

Day 2

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Title: Large-scale optical simulator for spin glasses and adiabatic computing

Abstract:

We propose and experimentally demonstrate a scalable optical spin-glass simulator based on spatial light modulation and multiple light scattering. By tailoring coherent optical transmission through a disordered medium, we optically accelerate the computation of the ground state of large-scale spin networks with continuous random couplings. The photonic hardware exhibits an optical advantage over digital computing by simultaneous processing of all spin interactions in parallel. Our setup may potentially speed-up any minimization algorithm. We realize adiabatic evolution of frustrated Ising models by optical control of the spin couplings and exploiting experimental noise to explore the energy landscape. Our results provide a general route toward large-scale computing that exploits speed, parallelism, and coherence of light. The approach opens the way to classical annealing methods and adiabatic quantum algorithms enforced by optical vector-matrix multiplications and scalable photonic technology.

References:

D.Pierangeli, M.Rafayelyan, C.Conti, and S.Gigan, *Phys.Rev.Appl.* 15, 034087 (2021). D.Pierangeli, G.Marcucci, and C.Conti, *Optica* 7, 1535 (2020).