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# Temporal shaping of acoustic waves in scattering media: maximization and focusing of the Fisher information

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## Abstract

A wave propagating through a scattering medium typically yields a complex temporal field distribution. Over the years, a number of procedures have emerged to shape the temporal profile of the field in order to temporally focus its energy on a receiver. By analogy, we theoretically and experimentally demonstrate how to maximize the total Fisher information transmitted to a receiver, and how to focus the Fisher information at any given time. This enables one to estimate the value of any physical observable with optimal precision from noisy measurements, as experimentally illustrated using acoustic waves in the ultrasound regime. By yielding the ultimate precision limit achievable from time-resolved measurements performed in arbitrarily complex media, our approach sets a new general benchmark for different applications such as structural health monitoring and biomedical imaging.

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