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Listening With Light

Environmental vibrations can induce distortions in live fibre optic cables through the elasto-optic effect, leading to changes to both the light's state of polarisation (SOP) and phase. Coherent optical receivers, essential to modern telecommunications, offset these distortions by employing advanced digital signal processing (DSP) techniques to filter out the effects during high-speed data reception. This presents an interesting opportunity: Why not extract the channels' SOP and phase estimation data from the receiver for environmental sensing purposes? Although SOP and phase estimation data from coherent optical receivers have been used to detect sub-hertz frequency events like earthquakes and tsunamis, their application in acoustic sensing remains unexplored. This study investigates whether these SOP and phase changes, detectable over live data channels using coherent receivers, can be used to sense low-frequency acoustic signals in a controlled laboratory environment. Unlike traditional acoustic sensing techniques, such as Distributed Acoustic Sensing (DAS), which relies on dedicated sensing fibres, this method uses existing data channels and receivers, eliminating the need for additional infrastructure. If successful, this approach could extend existing fibre optic infrastructure capabilities for applications like subsea cable monitoring and urban infrastructure surveillance.

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