Program

Monday, 24. 8. 2020

12:30 Arrival and lunch

13:55 Conference opening
14:00 Sazim Sheikh (C)
14:30 Nana Siddhartha Yenamandala (R)
15:00 Nidhin Sudarsanan Ragini (R)
15:30 Jaroslav Pavličko (R)
16:00 Coffee & Discussions

19:00 Welcome dinner

Tuesday, 25. 8. 2020

08:00 Breakfast

09:00 Teiko Heinosaari (I@)
10:00 Jakub Mareček (I)
11:00 Coffee & Refreshment
11:30 Hamed Mohammady (T)

12:30 Lunch

14:00 Nikolai Miklin (I@)
14:30 Roman Krčmár (C)
15:00 Mário Ziman (T)
16:00 Coffee & Refreshment
Poster session & Discussions

19:00 Conference dinner

Wednesday, 26. 8. 2020

08:00 Breakfast

09:00 Zbigniew Puchała (I)
10:00 Janos Asboth (I)
11:00 Coffee & Refreshment
11:30 Anna Jenčová (C)
12:00 Daniel Reitzner (C)

12:30 Lunch

14:00 Aleksandra Krawiec (C)
14:30 Bartlomiej Gardas (C)
15:00 Libor Caha (C)
15:30 Andrej Gendiar (C)
16:00 Coffee & Refreshment
Discussions

19:00 Dinner

Thursday, 27. 8. 2020

08:00 Breakfast

09:00 Sergey Filippov (I@)
10:00 Aurél Gábris (I)
11:00 Coffee & Refreshment
11:30 Daniel Nagaj (T)

12:30 Lunch

14:00 Conference trip
Discussions

19:00 Dinner

Friday, 28. 8. 2020

08:00 Breakfast

09:00 Michal Sedlák (T)
10:00 Jaromír Fiurášek (I)
10:45 Coffee & Refreshment
11:00 Daniel Nagaj (T)

11:45 Conference closing
12:30 Lunch

(I) Invited talk
(I@) Invited online talk
(T) Tutorial
(C) Contributed talk
(R) Review

Tutorials

Hamed Mohammady: QUANTUM MEASUREMENTS CONSTRAINED BY SYMMETRY

Quantum measurement, conceived as a physical process, results from an interaction between the system to be measured and the measuring apparatus, followed by a suitable measurement of the apparatus. In many situations, such measurement schemes are subject to symmetry constraints, most notably conservation of an additive quantity, such as energy or angular momentum. Under such situations, however, the set of measurable observables will be heavily restricted. The paradigmatic example of how conservation laws limit the measurability of observables is due to the Wigner-Araki-Yanase theorem. In this lecture we shall review this theorem, from its initial conception by Wigner and the later refinement by Araki and Yanase, to its subsequent generalizations throughout the years. We shall finish by commenting on the consequences of this theorem in other areas of quantum information, such as quantum thermodynamics.

Daniel Nagaj: QUANTUM ADVANTAGE: A TUTORIAL

Can we actually prove that quantum computers can do stuff that classical ones can't (efficiently)? We'll survey the many recent approaches to quantum supremacy. My aim is to help us physicists make proper complexity theory statements.

Michal Sedlák: WHAT HIGHER ORDER MAPS, AND QUANTUM SWITCH ESPECIALLY, COULD OFFER?

We will introduce the concept of higher order maps, define the Quantum Switch and discuss its potential benefits for quantum communication and computation. We will also discuss experimental efforts that try to realize or simulate it.

Mário Ziman

Reviews

Jaroslav Pavličko: OPTIMAL UNIVERSAL PROGRAMMING OF UNITARY GATES

Reviewed paper: `arXiv:2007.10363 [quant-ph]`
Authors: Yuxiang Yang, Renato Renner, Giulio Chiribella

A universal quantum processor is a device that takes as input a (quantum) program, containing an encoding of an arbitrary unitary gate, and a (quantum) data register, on which the encoded gate is applied. While no perfect universal quantum processor can exist, approximate processors have been proposed in the past two decades. A fundamental open question is how the size of the smallest quantum program scales with the approximation error. Here we answer the question, proving a fundamental bound on the size of the program and designing a concrete protocol that attains the bound in the asymptotic limit. Our result is based on a connection between optimal programming and the Heisenberg limit of quantum metrology, and establishes an asymptotic equivalence between the tasks of programming, learning, and estimating unitary gates.

