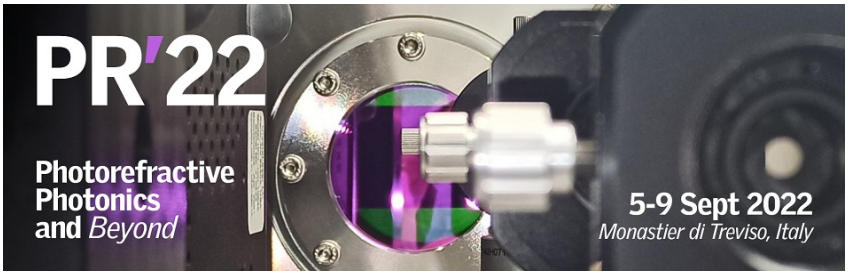

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Interferometric complex-field retrieval in photorefractive transient detection imaging

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A transient detection imaging system (TDI), also known as optical novelty filter, is an adaptive interferometric device that detects temporal changes in a scene while suppressing its static parts. Removal of background improves contrast and helps visualizing and measuring intensity and phase. Most TDI systems are based on photorefractive two-wave mixing. Previous works rely on conventional intensity measurements, where partial information about input signal phase changes are obtained by previous calibration.
We present our results on the TDI output complex-field and its relation with the input signal phase changes. The experimental setup is based on a single-frequency laser and SBN crystal. The laser beam is split into a signal, pump, and reference beam for interferometry. Signal and pump beams intersect at the nonlinear crystal, oriented to get strong energy transfer from signal to pump. Therefore, the output beam contains images only when the input signal beam changes. Output signal phase is retrieved from off-axis holographic Fourier technique which, compared to conventional intensity-based TDI, provides important additional features such as directionality of the phase change, higher resolution ($\lambda/30$), and differential-phase measurement for enhanced sensitivity without calibration.
We have evidenced the linear relation between input and output phases for the entire range from $-\pi$ to π in excellent agreement with our theory.
We believe that this work takes advantage of background suppression with high phase-sign sensitivity, especially important for low-power small-phase change signals sensors, and opens up new possibilities.

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