



Walther-Meißner-Institut

Bayerische Akademie der Wissenschaften



## Walther-Meißner-Seminar

Walther-Meißner-Institut, Seminar Room 143

(or Room 128 if noisy)

**Date:** Friday, May 18, 2018, 13:30 h

**Speaker:** Dr. Shai Machnes

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**Title:** Control of Quantum Devices: Merging Pulse Calibration and System Characterization using Optimal Control

**Abstract:**

The current methodology for designing control pulses for quantum devices circuits often results in a somewhat absurd situation: pulses are designed using simplified models, resulting in initially poor fidelities. The pulses are then calibrated in-situ, achieving high-fidelities, but without a corresponding model. We are therefore left with a model we know is inaccurate, working pulses for which we do not have a matching model, and a calibration process from which we learned nothing about the system. We propose a novel procedure to rectify the situation, by merging pulse design, calibration and system characterization: Calibration is recast as a closed-loop search for the best-fit model parameters, starting with a detailed, but only partially characterized model of the system. Fit is evaluated by fidelity of a complete set of gates, which are optimized to fit the current system characterization. The end result is a best-fit characterization of the system model, and a full set of high-fidelity gates for that model. We believe the new approach will greatly improve both gate fidelities and our understanding of the systems they drive.

Shai Machnes, Elie Assémat, David Tannor, and Frank K. Wilhelm. Tunable, Flexible, and Efficient Optimization of Control Pulses for Practical Qubits. [Phys. Rev. Lett. 120, 150401](#) (2018).