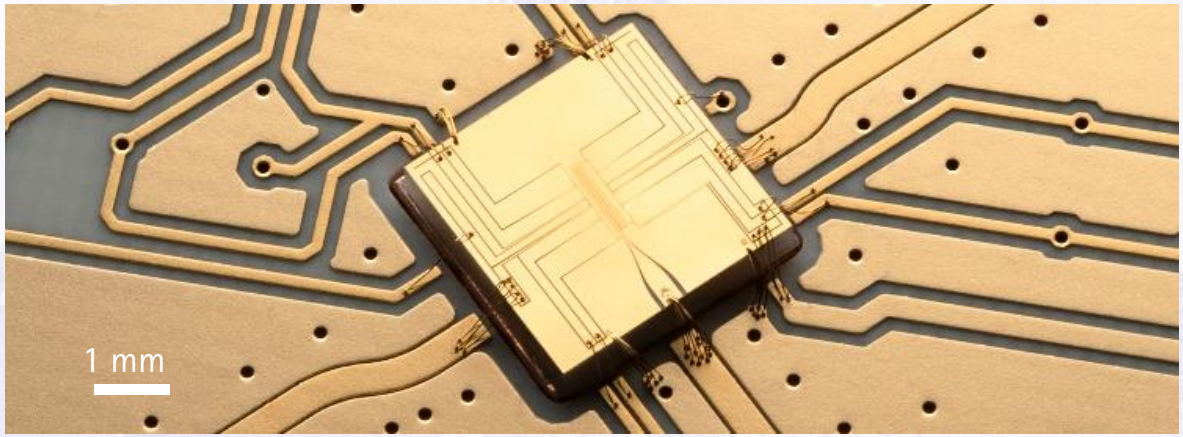
Microwave quantum computing and quantum simulation with trapped ions at PTB



EPIC Online Technology Meeting on Quantum Computing

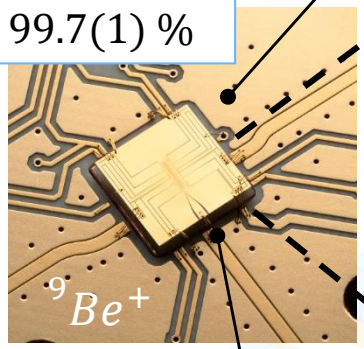
Group leader
C. Ospelkaus

Members
A. Bautista-Salvador
G. Zarantonello
H. Hahn
N. Pulido
H. Mendpara
J. Morgner
F. Ungerechts
M. Duwe

Two-qubit gate infidelities (10^{-3})

without fundamental limitations

$F = 99.7(1)\ \%$



$|0\rangle$

$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$

$|1\rangle$

Robust and resource efficient

Less sensitive to environmental noise

Robust and Resource-Efficient Microwave Near-Field Entangling $^9Be^+$ Gate

G. Zarantonello, H. Hahn, J. Morgner, M. Schulte, A. Bautista-Salvador, R. F. Werner, K. Hammerer, and C. Ospelkaus

Phys. Rev. Lett. **123**, 260503 – Published 26 December 2019

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npj | Quantum Information www.nature.com/npjqi

ARTICLE OPEN

Integrated $^9Be^+$ multi-qubit gate device for the ion-trap quantum computer

H. Hahn[1,2], G. Zarantonello[1,2], M. Schulte[3], A. Bautista-Salvador[1,2,4], K. Hammerer[3] and C. Ospelkaus[1,2,4]

npj Quantum Information (2019)5:70 ; https://doi.org/10.1038/s41534-019-0184-5

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Multilayer ion trap technology for scalable quantum computing and quantum simulation

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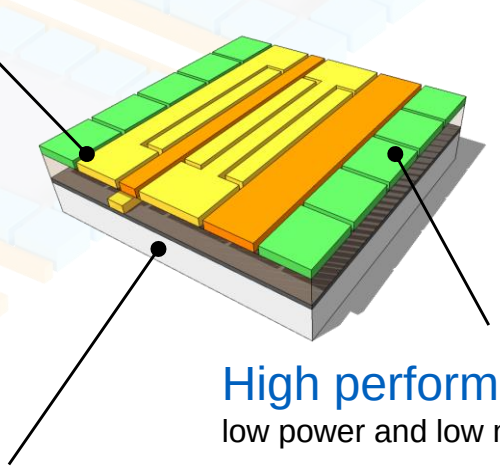
high-quality finishing

with low surface roughness (Ra ~ 20 nm)



High performance

low power and low noise devices

multiple metal-dielectric layers

for scalable hybrid integration

A. Bautista-Salvador et al. Patent DE 10 2018 111 220 (2019)

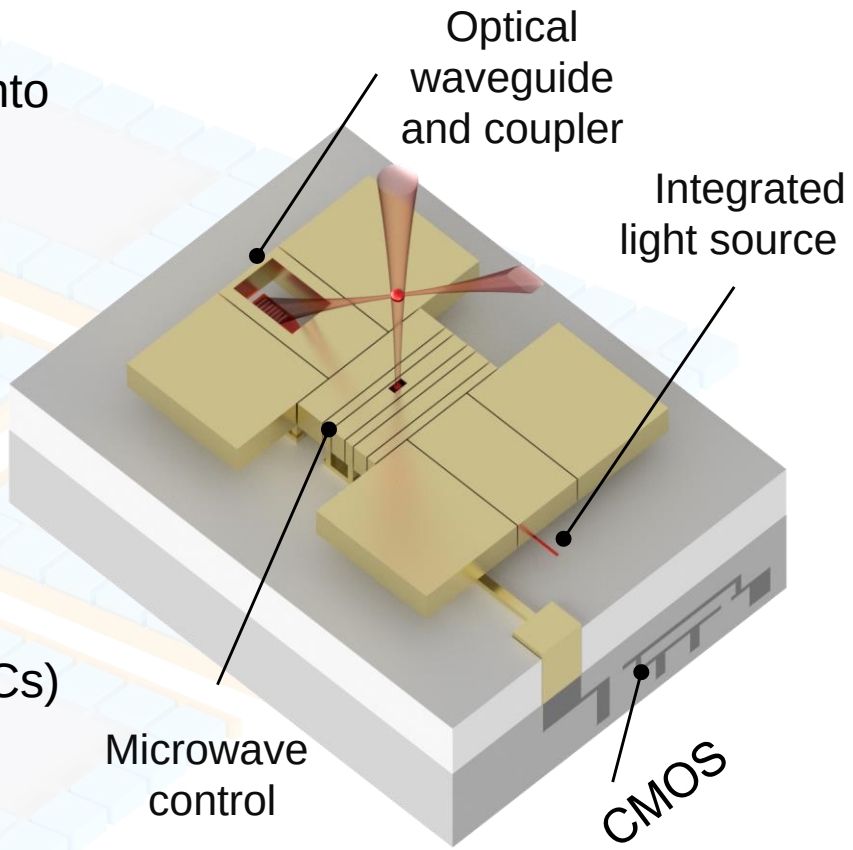
Looking for potential partners

What do we need?

- Integration of current technology into a single system.

Challenges

- Low-loss rf/microwave circuitry
- Waveguides in the UV range
- Integrated single photon detectors
- Low-noise control electronics (DACs)



Mid-term goal

•Realization of a QC demonstrator with up to 100 qubits.

Thanks for your attention!