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UBITECH quantum supremacy

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CONTACT INFORMATION

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TO DISCOVER
THE PROJECT

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Spatial Quantum Optical Annealer for Spin Hamiltonians

$$H = -\sum_{ij} J_{ij} \sigma_i \sigma_j$$

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 3 x 3 lattice

• Development of a dedicated graphical control software for the HEISINGBERG platform and online server for open access