QUANTUM INTERFERENCE OF INDIVIDUAL QUANTUM SYSTEMS

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Recent years have seen an impressive progress in interference with individual quantum systems. Experiments with individual photons are now daily routine in many laboratories. An important theme of present research is to extend such experiments to increasingly more complex systems. This includes many different aspects. Entanglement has been become a central focus of research paving the way for new ideas in communication and computation, including quantum teleportation. One line of development is the realisation of entanglement of more than two systems and with systems carrying more than two degrees of freedom. Using that kind of entanglement of the orbital angular momentum of photons recently the first demonstration of a Bell inequality for qutrits, i.e. 3-valued observables, was achieved.

Another line is quantum interference of increasingly larger and complex molecules. A remarkable feature of our experiments with fullerenes is that these molecules were at a temperature as high as 900 K and thus not fully decoupled from the environment. Nevertheless they showed perfect interference fringes.

The talk will conclude with a view at future research extending, among others, to quantum interference with biological macromolecules. Recent experiments with Porphyrine molecules are very encouraging in that respect demonstrating quantum interference of molecules with low symmetry.

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