

Plenary Talk

PV XII Fri 9:00 e415

**Quantum Computing to advance Artificial Intelligence:
Where do we stand?** — ●HARTMUT NEVEN — Google, 340 Main
Street, Venice CA 90291

In this talk I will describe two processor architectures that the Quantum AI team at Google is currently experimenting with: quantum annealers and quantum circuits. Quantum annealers are a promising tool to find good solutions to hard combinatorial optimization problems. In recent tests we were able to show that in the D-Wave 2X

quantum annealer multi-qubit tunneling does play a computational role. For crafted benchmark problems the D-Wave runs significantly faster than purely thermal annealing that does not employ tunneling. I will discuss the implications of these experiments for the design of next generation quantum annealers. With quantum circuits we implemented what could be described as a quantum neural network. In a first application we used this circuit to calculate the energy surface of molecular hydrogen to chemical precision. Emerging quantum processors offer interesting opportunities to advance machine intelligence. I will describe the example of machine learning from very noisy data.