BOOK OF ABSTRACTS

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21th Central European Quantum Information Processing Workshop

September 14th– 17th 2026, Mikulov, Czechia
https://ceqip.eu/2026

CEQIP 2026

Central European Quantum Intelligence Party is a fiction. We mean non-artificial science fiction. Become its proud member and join its constitutional meeting this autumn. Apart other things we will wonder together why European quantum navy does not have any flag although it claims to have Quantum Flagship. Act now and share your favorite quantum advantage.

CEQIP (Central European Quantum Information Procesing workshop) is traditionally focused on current challenges and paradigms of mathematical and computational aspects of emerging quantum technologies. One of its strengths is the traditionally strong social program creating very friendly and creative atmosphere. Except of a traditional wine tasting and a cipher game we plan to visit surrounding natural beauties.

Venue

CEQIP will be held in *Large Hall at Mikulov castle*. Mikulov is a picturesque town on Moravia-Austria border. Its history dates back to 12th century (see wikipedia website).

Invited speakers

- ⋆ Augustin Vanrietvelde (Paris)
- ⋆ Francesco Cosco (Espoo)
- ⋆ Vedran Dunjko (Leiden)
- ⋆ Teiko Heinosaari (Jyväskylä)
- ⋆ Karen Hovhannisyan (Potsdam)
- ⋆ Peter Staňo (Saitama/Bratislava)
- ⋆ Ivan Šupić (Grenoble)

Selection Comittee

- ⋆ Francesco Buscemi
- ⋆ Arash Ghoreishi (Chair)
- ⋆ Sibasish Ghosh
- ⋆ Karen Hovhannisyan
- ⋆ Leevi Leppäjärvi
- ⋆ Ion Nechita
- ⋆ Martin Plávala
- ⋆ Ramon Munoz Tapia
- ⋆ Michal Sedlák
- ⋆ Augustin Vanrietvelde
- ⋆ Stephen Walborn
- ⋆ Mario Ziman

Organizing Team

- ⋆ Arash Ghoreishi
- ⋆ Mário Ziman
- ⋆ Michal Sedlák
- ⋆ Radka Hovorková
- ⋆ Diana Cencer Garafová
- ⋆ Mirka Šebestová
- ⋆ Daniel Reitzner

The workshop is organized by Slovak National Center for Quantum Technologies QUTE.sk (Bratislava), Research Center for Quantum Information (Bratislava), and Cyber Security Hub (Brno).

Program

Monday, 14.9.2026

16:00	Arrival and registration (with refreshment)
17:00	Evening session
17:00	TEIKO HEINOSAARI (I)
17:40	IVAN ŠUPIĆ (T)
18:40	End of session
19:00	Welcome dinner (Hotel Tanzberg)

Tuesday, 15.9.2026

07:30	Breakfast in hotels
09:00	Morning session
09:00	AUGUSTIN VANRIETVELDE (I)
09:40	VEDRAN DUNJKO (I)
10:20	KYRYLO SIMONOV (C)
10:45	Coffee & Refreshment
11:10	FRANCESCO ARZANI (C)
11:35	LIN HTOO ZAW (C)
12:00	REMIGIUSZ AUGUSIAK (C)
12:25	ARNAU DIEBRA (C)
12:50	End of session
12:50	Group photo
13:00	Lunch (Hotel Galant)
14:00	Afternoon session
14:00	PETER STANO (I)
14:40	GERARD ANGLÈS MUNNÉ (C)
15:05	TIMOTHÉE HOFFREUMON (C)
15:30	PAOLO ABIUSO (C)
16:00	Coffee & Refreshment
16:00	POSTER SESSION
18:30	Buses to Valtice
19:00	CONFERENCE DINNER (Saloon of wines, Valtice)
22:30	Buses to Mikulov

Wednesday, 16.9.2026

08:00	Breakfast in hotels
09:00	Morning session
09:00	KAREN HOVHANNISYAN (T)
10:00	ELISABET RODA-SALICHS (C)
10:25	Coffee & Refreshment
10:50	FRANCESCO COSCO (I)
11:30	WOJCIECH BRUZDA (C)
11:55	LEWIS WOOLTORTON (C)
12:20	MAREK WINCZEWSKI (C)
12:45	End of session
12:45	CIPHER/SIGHTSEEING BEGINS
13:00	Lunch (Hotel Tanzberg)
13:45	Meet at tower Britova vez
14:00	CONFERENCE WALK (visit of castle, ruins, cave and viewpoint)
18:30	Cipher game registration
18:30	Dinner at the venue (venue open until 23:00)
18:45	Cipher game

