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Sanjoy Datta

Curriculum Vitae

GENERAL INFORMATION

Current Designation Assistant Professor

ACADEMICS

- **Ph.D** , Saha Institute of Nuclear Physics, Kolkata, India (Degree awarded by Jadavpur University).
  Thesis Title: Study Of Charge Density Wave Transition In Electron-Phonon Interaction Models.
  Thesis Supervisor: Prof. Sudhakar Yarlagadda.
- **Post M.Sc Associateship Course**, Saha Institute of Nuclear Physics.
- **Master of Science in Physics** , Indian Institute of Technology, Kharagpur, India.
- **Bachelor of Science with Honours in Physics** , The University of Burdwan, India.
- **Higher Secondary,** West Bengal Council of Higher Secondary Education .
- **Secondary**, West Bengal Board of Secondary Education

AWARDS/DISTINCTIONS

- Awarded Post Doctoral Research Fellowship by Laboratoire de Physique et Modélisation des Milieux Condensés (LPMMC), Grenoble, France from August, 2012 - August, 2014.
- Awarded Post Doctoral Research Fellowship by Harish-Chandra Research Institute, Allhabad, India for the period 2009-2012.

- Ranked 2nd in Post M.Sc Associateship Course at Saha Institute of Nuclear Physics in the year 2003 .
- Qualified SLET (State Level Eligibility Test) in the year 2002 organized by The West Bengal College Service Commission .
- Qualified NET (National Eligibility Test) in the year 2002 organized by Council Of Scientific & Industrial Research, Human Resource Development Group, Govt. of India . Awarded CSIR fellowship in the year 2002.
- Ranked 2nd in Bachelor of Science Examination (Physics Honours) in the year 1999.
- Awarded National Scholarship in the year 1999.

RESEARCH INTERESTS

My area of interest is equilibrium and out of equilibrium properties of **strongly correlated electronic/bosonic systems**. Apart from these, I have also studied the problem of **spin transport through a quantum wire network**. More specifically I am interested in understanding the **equilibrium superfluid and spectroscopic properties of attractive ultracold fermi gas in an optical lattice** and **out of equilibrium correlation properties of one and two-dimensional exiton-polariton condensate**. A brief summary of the problems that I have worked on so far is given below.

- **BCS-BEC** crossover and spectroscopic signatures of ultracold Fermi gas in an optical lattice for spin balanced systems. To study this we start from the negative U Hubbard model. Using suitable Hubbard-Stratonovich transformation we have derived an effective Hamiltonian in the static limit. Finally this effective Hamiltonian is studied numerically with the help of **Traveling Cluster Algorithm (TCA)**, which helps us to access large system sizes and whole parameter space easily.
- Out of equilibrium correlation properties exciton-polariton condensate. These systems are inherently out of equilibrium due to the presence of external laser which acts as the pump and the finite lifetime of the polariton quasiparticles. For the experiments done by my collaborator on one-dimensional exciton-polariton condensate in ZnO microware, we numerically solve the Gross-Pitaevskii equation for polariton condensate in presence of pump and loss.

- Using an equivalent quantum Langevin equation for a system of bosons in one-dimension we study the out of equilibrium correlation properties in steady state condition. To eliminate the extracavity photon or phonon we used Markov approximation. Finally we get the correlation functions using equation of motion approach.
- **Orbital ordering** transition in manganites and the effect of doping, cationic disorder on it. This is being studied by modeling an appropriate Hamiltonian supplemented by **classical Monte-Carlo simulations**. **(No publication related to this topic)**
- Spin transport through a quantum wire network. The main focus of this work is to study the **tunability of spin polarized current**. **(No publication related to this topic)**
- Luttinger liquid to charge-density-wave (CDW) transition in one dimensional spinless Holstein model both in the adiabatic and anti-adiabatic limit. I have used a combination of **analytical and exact diagonalization based numerical methods** to understand the problem.
- **Supersolidity of hard core bosons** coupled to optical phonons have been studied in the framework of Holstein like model which we call as Bose-Holstein model. This problem had been studied using **exact diagonalization method**.

COMPUTATIONAL AND OTHER SKILLS

- Exact diagonalization of fermionic/bosonic systems using Lanczos method.
- Monte-Carlo methods for classical systems. Fermionic exact diagonalization based classical Monte-Carlo methods.
- Split step Crank-Nicholson method to solve time dependent, non-linear differential equation.
- Extensive experience of Linux environment.

TEACHING

- Statistical Mechanics (PH405) : 08/14 – 11/14, N.I.T, Rourkela
- Fortran Programming Laboratory (PH475): 08/14 – 11/14, N.I.T, Rourkela

- Teaching assistant for the part of statistical mechanics course, HRI (January-May, 2010). Instructors Pinaki Majumdar and G. V. Pai.
- Teaching assistant for the advanced condensed matter course, HRI (August-November, 2010). Instructors G. V. Pai and T. P. Pareek.

SELECTED PUBLICATIONS

1. **Radio-frequency spectroscopy of the attractive Hubbard model in a trap**
   Sanjoy Datta, Viveka Nand Singh, Pinaki Majumdar
   Phys. Rev. A **89**, 053609 (2014)

2. **Long range correlations in a 97% excitonic one-dimensional polariton condensate**
   Aurélien Trichet, Emilien Durupt, François Médard, **Sanjoy Datta**, Anna Minguzzi, Maxime Richard
   Phys. Rev. B (Rapid Communication) **88**, 121407(R) (2013)

3. **Thermally Fluctuating Inhomogeneous Superfluid State of Strongly Interacting Fermions in an Optical Lattice**
   Viveka Nand Singh, **Datta, S.** and Pinaki Majumdar
   arXiv:1104.4912 (2011)

4. **Supersolidity for hard-core-bosons coupled to optical phonons**
   Datta, S. and Yarlagadda, S.
   Solid State Commun. 150, 2040 (2010)

5. **Phase transition and phase diagram at a general filling in the spinless one-dimensional Holstein Model**
   Datta, S. and Yarlagadda, S.
   Phys. Rev. B 75, 035124 (2007)

6. **Many-polaron effects in the Holstein Model**
   Datta, S., Das, A. and Yarlagadda, S.
   Phys. Rev. B 71, 235118 (2005)