J Material Sci Eng 2015, 4:3
http://dx.doi.org/10.4172/2169-0022.C1.032

Equilibrium of a mesoscopic system in an inhomogeneous space with coordinate dependent damping

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Complex molecules like proteins, colloids etc can often have conformation dependent damping due to varied proximity of its constituents from each other at different conformational states. The dynamics of such systems in the conformation space, when inequilibrium with a homogeneous heat bath, is a stochastic dynamics with multiplicativenoise. The origin of the multiplicative noise is related to the in homogeneity of the conformation space on top of which there can exist inhomogeneity of space caused by a conservative force field as usual. In this talk, I would show that, the equilibrium distribution of such systems has to be of a modified Maxwell-Boltzmann form where the coordinate dependent damping modifies the standard Maxwell-Boltzmann distribution. I would show an alternative approach to such problems based entirely on the demand of the absence of any current in an in homogeneous space under equilibrium conditions. In this approach, mapping of the multiplicative noise problem to an additive noise one would come out as the prerequisite for equilibrium. The results at the limit of constant damping would be recovered.

Biography

Arijit Bhattacharyay got his PhD from Jadavpur University, India in 2004 and has done Postdoctoral works at 1. TU Darmstadt, Germany, 2. Padova University, Italy and 3. The University of Warwick, UK. He is presently an Assistant Professor at Indian Institute of Science Education and Research, Pune, India. His interest, in general, is in Statistical and Condensed Matter Physics.

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Electronic, magnetic and spintronic properties of quantum dots and quantum rings

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The talk will focus on some of the electronic, magnetic and spintronic properties of low-dimensional structures. First of all, the energetics of an off-centre neutral hydrogenic donor impurity trapped in a three-dimensional GaAs quantum dot with Gaussian confinement will be considered in the presence of a magnetic field and the effect of dot size and the impurity position on its binding energy will be discussed. The effect of Rashba interaction on the magnetization and electron susceptibility in the same GaAs quantum dot will also be discussed. Next the two-electron problem in a GaAs quantum dot will be considered in the presence of a magnetic field taking into account the spin of the electrons and the results for the low-lying energy levels and the spin-dependent persistent current obtained by the exact diagonalization method will be presented. Finally the persistent current will be calculated in a Holstein-Hubbard quantum ring threaded by an Aharonov-Bohm magnetic flux. It will be shown that the persistent current is suppressed by both the electron-electron and electron-phonon interactions. Our calculation reveals that the persistent current is diamagnetic and dies out continuously with increasing number of atoms in the ring. It will be predicted that there exists an intervening metallic phase in between the SDW and CDW phases whose width increases as the band becomes less than half-filled. This may have important implications in the context of superconductivity and nanotechnology.

Biography

Ashok Chatterjee has carried out his Doctoral work at IACS, Kolkata and obtained his PhD from Jadavpur University, Kolkata in 1988. He did his Postdoctoral work at S N Bose National Centre for Basic Sciences, Kolkata and joined as a Lecturer at University of Hyderabad in 1990 where he eventually became a full Professor. He has visited several Universities and Institutes in India and abroad for collaboration and as a Visiting Professor. He has published around 100 papers in international journals of repute and is also serving as an Editorial Board Member of many journals.

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