Thursday, 17.9.2026

07:30	Breakfast in hotels
09:00	Morning session
09:00	HIMANSHU BADHANI (C)
09:25	FIONNUALA CURRAN (C)
09:50	SANTIAGO LLORENS (C)
10:15	MARCO WIEDMANN (C)
10:40	Coffee & Refreshment
11:10	SAMGEETH PULIYIL (C)
11:35	TAMAL GUHA (C)
12:00	LIBOR CAHA (C)
12:25	End of session
12:30	Takeaway Lunch
12:45	Conference bus to Vienna Airport

(T) Invited tutorial ($55 + 5$ min.)
(I) Invited talk ($35 + 5$ min.)
(C) Contributed talk ($20 + 5$ min.)

Invited Tutorials

1. **Ivan Šupić:** SELF-TESTING IN QUANTUM INFORMATION THEORY
2. **Karen Hovhannisyan:** QUANTUM WORK AND ITS MEASUREMENT

Invited talks

1. **Augustin Vanrietvelde:** CAUSAL DECOMPOSITIONS OF 1D QUANTUM CELLULAR AUTOMATA, WITH A DETOUR VIA THEORY OF PARTITIONS OF QUANTUM SYSTEMS
2. **Francesco Cosco:** PULSE-LEVEL QUANTUM COMPUTING: FROM LEAKAGE SUPPRESSION TO HARDWARE-AWARE ALGORITHMS
3. **Vedran Dunjko:** CAN WE HAVE QUANTUM ADVANTAGES IN MACHINE LEARNING PLEASE?
4. **Teiko Heinosaari:** QUANTUM ADVANTAGE IN COMMUNICATION
5. **Peter Stano:** COLORED CORRELATED NOISE AND QUANTUM COMPUTATION

Contributed talks

1. **Paolo Abiuso:** Measurement-device-independent certification for quantum optics
2. **Gerard Anglès Munné:** Combining moment matrices, symmetric extension, and Lovász theta: Φ_{E8} is entangled
3. **Francesco Arzani:** Complex zeros of the wavefunction as theoretical and experimental signatures of non-Gaussianity
4. **Remigiusz Augusiak:** Device-independent certification of Majorana fermions and a new self-testing equivalence
5. **Himanshu Badhani:** Thermodynamics of quantum information processing
6. **Wojciech Bruzda:** Equivalence of Genuine Multipartite Entanglement and Nonlocality of Nearly Symmetric Multiqubit Pure States
7. **Libor Caha:** Layer codes as partially self-correcting quantum memories
8. **Fionnuala Curran:** Unambiguous randomness from a quantum state
9. **Tamal Guha:** Strong Inequivalence of Quantum Nonlocal Resources
10. **Timothée Hoffreumon:** On the experimental falsification of Real Quantum Theory
11. **Arnau Diebra Huertas:** Quantum Advantage in Identifying the Parity of Permutations with Certainty
12. **Santiago Llorens:** Exact identification of unknown unitary processes
13. **Samgeeth Puliyil:** Semi-device-independent channel identification with communication matrices
14. **Elisabet Roda-Salichs:** Sequential analysis in a continuous spin-noise quantum sensor
15. **Kyrylo Simonov:** Higher-order transformations of bidirectional quantum processes
16. **Marco Wiedmann:** On the convergence of the variational quantum eigensolver and quantum optimal control
17. **Marek Winczewski:** Quantification of the energy consumption of entanglement distribution
18. **Lewis Wooltorton:** Chain rules for conditional entropies in quantum cryptography: limitations and improvements
19. **Lin Htoo Zaw:** Rigorously and vigorously extracting nonclassicality certificates from a few characteristic function measurements

