heisingberg

$H = -J \sum_{i,j} s_i s_j$

Spatial Quantum Optical Annealer for Spin Hamiltonians

Vision

HEISINGBERG aims to develop a novel photonic Ising machine operating at room temperature, leveraging newly established holographic and nonlinear photonics principles for the efficient solution of NP-hard problems. HEISINGBERG proposes an alternative approach to existing photonic simulators exploiting the mature technology of spatial light modulation. The latter introduces a range of advantages that mitigate systemic bottlenecks associated with the scalability and applicability of these devices, with the most pronounced of these being: i) cost effective, ii) easily programmable, iii) environmentally friendly, low power consumption, iv) scalability, v) non-cryogenic operation.

Challenges

Real-life NP-hard problems solution is challenging since:

- ✓ Require improved computational efficiency, that conventional von Neumann architectures struggle to provide as they are reaching their scalability and power efficiency limits
- ✓ Existing approaches, such as GQC and analog quantum simulators, suffer from limited qubit count, high error rates (need for error mitigation protocols), quantum decoherence, hardware complexity, low temperature operation (sophisticated cryogenics required), high Energy consumption and they are costly.

Main goals

HEISINGBERG envisions to offer the following value propositions:

- ✓ Demonstrate fully programmable spin coupling up to 100,000 spins.
- ✓ Incorporation of an effective magnetic field, enabling the solution of a range of optimization problems
- ✓ Deployment of annealing algorithms based on HEISINGBERG mode of operation.
- ✓ Theoretical model describing the simulator beyond the mean-field approximation using squeezed light states
- ✓ Proof-of-principle experimental showcase of the Quantum HEISINGBERG annealer with a 3x3 lattice
- ✓ Development of a dedicated graphical control software for the HEISINBERG platform and online server for open access

Partners

UBITECH · FORTH · Sapienza University of Rome · UBITECH quantum technologies · CSIC · University of Cambridge

Contact information

https://www.heisingberg.eu/

@HEISINGBERG

@HEISINGBERG

SCAN ME

Views and opinions expressed are those of the HEISINGERG consortium authors only and do not necessarily reflect those of the European Union or its delegated Agency DG EISMEA. Neither the European Union nor the granting authority can be held responsible for them. HEISINGBERG is funded under GA No: 101114978.