

MOCA ~ Integrated Microwave-to-Optical Conversion by Atoms on a superconducting chip

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FUNDING
AGENCIES

ANR

MUR

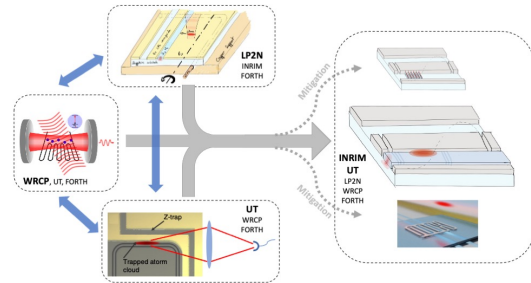
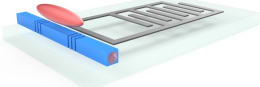
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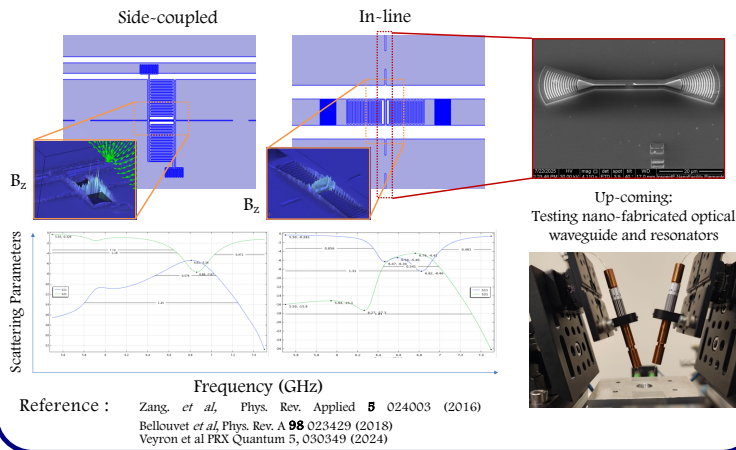
Own funding :

Motivation

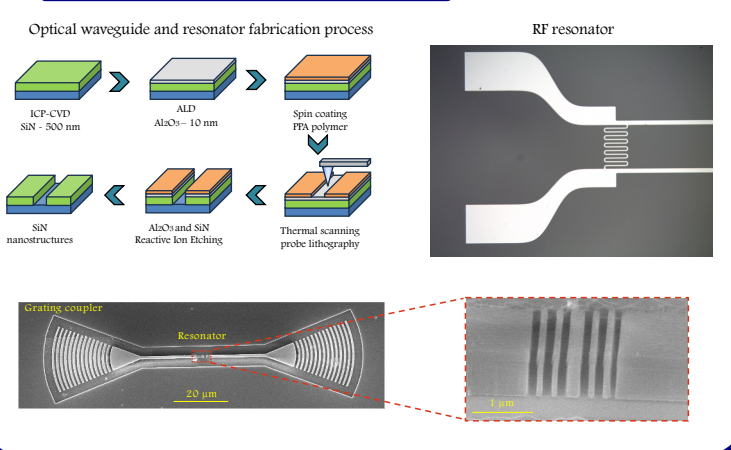
In recent years, **superconducting (SC) circuits** have shown extraordinary abilities in performing **fast and high-fidelity** quantum logic operations, which enabled them to move from fundamental research to the R&D units of companies. This technology is still **limited by short coherence times** of SC qubits precluding long-term storage of quantum information, and the **difficulty to transfer microwave (MW) photons** over long distances which prevents coupling of distant quantum registers. While **cold alkali atoms** have a smaller processing speed than SC qubits, they are better at quantum information storage and optical communication. But their incorporation into a hybrid SC device represents an experimental challenge. **This project aims at the coherent conversion of MW to optical signals on an integrated atom chip compatible with SC quantum processors and optical communication networks.** Such hardware components will form the basis for long-distance quantum communication between SC quantum (sub)processors – nodes of a quantum network – mediated by optical photons.



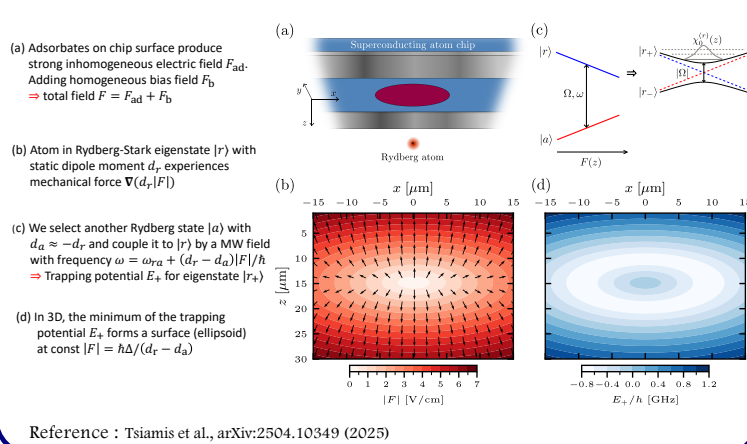
MW and optical waveguide design



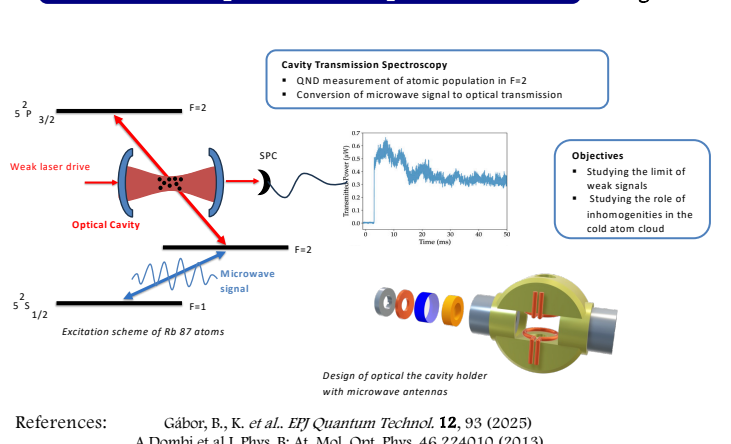
Nano-fabrication process



Coherent Trapping of Rydberg states



A new setup for Free space MOC



Implementation of MOC with Rydberg/hyperfine states on a SC atom chip