Posters

1. **Guillermo Abad López:** Entanglement-assisted Hamiltonian dynamics learning
2. **Ieline Ahmed:** Multipartite Bell inequalities with interferometric multiports
3. **Ardra Ajitha Vijayan:** Noise Reduction for Phase Gates Using Two-Channel Uses
4. **David Amaro Alcala:** Symmetry-Sector Filtering for Passive Bosonic Randomized Benchmarking
5. **Piotr Bereza:** From minimal s-tight IC measurements to orthocentric
6. **Kaushik Das:** Quantum computation of electronic structures using VQE
7. **Gabor Drotos:** Minimum Hilbert-space dimension for attaining Tsirelson bounds of bipartite correlation-type Bell expressions
8. **Veres Gergő:** Towards an assessment of tolerance against imperfections in semi-device-indepent certification of single qualitative properties
9. **Arash Ghoreishi:** Multiple-shot labeling of quantum observables
10. **Tamal Guha:** Minimal Help, Maximal Gain: Environmental Assistance
11. **Anna Jenčová:** Higher order processes in the polytope GPT
12. **Kartik Kakade:** Maximum Entropy Principle for Quantum Channels
13. **Ram Krishna Patra:** Certification of Absolutely Entangled Sets in Prepare-and-Measure Scenarios
14. **Leevi Leppäjärvi:** Adversarial information gain in non-ideal quantum measurements
15. **István Márton:** Preprocessed Branch-and-Bound Computation of Local Bounds for Correlation-Type Bell Inequalities
16. **Simon Morelli:** Sequential parameter testing
17. **Jake Muff:** Quantum instruments on noisy qubits: joint measurement, repeated measurement, and sequential tomography
18. **Miguel Navascués:** Causality and realizability of local operations in quantum field theory
19. **Soham Sau:** Demultiplexing Generalized Information via Quantum Transmission Lines
20. **Michal Sedlák:** Sequential realization of Quantum Instruments
21. **Samrat Sen:** Entanglement of flower states
22. **Jedrzej Stempin:** Quantum capacity of a graph
23. **Konrad Szymański:** Look Mum No Hands: reachability in autonomous quantum control
24. **Abdelmalek Taoutioui:** Certifying Asymmetry in the Configuration of a Finite Set of Qubits
25. **Marek Winczewski:** Energy Cost of a Quantum Operation: From Axioms to a Hamiltonian Framework

Invited tutorials

1. **Ivan Šupić:** SELF-TESTING IN QUANTUM INFORMATION THEORY

   What can observed measurement statistics tell us about the quantum system that produced them, if we make no assumptions about the internal functioning of the devices? Self-testing addresses this question in a particularly striking way: certain nonlocal correlations uniquely determine the underlying quantum state and measurements, up to the unavoidable local equivalences. It therefore turns Bell-type experiments into a powerful tool not only for witnessing nonclassical behaviour, but for identifying the quantum realization responsible for it.

   In this tutorial, I will introduce the basic ideas and techniques of self-testing, with particular emphasis on its conceptual and foundational aspects. We will see how self-testing sharpens our understanding of quantum nonlocality and of the information encoded in observable correlations, and how it provides a rigorous framework for reasoning about quantum systems in a device-independent manner. I will then discuss several of its applications, ranging from quantum cryptography and randomness certification to questions at the interface of quantum foundations and theoretical computer science. In particular, I will explain how self-testing became an important ingredient in fundamental results in quantum complexity theory, culminating in its role in the proof of $MIP^* = RE$. Along the way, I will present the main techniques behind self-testing proofs and illustrate how a seemingly simple question about measurement statistics leads to surprisingly rigid conclusions about the underlying quantum world.

2. **Karen Hovhannisyan:** QUANTUM WORK AND ITS MEASUREMENT

   Work is a central notion in both mechanics and thermodynamics, being the only touching point between the two theories. When its full statistics is required, classical mechanics provides a natural description in terms of phase-space trajectories, whereas no analogous prescription exists for accessing work statistics in the quantum regime. A central challenge in quantum thermodynamics is therefore to measure work in coherent processes without distorting the energetics of the unmeasured evolution. In this tutorial, I will give a general overview of existing approaches to this problem through the lens of their compatibility with two fundamental physical principles: energy conservation and fluctuation relation. I will then argue in favor of an operational measurement scheme based on the abstract notion of variation in the Heisenberg-picture Hamiltonian. In a landscape constrained by various no-go theorems, this scheme strikes a good balance between conflicting desirable conditions. Most importantly, it preserves coherences and thereby faithfully reproduces the work of the unmeasured process, while inducing minimal backaction on both the state and the energetics. This scheme requires only a single measurement, a feature that can be exploited to construct a Maxwell-demon protocol capable of outperforming energy-based feedback engines in coherent work extraction.

