Robust Generation of Kerr Squeezed Light and Interferometric Application

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Several groups explored changing the photon statistics of coherent states of light by the optical Kerr effect [1], motivated partly by Kerr interaction coming, so to say, for free with no phase matching condition that has to be fulfilled. But on the other hand, typical Kerr nonlinearities are fairly small so that an effect is only observable, if the incoming coherent light is intense enough, the interaction is long enough and losses are small enough. Therefore, the experimental studies concentrated on optical waveguides, such as fibers of several meters' length, using pulses preferentially in the soliton domain to enhance the over-all effect [2]. The Kerr effect induces a nonlinear phase shift, such that the resulting ellipse in phase space is tilted with respect to amplitude and phase quadrature, generating a squeezed state of light. Because of this tilt, the squeezing cannot be seen in direct intensity detection, which also complicates the potential sensitivity enhancement of an interferometer using this effect.

We report on a novel experimental study, and a modified set-up allowing for reliably generating 5dB of two-mode squeezing. Manipulating the two-mode squeezed state using standard linear optic unitary transformations, we demonstrated the enhancement of interferometric sensitivity at IAP RAS. In addition, we are studying different glasses with higher Kerr effect [3].

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