INSTITUT DE PHYSIQUE ET CHIMIE DES MATERIAUX DE STRASBOURG
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Séminaire AXE 1 - Sciences et Matériaux Quantiques

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Quantum circuit design for polaritonic chemistry

In the field of polaritonic chemistry, quantum computers offer a promising pathway for simulating cavity-induced light-matter phenomena. Addressing such systems poses significant challenges for near-term platforms, particularly in designing quantum circuits capable of encoding strongly correlated electron-photon states.

In this talk, I will present different circuit strategies tailored to three quantum computing architectures: qubits, qudits, and hybrid qubit-qumode units. All circuits are compact, physically motivated, and incorporate spin-adapted electron-photon entangling fragments optimized for each platform. I will show that, using state-vector simulations within the State-Averaged Variational Quantum Eigensolver, these circuits accurately capture ground and excited polaritonic states of a cavity-embedded H_2 molecule, reproducing hallmark light-matter phenomena such as avoided crossings and conical intersections.

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