SYRT 2 Radiation transport in random media II

Zeit: Freitag 14:00–16:00 Raum: HVI

Hauptvortrag

SYRT 2.1 Fr 14:00 HVI

Twin-photon light scattering — •J.P. Woerdman — Huygens Laboratory, Leiden University, 2300 RA Leiden, The Netherlands

We will report our recent experimental work on the scattering of entangled twin-photons by a variety of media, such as suspensions, multimode fibers, sub-wavelength hole arrays, etc. The common aspect of all this is the central role played by the spatial degrees of freedom. This can work out in a 'positive' sense, by allowing the possibility of high-dimensional spatial entanglement of the two photons. It can also work out in a 'negative' sense, when the (unobserved) spatial degrees of freedom are coupled to the polarization degree of freedom, thus degrading the polarization entanglement ('decoherence'). In both cases the presence of a high-dimensional Hilbert space of spatial states leads to very rich physics.

Hauptvortrag

SYRT 2.2 Fr 14:30 HVI

Effects of strong localization of light in disordered media with loss or gain — •Johann Kroha, Regine Frank, and Andreas Lubatsch — Physikalisches Institut, Universität Bonn, D-53115 Bonn, Germany

Despite intensive theoretical investigations the origin of coherent feedback in random laser systems has remained controversial. In this talk we present a systematical theory for the interplay of strong localization effects and absorption or gain of classical waves in 3-dimensional, disordered dielectrics [cond-mat/0511331]. The theory is based on a self-consistent Cooperon resummation, implementing the effects of energy conservation and its absorptive or emissive corrections by means of an exact, generalized Ward identity. Substantial renormalizations are found, depending on whether the absorption/gain occurs in the scatterers or in the background medium. We find a finite, gain-induced correlation volume which may be significantly smaller than the scale set by the scattering mean free path, even if there are no truly localized modes. Possible consequences for coherent feedback in random lasers as well as the possibility of oscillatory in time behavior due to memory effects caused by the interplay of interference and sufficiently strong gain are discussed.

Hauptvortrag

SYRT 2.3 Fr 15:00 HVI

Transport of near-resonant light in cold atomic vapors — •Guillaume Labeyrie — Institut Non Linéaire de Nice, CNRS / UMR 6618, F-06560 Valbonne, France

Ultracold atomic vapors constitute attractive new samples to study the transport of light in disordered media. Among the most remarkable features of these gases are the very sharp resonances, the monodispersivity and absence of defects or absorption. I will review our work on both incoherent and coherent signatures of the transport in our atomic clouds, which are currently in the weak localization regime. In particular, I will show how coherent backscattering allowed us to identify several mechanisms which limit the phase coherence length in such samples. I will conclude with some prospects on the route to the strong localization regime.

Hauptvortrag

SYRT 2.4 Fr 15:30 HVI

Nonlinear transport of matter waves through disorder potentials — •Peter Schlagheck — Institut für Theoretische Physik, Universität Regensburg, D-93040 Regensburg, Germany

The rapid progress in technologies for trapping, cooling and manipulating ultracold atoms has lead to a number of fascinating experiments probing phenomena from condensed matter physics and nonlinear theory. A new direction in this context is the dynamics of Bose-Einstein condensates in disorder potentials, which can be induced with optical speckle potentials or on miniaturized magnetic waveguide geometries ("atom chips"), and which bears intriguing analogies to localization phenomena of electrons in solids as well as to the interplay of nonlinearity and disorder in the propagation of radiation. In our studies, we focus on the transport of a Bose-Einstein condensate through an atom-chip waveguide with smooth longitudinal disorder. We shall show that for weak atom-atom interactions an exponential (Anderson-like) decrease of the transmission with the sample length is obtained, where the localization length is reduced compared to the interaction-free case. For strong interactions, a cross-over to an algebraic (Ohm-like) decrease of the transmission is encountered, which correlates with the appearance of a permanently time-dependent scattering process of the condensate.