SYDC 2: Decoherence in the Light of Modern Experiments II

Time: Tuesday 16:30–18:30 Location: E 415

Invited Talk SYDC 2.1 Tu 16:30 E 415

Coherence and the loss of it in molecular photoionization — •Uwe Hergenhahn — Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching

A molecule, which is ionized by absorption of a single, energetic photon, can be seen as a complex source of outgoing photoelectron waves. Intramolecular electron scattering phenomena have been known in photoemission for a long time. More interesting questions arise in molecules containing several chemically equivalent sites, homonuclear diatomics being the simplest example. Here, rigourous application of quantum mechanics dictates to consider these sites as coherent emitters of photoelectron waves. I will give an overview about recent experiments which have probed this paradigm.

Invited Talk SYDC 2.2 Tu 17:00 E 415

Decoherence in fermionic interferometers — •Florian Marquardt — Friedrich-Alexander Universität Erlangen-Nürnberg und Max-Planck Institut für die Physik des Lichts

Interference experiments with electrons in solids represent a powerful tool to learn about decoherence and interaction effects. In contrast to interferometers based on single photons, neutrons, atoms or molecules, many-body effects play an essential role. In this talk I will discuss some aspects of the decoherence of electrons. In particular, I will describe the electronic Mach-Zehnder interferometer that is based on electrons traveling chirally along edge channels in the quantum Hall effect regime. We find that, in the appropriate regime, the loss of phase coherence obeys a power-law decay with a universal exponent, independent of the details of the interaction potential.

Invited Talk SYDC 2.3 Tu 17:30 E 415

Quantum diffusion in gravitational waves backgrounds — •Serge Reynaud, Brahim Lamine, Rémy Hervé, and Astrid Lambrecht — Laboratoire Kastler Brossel, CNRS, ENS, UPMC, Paris

The value of the Planck mass (22μg) may lead to the idea that intrinsic fluctuations of spacetime are responsible in some manner for the existence of a natural borderline between quantum and classical worlds. We propose quantitative answers to this question by considering the diffusion and decoherence mechanisms induced on quantum systems by the stochastic gravitational waves (GW) backgrounds generated at the galactic and cosmic scales.

This universal fluctuating environment indeed blurs quantum interferences on macroscopic systems (large masses), while leaving essentially untouched those on microscopic systems (small masses). We give relevant numbers in the context of ongoing progress towards more and more sensitive matter-wave interferometry.

Similar ideas are also worthy of attention in the context of quantum information. For example EPR correlations encoded on photon polarizations are affected by the exposition to the GW backgrounds, and one can wonder whether or not, and to what extent, the correlations survive propagation on long distances.

Invited Talk SYDC 2.4 Tu 18:00 E 415

Quantum coherence and decoherence in biological systems — •Martin Plenio — Institut für Theoretische Physik, Universität Ulm, Ulm, Germany — QOLS, Blackett Lab, Imperial College London, London SW7 2BW, UK

Quantum dynamics is often subjected to uncontrollable interactions with the environment. These are generally assumed to have a detrimental effect but this is not always the cased. In this talk I will discuss the dynamics of dissipative and noisy quantum networks and will show how noise, both dephasing type and dissipative noise may actually improve the transport performance of the network. I will use the example of the FMO complex to elucidate the principles that govern the dynamics of such networks and use them to explain specific features of this dynamics.