, **18** (03), (2020).
7. Structure, magnetism and dielectric study of nano-crystalline Gd_2CoMnO_6 , Ilyas Noor Bhatti, Imtiyaz Noor Bhatti, Rabindra Nath Mahato and M. A. H. Ahsan, *Solid State Sciences*, **108**, 106384 (2020).
8. Ground state properties of trapped boson system with finite-range Gaussian repulsion: Exact diagonalization study, Mohd. Imran and M. A. H. Ahsan, *Journal of Physics B: Atomic, Molecular and Optical Physics*, **53**, 125303 (2020).
9. Structure, magnetic and dielectric properties in nano-crystalline Yb_2CoMnO_6 , Ilyas Noor Bhatti, Imtiyaz Noor Bhatti, Rabindra Nath Mahato and M. A. H. Ahsan, *Material Chemistry and Physics*, **244**, 122709 (2020).
10. Physical properties of nano-crystalline Sm_2CoMnO_6 : Structure, magnetism, spin-phonon coupling and dielectric study, Ilyas Noor Bhatti, Imtiyaz Noor Bhatti, Rabindra Nath Mahato and M. A. H. Ahsan, *Physica B: Condensed Matter*, **582**, 411975 (2020).
11. Physical properties in nano-crystalline Ho_2CoMnO_6 , Ilyas Noor Bhatti, Imtiyaz Noor Bhatti, Rabindra Nath Mahato and M. A. H. Ahsan, *Ceramics International*, **46**(1), Pages 46-55 (2020).
12. Synthesis and Magnetic Study of Nano-Crystalline Gd_2CoMnO_6 , Ilyas Noor Bhatti, Imtiyaz Noor Bhatti, Rabindra Nath Mahato and M. A. H. Ahsan, *Materialstoday:Proceedings*, **17**(1), Pages 216-219 (2019).
13. Magnetic behavior, Griffiths phase and magneto-transport study in 3d based nano-crystalline double perovskite Pr_2CoMnO_6 , Ilyas Noor Bhatti, Imtiyaz Noor Bhatti, Rabindra Nath Mahato and M. A. H. Ahsan, *Physics Letters A*, Vol. **283**, pages 2326-2332 (2019).
14. Critical behavior and magnetocaloric effect in ferromagnetic nano-crystalline Pr_2CoMnO_6 , Ilyas Noor Bhatti, Imtiyaz Noor Bhatti, Rabindra Nath Mahato and M. A. H. Ahsan, *Physica B: Condensed Matter*, Vol. **558**, Pages 59-64 (2019).
15. Effect of van-Hove singularities in single-walled carbon nanotube leads on transport through double quantum dot system, Haroon and M. A. H. Ahsan, *arXiv:1809.03379 [cond-mat.mes-hall]*, (2018).
16. Vortex patterns in moderately rotating Bose-condensed gas, Mohd. Imran and M. A. H. Ahsan, *Journal of Physics B: Atomic, Molecular and Optical Physics*, **50**, 045301 (2017).
17. Ground and Low-Lying Collective States of Rotating Three-Boson System, Mohd. Imran and M. A. H. Ahsan, *Communications in Theoretical Physics*, Vol. **65**, PP. 473-482 (2016).
18. Exact diagonalization study of double quantum dots in parallel geometry in zero-bandwidth limit, Haroon and M. A. H. Ahsan, *arXiv:1602.03900 [cond-mat.mes-hall]*,

(2016).

