

Optical Parametric Oscillators as Advanced Computers and Advanced Lightsources

Ryan Hamerly

Stanford University

Wednesday, August 23, 2017

Time: 13:30

Room: Falkenbrunnen, room 04/05, Chemnitzer Str. 50

Abstract:

I will discuss two applications of optical parametric oscillators (OPOs) that have attracted recent interest, and demonstrate the usefulness of OPOs as lightsources and computing machines: (1) We have confirmed the existence of a new regime of operation for synchronously-pumped OPOs, in which the pump and signal fields simultaneously form dark and bright solitons. This "simulton" phenomenon can be used to produce ultrashort (few-cycle) pulses with broad, stable frequency-combs and high conversion efficiency, at mid-infrared "molecular fingerprint" wavelengths where lasers do not operate with the desired properties. (2) Networks of OPOs, which are straightforward to construct using a pulsed pump laser and a long fiber cavity, can be used to solve Ising optimization problems. While such "coherent Ising machines" have not (yet) shown exponential speedup over classical algorithms, their performance is superior to the most recent D-Wave quantum annealer for sufficiently dense Max-Cut and Sherrington-Kirkpatrick spin-glass problems.

Bio:

Ryan had many interests when he was young, but when he saw Tesla coil in action at high school, he knew he wanted to become a physicist. He taught himself electromagnetism to build his own Tesla coil, but during his studies at Caltech, he veered off into particle physics and general relativity. In graduate school at Stanford (Mabuchi group), he returned to electromagnetism, pursuing research on quantum feedback control, quantum optics, and nonlinear optics. After graduating, he spent a gap year working at NII in Tokyo (Yamamoto group) on many of the same topics, and will be starting as a postdoctoral fellow at MIT (Englund group) this fall.