Fabio Cavaliere

Associate professor

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Education and training

2005
Doktor Der Naturwissenshaften - Equivalent to the Italian Ph.D in Physics
Spin and correlation induced effects in mesoscopic transport and noise - 1.0/1.0
I Institut fuer Theoretische Physik - Universitaet Hamburg - Hamburg - DE

2001
Laurea in Fisica
Trasporto in un quantum dot effetti di spin - 110/110 cum laude
Università di Genova - Genova - IT

Academic experience

2016 - ONGOING
Ricercatore di tipo B
Università di Genova - Genova - IT
Scientific research supervising diploma and Ph.D. student teaching.

2011 - 2016
Ricercatore di tipo A
Università di Genova - Genova - IT
Scientific research supervising diploma and Ph.D. student teaching.

Language skills

Italian
Mother tongue

English
Independent

Research interests

My research deals with several aspects of the theoretical physics of low-dimensional condensed matter systems at the nanoscale.

The systems subject of my studies mainly focus on electron liquids in zero dimensions (such as quantum dots) and one dimensions (quantum wires, carbon nanotubes, edge states in topological insulators...), also in the strongly interacting regime.

I have been interested into their transport properties ever since my Ph.D, during which I characterized issues such as spin-induced negative differential conductance and large current fluctuations (noise). In the strongly interacting regime, not only transport properties are affected, but the very nature of quantum electron states can be structurally reshaped with the formation of highly correlated Wigner molecules. I have been investigating their structure in several systems, ranging from circular quantum dots to quantum wires with strong spin-orbit coupling, and have assessed the possibility to gather informations about their structure studying the transport properties of such systems also in the presence of scanning probes.
I have studied time-dependent electron and spin transport in interacting quantum dots investigating non-adiabatic quantum pumping.
I have also been interested in the rich physics scenario which arises when mechanical and electronical degrees of freedom are coupled at the nanoscale giving rise to states characterized by wide current fluctuations and unusual quantum effects in the coherent regime. I have also been discussing the possibilty to exploit such coupling between electrons and mechanical vibrations to develop molecular sensors able to identify different molecular species according to the characteristics of their vibrations around the bonding site in the system.
More recently I became interested in less conventional states of matter such as the edge states of topological insulators, where peculiar spin textures arise and can be detected via transport properties, and quasi-helical electron states occurring in quantum wirest with strong spin-orbit coupling, which can display peculiar finite-size effects and evidences of fractional Wigner molecules.
My actual research deals mainly with quantum quenches in integrable systems, the emergence of Universal power laws in the decay of correlations of such systems, the propagation dynamics of the quench information through the system and pseudo-thermalization issues in connection with the definition of Generalized Gibbs Ensembles.