Nidhin Sudarsanan Ragini: ON OPTIMAL CLONING AND INCOMPATIBILITY

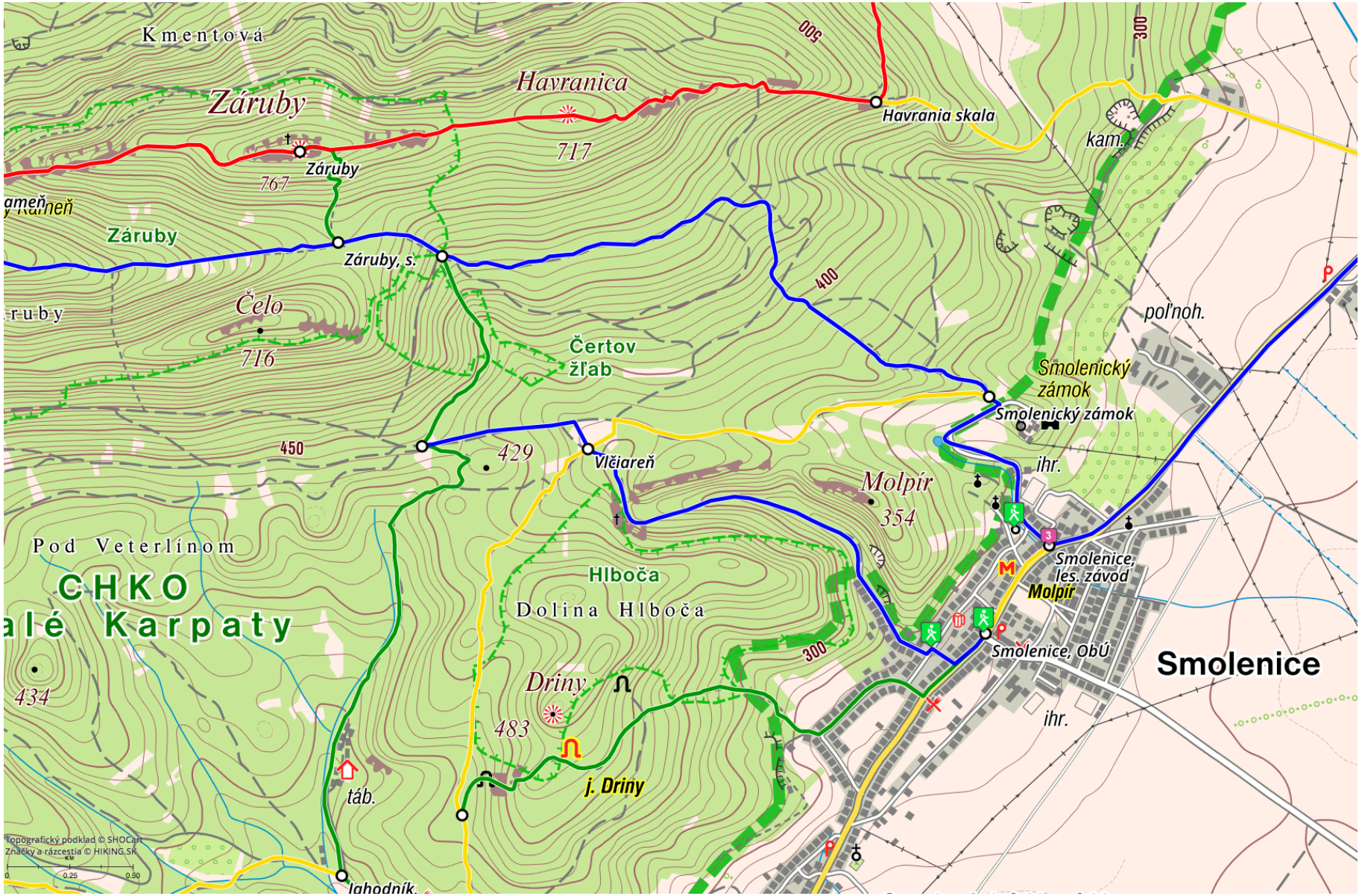
Reviewed paper: `arXiv:1908.04182 [quant-ph]`
Authors: Arindam Mitra, Prabha Mandayam

We investigate the role of symmetric quantum cloning machines (QCMs) in quantifying the mutual incompatibility of quantum observables. Specifically, we identify a cloning-based incompatibility measure whereby the incompatibility of a set of observables maybe quantified in terms of how well a uniform ensemble of their eigenstates can be cloned via a symmetric QCM. We show that this new incompatibility measure Qc is *faithful* since it vanishes only for commuting observables. We prove an upper bound for Qc for any set of observables in a finite-dimensional system and show that the upper bound is attained if and only if the observables are mutually unbiased. Finally, we use our formalism to obtain the optimal quantum cloner for a pair of qubit observables. Our work marks an important step in formalising the connection between two fundamental concepts in quantum information theory, namely, the no-cloning principle and the existence of incompatible observables in quantum theory.

Nana Siddhartha Yenamandala: FUNDAMENTAL ENERGY COST FOR QUANTUM MEASUREMENT

Reviewed paper: `arXiv:1609.06981 [quant-ph]`
Authors: Kais Abdelkhalek, Yoshifumi Nakata, David Reeb

Measurements and feedback are essential in the control of any device operating at the quantum scale and exploiting the features of quantum physics. As the number of quantum components grows, it becomes imperative to consider the energetic expense of such elementary operations. Here, we derive energy requirements for general quantum measurement, extending previous models and obtaining stronger bounds in relevant situations, and then study two important classes of measurements in detail. One is the projective measurement, where we obtain the exact cost rather than a lower bound, and the other is the so-called inefficient measurement, in which we explicitly show that energy extraction is possible. As applications, we derive the energy-precision trade-off in quantum Zeno stabilisation schemes and the exact energy expense for quantum error correction. Our results constitute fundamental energetic limitations against which to benchmark implementations of future quantum devices as they grow in complexity.



Scenic route: Castle – Vlčiareň – – – Záruby – – – Havrania skala (viewpoint) – (unmarked path) – – Castle