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Wave engineering — using interference as a resource

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Abstract

In a generic wave (chaotic) system, an incoherent superposition of wave components leads to pseudo-random wave patterns and universality in the statistical properties of the wave dynamics. A lot of information about the details of the specific system under consideration is, however, stored in the phases. Using this phase information constructively can lead to surprising effects in which interference becomes a true resource.

In this talk, I will review some of the more spectacular successes in this area, such as time reversal imaging, Green function reconstruction or quantum random walks. I will present recent results on wave search algorithms on graphs and discuss in more detail the mechanism behind localisation phenomena leading to an efficient search of a marked vertex on the hypercube.