INTERNATIONAL CENTRE *for* THEORETICAL SCIENCES

TATA INSTITUTE OF FUNDAMENTAL RESEARCH

ICTS Thesis Synopsis Seminar

Title : Transport in open quantum system

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Date : Monday, April 2, 2018

Time : 10:00 AM

Venue : Emmy Noether Seminar Room, ICTS Campus, Bangalore

Abstract : Transport properties of materials are regularly measured in experiments. However, a microscopic theory for calculating transport properties is far from complete. For isolated systems in the thermodynamic limit, the standard linear response theory can be used to extract transport coefficients from various equilibrium correlation functions of the isolated system. However, real set-ups are not completely isolated and are of finite size. So, in many cases, the effect of the environment can become important. This is not captured in the standard linear response approach. As a result, a more direct way of describing transport properties is via the open (quantum) system approach. This involves connecting the system to baths which have different temperatures and chemical potentials and looking at the non-equilibrium steady state (NESS) currents. Several formalisms exist in the literature for studying such open quantum set-ups, such as, non-equilibrium Greens functions (NEGF), quantum Langevin equations (QLE), quantum master equations (QME) etc. In this thesis, we

- investigate and improve the QME approach to quantum transport and give the connection between the QME and QLE formalisms for obtaining transport properties of various set-ups,
- apply our improved formalisms to some small quantum systems thereby discovering rich and interesting physics, much of which would be missed or would be harder to obtain by other formalisms,
- explore transport behavior in 1D quasiperiodic systems, obtaining their high temperature non-equilibrium phase diagrams, and explicitly showing a case where open system approach and standard linear response theory give very different results,
- explore the connection between transport properties obtained via the standard linear response theory for isolated systems and via the open system approach.

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