19. $\text{Sr}_2\text{Cu}(\text{PO}_4)_2$ and $\text{Ba}_2\text{Cu}(\text{PO}_4)_2$ as quasi-one-dimensional spin-1/2 Heisenberg antiferromagnet, Md. Mahfoozul Haque and M.A.H. Ahsan, *Journal of Magnetism and Magnetic Materials*, **402**, 143149, (2016).
20. Layered frustrated antiferromagnetic Heisenberg spin model: role of inplane frustration and interlayer coupling, Md. Mahfoozul Haque, M. A. H. Ahsan, Jamal Berakdar and Dipan Ghosh, *arXiv:1603.02601 [cond-mat.stat-mech]*, (2016).
21. Finite Temperature Exact Results on $\text{La}_4\text{Ni}_3\text{O}_8$ Like Antiferromagnetic, Md. Mahfoozul Haque and M.A.H. Ahsan, *Advanced Science Letters*, Vol. **21**, No. **9**, pp. 2713-2716 (2015).
22. Exact Diagonalization Study of Bose-Condensed Gas with Finite-Range Gaussian Interaction, Mohd. Imran and M. A. H. Ahsan, *Advanced Science Letters*, Vol. **21**, No. **9**, pp. 2764-2767 (2015).
23. Exact Diagonalization Study of Double Quantum Dot System in Zero-bandwidth Limit, Haroon and M. A. H. Ahsan, *Journal of Atomic, Molecular, Condensate and Nano Physics*, Vol. **6**, No. **3**, pp. 187-193 (2015).
24. Breathing Modes in Rotating Bose-Condensed Gas: An Exact Diagonalization Study, Mohd. Imran and M. A. H. Ahsan, *Journal of Atomic, Molecular, Condensate and Nano Physics*, Vol. **2**, No. **2**, pp.133-139 (2015).
25. Organization of Hilbert space for exact diagonalization of Hubbard model, Medha Sharma and M. A. H. Ahsan, *Computer Physics Communications*, **193**, pp. 19-29 (2015).
26. A Davidson-Lanczos iteration method for computation of continued-fraction expansion of the Green's function at very low temperatures: Applications to the dynamical mean field theory, Medha Sharma and M. A. H. Ahsan, *arXiv:1409.3374 [cond-mat.str-el]*, (2014).
27. Electron Transport in T-Shaped Double Quantum Dot System Using Non-Equilibrium Green's Function, Haroon and M. A. H. Ahsan, *Advanced Science Letters, Volume 20, Numbers 7-9*, pp. 1281-1286(6), (2014).
28. Simulation of Pauli Spin Blockade Readout in Zero-Dimension Nanostructures, Medha Sharma and M. A. H. Ahsan, *Advanced Science Letters, Volume 20, Numbers 7-9*, pp. 1601-1604(4), (2014).
29. Magnetoresistance, thermal conductivity, thermo-electric power and specific heat of superconductor $\text{Gd}_{0.95}\text{Pr}_{0.05}\text{Ba}_2\text{Cu}_{2.94}\text{M}_{0.06}\text{O}_{7-\delta}$ (M=Fe, Ni, Zn and Mn), Tirthankar Chakraborty, Bhasker Gahtori, Ajay Soni, Gunadhor Okram, S. K. Agarwal, S.-Y. Chen, Yung-Kang Kuo, M. A. H. Ahsan and Ashok Rao, *Solid State Communications, Volume 151, Issue 17, Pages 1117-1121*, (2011).
30. Thermal conductivity and thermo-power of $\text{Y}_{1-x}\text{Pr}_x\text{Ba}_2(\text{Cu}_{1-x}\text{M}_x)_3\text{O}_{7-\delta}$ (M=Fe, Mn, Zn and Ni) bulk superconductors, Tirthankar Chakraborty, Bhasker Gahtori, M. A. H. Ahsan, Geetha, Y.-S. Chen, Yung-Kang Kuo, Ashok Rao, Chandan Kumar Sarkar and S. K. Agarwal, *Solid State Communications, Volume 150, Issues 910, Pages 454-457*, (2010).
31. Electronic Structure of Spin- $\frac{1}{2}$ Heisenberg antiferromagnetic systems: $\text{Ba}_2\text{Cu}(\text{PO}_4)_2$ and $\text{Sr}_2\text{Cu}(\text{PO}_4)_2$, Sarita S. Salunke, M. A. H. Ahsan, R. Nath, A. V. Mahajan, and I. Dasgupta, *Phys. Rev. B* **76**, 085104, (2007).
32. Thermal transport in $(\text{Y}, \text{Gd})\text{Ba}_2(\text{Cu}_{1-x}\text{Mn}_x)_3\text{O}_{7-\delta}$ for $x \leq 0.02$, Bhasker Gahtori, Ratan Lal, S K Agarwal, M A H Ahsan, Ashok Rao, Y F Lin, K M Sivakumar and Y-K Kuo, *Journal of Physics: Condensed Matter, Volume 19, Number 25*, (2007).
33. Combined effect of Pr and Mn on the resistivity and low-field AC susceptibility of $\text{Y}_{0.95}\text{Pr}_{0.05}\text{Ba}_2(\text{Cu}_{1-x}\text{Mn}_x)_3\text{O}_{7-\delta}$ superconductors for $x \leq 0.02$, Bhasker Gahtori, R. Lal, M. A. H. Ahsan, Radhe Shyam, Ashok Rao and S. K. Agarwal, *Physica C: Superconductivity and its Applications, Volume 449, Issue 2, Pages 128-132*, (2006).
34. Rotating Bose gas with hard-core repulsion in a quasi-two-dimensional harmonic trap: Vortices in Bose-Einstein condensates, M. A. H. Ahsan and Nimesh Kumar,

Phys. Rev. A 64, 013608, (2001).

35. Configuration-space truncation scheme for the Heisenberg spin-1 model, M. A. H. Ahsan, Charudatt Kadolkar and C R Sarma, *Journal of Physics: Condensed Matter*, Volume 6, Number 23, (1999).

36. Electron correlation studies: Rumer basis approach, C R Sarma and M. A. H. Ahsan, *International Journal of Quantum Chemistry*, Volume 60, Issue 1, (1996).

37. A graphical approach to permutation group representations for many-electron systems, C. R. Sarma, M. A. H. Ahsan and Sten Rettrup, *International Journal of Quantum Chemistry* (1996).

38. Configuration space truncation scheme for Hubbard Hamiltonian, M. A. H. Ahsan and C. R. Sarma, *Journal of Chemical Sciences*, (1994).

Extramural Research Grant

2012-2015: Understanding the role of correlation in high temperature cuprate superconductors: An extended dynamical mean field study on model Hamiltonians, Rupees 12.58 Lakhs, University Grants Commission, New Delhi, India.