Water wave implementation of a coherent source based on time-varying medium

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Time crystals [1] and time-varying media [2] are a promising playground for new physics and for novel manipulation of wave propagation. Recently, the time analog of a laser has been proposed theoretically based on a time modulation of the medium properties [3, 4]. The experimental realization of this concept is most challenging and currently out of reach in optics. Here, we show the first experimental realization of a time-modulated source with water waves. A vertical shaking of the bath can be used with a bathymetric confinement to modulate the medium over arbitrary spatial geometries at fast timescales relative to the wave speed (Fig. 1). Alternatively, we also use electrostriction to reach higher modulation amplitudes and to reduce the spatial boundary effects [5–7]. We characterize our system and discuss the relation with the Faraday instability, the parametric amplification, the phase-conjugate mirrors, and the analogy with the optical counterpart [8].

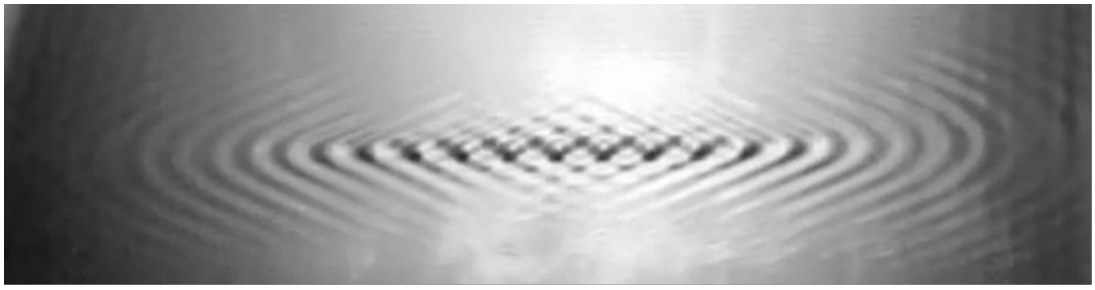

Figure 1. A time-modulated source emitting coherent waves under vertical vibration. (Photo credit : Sander Wildeman)

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