

Speaker: Hlér Kristjánsson, University of Montreal
Title: A higher-order perspective on quantum signal processing
Date: Tuesday, July 7, 12:30 pm (s.t.)
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Title: A higher-order perspective on quantum signal processing (Marek Arsenault and Hlér Kristjánsson)

Two distinct paradigms for quantum functional programming have been developed in the last few years: Quantum Signal Processing (QSP)-based methods, including the Quantum Singular Value Transformation (QSVT) [GLSW19], and methods based on higher-order transformations, such as the Universal Hamiltonian Eigenvalue Transformation (UHET) [OKTM25]. While UHET performs functional transformations of Hamiltonian dynamics, its relationship to QSP-based techniques has remained unclear despite evident structural similarities. In this work, we resolve this gap by establishing a connection between UHET and QSP-based frameworks, specifically, we show that UHET can be interpreted as a (randomised) linearisation of Generalised QSP (GQSP) [MW24]. Building on this result, we introduce a linearised variant of (Hamiltonian-based) QSVT, which we call Universal Hamiltonian Singular Value Transformation (UHSVT). This algorithm enables a transformation by any sufficiently differentiable (odd) function f of any arbitrary matrix A encoded in a block of a Hamiltonian, whose dynamics is accessible as a black box, and can be performed in a wider range of settings than previous QSVT-based approaches.