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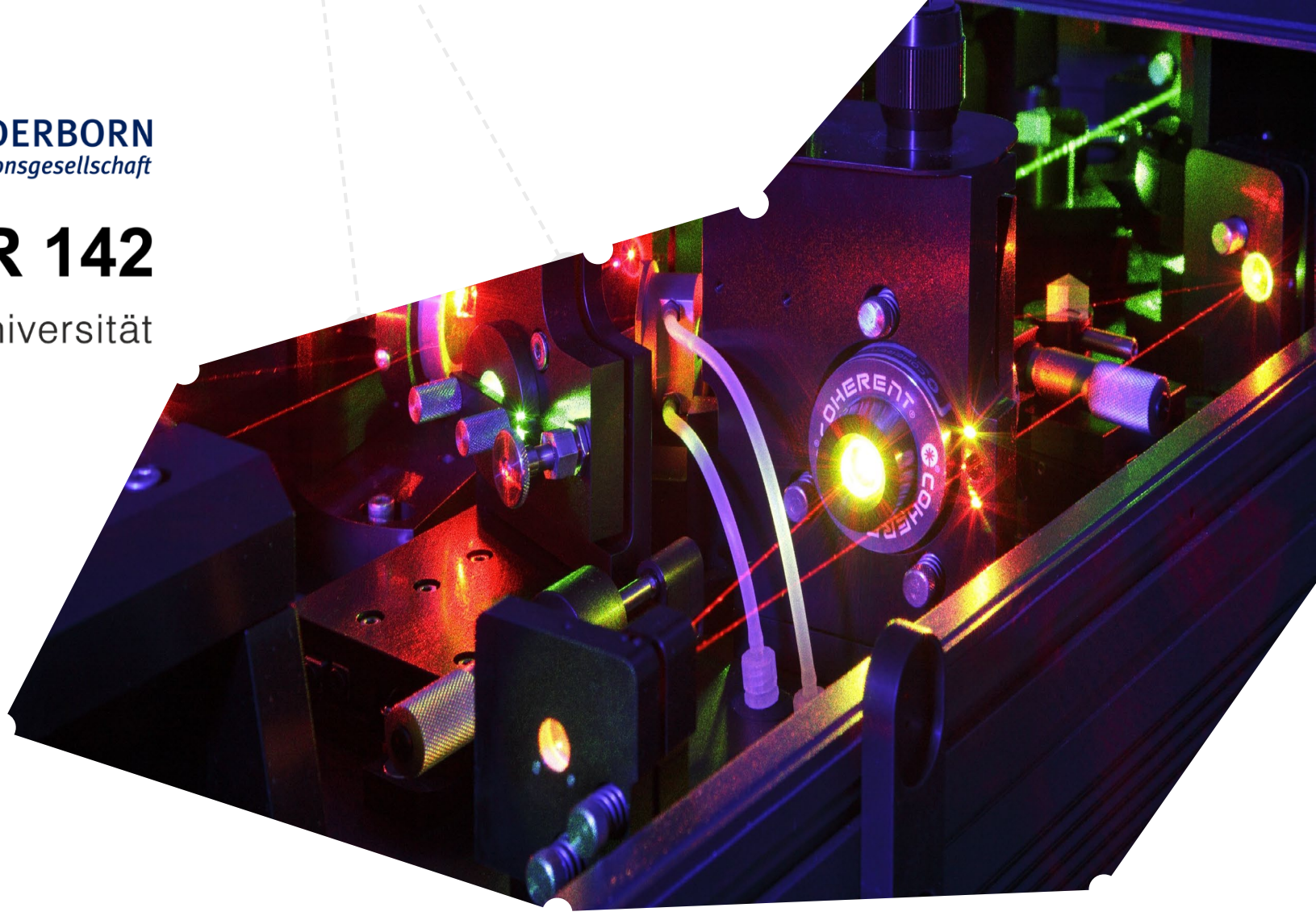

PHOTONICS LECTURE

TUESDAY, 8 AUGUST 2023 | 15:00 H (S.T.)

PROF. HAIM SUCHOWSKI

LECTURE HALL A.1

Detuned composite segmented design for robust quantum integrated photonics

Quantum information processing (QIP) relies on high-fidelity quantum state preparation and accurate unitary operations; this presents a challenge in practical realizations where the permissible error of quantum operations is smaller than 10−3. Thus, even minor systematic errors, i.e., due to imperfections in fabrication or in the experimental control knobs, reduce the fidelity of state transfer below the fault-tolerant threshold.

A powerful tool to correct for such errors is composite pulses (CPs), initially developed in the field of nuclear magnetic resonance. These are a sequence of pulses with different areas and/or phases that implement accurate and robust quantum gates. Integrated photonic circuits are promising for advancing QIP technologies due to their scalability and on-chip integration capacity. However, the fidelity of operations remains below the QIP due to unavoidable fabrication errors. Traditional CPs have not previously been used to correct such errors, as existing sequences require control of the phase of the coupling, which in integrated photonics is a real parameter.

Prof. Haim Suchowski
Tel Aviv University (Israel)

We introduce the detuning-modulated composite control method that offers a robust QIP also for integrated photonic systems. The scheme allows to correct errors in various parameters, achieving fidelity above the QI threshold 10−3. In my talk, I will introduce the scheme and share with you our recent numerical and experimental achievements in integrated photonic circuits, where detuning-modulated CPs obtain remarkable error tolerance in qubit inversions as well as accurate unitary operations for single and two-qubits operations.