Colloquium

SFB 956

Conditions and Impact of Star Formation

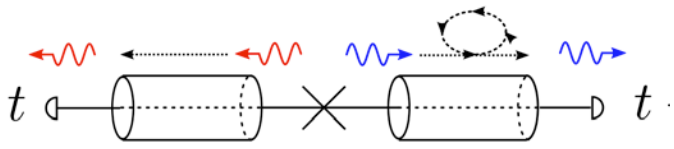
12.10.2016 | supplementary colloquium

Wednesday 10:00 am

Physikalische Institute Köln

KOSMA room

Zülpicher Straße 77 | 50937 Köln



Marc Peter Westig

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Charge and Photon Dynamics in Driven Mesoscopic Systems: Devices – Detectors – Disordered Superconductors – Quantum Materials

There is a growing interest in the physics of superconducting circuits. They are studied in interdisciplinary fields such as circuit quantum electrodynamics, quantum computing, ultrasensitive astronomical detectors, parametric amplifiers, devices made of disordered superconductors and hybrid devices. In the latter class of devices one combines e.g. massive superconducting electrodes with topological materials, low-dimensional systems like carbon nanotubes or graphene and with nanowires in general. In my talk I would like to focus primarily on circuit quantum electrodynamics, disordered superconductors and astronomical detectors, but would like to acknowledge interesting links to the other fields as well.

First, I will present the research focus of my former team of the Quantronics and Nanoelectronics groups at the Service de Physique de l'État Condensé/CEA Saclay. Here, we have contributed establishing a new direction in mesoscopic physics in which we have applied concepts of quantum optics to phase coherent mesoscopic circuits. A dc biased quantum conductor such as a Josephson junction gives rise to current fluctuations due to the granularity of charge carriers and the probabilistic character of quantum transport. Such current fluctuations may excite the electromagnetic environment, giving rise to a rich regime of light-matter coupling. I will show that this light-matter coupling strongly modifies the response of the quantum conductor and can produce non-classical radiation.

Second, I will present our actual research efforts at the Kavli Institute of Nanoscience in Delft in which we try to understand electronic inhomogeneity in disordered superconductors, providing evidence of different competing ground states in these materials. Ultimatively, we find a way of how to build a coherent quantum phase slip junction which would open up entire new directions of circuit quantum electrodynamics with an exactly dual element to conventional Josephson tunneling. New ideas to understand the noise physics of hot-electron bolometer mixers are briefly presented.