Invited talks

1. **Augustin Vanrietvelde:** CAUSAL DECOMPOSITIONS OF 1D QUANTUM CELLULAR AUTOMATA, WITH A DETOUR VIA THEORY OF PARTITIONS OF QUANTUM SYSTEMS

   Understanding quantum theory's causal structure stands out as a major matter, since it radically departs from classical notions of causality. We present advances in the research program of causal decompositions, which investigates the existence of an equivalence between the causal and the compositional structures of unitary channels. Our results concern one-dimensional Quantum Cellular Automata (1D QCAs), i.e. unitary channels over a line of N quantum systems (with or without periodic boundary conditions) that feature a causality radius r: a given input cannot causally influence outputs at a distance more than r. We prove that, for $N \geq 4r + 1$, 1D QCAs all admit causal decompositions: a unitary channel is a 1D QCA if and only if it can be decomposed into a unitary routed circuit of nearest-neighbour interactions, in which its causal structure is compositionally obvious. This provides the first constructive form of 1D QCAs with causality radius one or more, fully elucidating their structure. In addition, we show that this decomposition can be taken to be translation-invariant for the case of translation-invariant QCAs. Our proof of these results makes use of innovative algebraic techniques, leveraging a new framework for capturing partitions into non-factor sub-C* algebras.

2. **Francesco Cosco:** PULSE-LEVEL QUANTUM COMPUTING: FROM LEAKAGE SUPPRESSION TO HARDWARE-AWARE ALGORITHMS

   Quantum computers are typically programmed through sequences of logical gates. While this abstraction greatly simplifies application development, it hides much of the underlying hardware physics dynamics and limits the opportunities for optimization. Pulse-level access exposes the physical control signals driving the quantum processor and enables a closer integration between hardware, software, and applications. In this talk, I will discuss how pulse-level control can be used to improve the performance of superconducting quantum processors. Starting from the challenges posed by noise, leakage, and limited coherence times, I will present recent work on geodesic-based optimal control for low-leakage gate design, pulse-level optimization of variational quantum algorithms, and scheduling-aware control strategies for superconducting architectures.

3. **Vedran Dunjko:** CAN WE HAVE QUANTUM ADVANTAGES IN MACHINE LEARNING PLEASE?

Quantum machine learning has produced plenty of quantum models. Quantum advantages have been less cooperative. What would it take for one to survive training costs, finite-size experiments—and a determined classical competitor? I will discuss two attempts to make the question less slippery: learning with privileged quantum information, where quantum data help only during training, and quantum generative models that can be benchmarked classically while remaining hard to sample from. Along the way, we will ask what theory can actually certify—and whether "classically testable" and "quantumly advantageous" can coexist.

4. **Teiko Heinosaari:** QUANTUM ADVANTAGE IN COMMUNICATION

   Quantum and classical communication systems of the same dimension are often compared through success probabilities in communication tasks. I will first recall the well know fact that standard performance measures fail to reveal operational differences between classical and quantum communication in the basic communication task. By introducing more general framework, one can identify communication tasks in which qubits outperform classical bits. This perspective reveals new forms of quantum advantage that remain hidden in the basic communication. I will explain the minimal setting where the quantum advantage exists.

5. **Peter Stano:** COLORED CORRELATED NOISE AND QUANTUM COMPUTATION

   The threshold theorems on which the quantum error correction hinges usually assume uncorrelated noise (both in space and time). In any real device, the noise is, to some degree, correlated (both in space and time). What such correlations imply for the feasibility of quantum computation is largely unknown. I will review our recent work on characterization of noise correlations in current silicon spin qubit hardware [1-4]. It culminates in Ref.[5], where we quantify the spatial extent of noise correlations in a five-qubit silicon array and assess their impact on quantum error correction. We identify two distinct sources of correlated noise: global magnetic field drifts that generate perfectly correlated fluctuations, and charge noise from two-level fluctuators that produces short-range correlations decaying within neighboring qubits. The magnetic drift is an example of noise so strongly correlated that it can compromise quantum error correction. In contrast, the measured charge noise correlations are moderate, electrically tunable, and compatible with fault-tolerant operation with minimal qubit overhead. [1] J. Yoneda et al., Noise-correlation spectrum for a pair of spin qubits in silicon, Nature Physics 19, 1793 (2023) [2] J. S. Rojas-Arias et al., Spatial noise correlations beyond nearest-neighbor in 28Si/SiGe spin qubits, Phys. Rev. Applied 20, 054024 (2023) [3] J. S. Rojas-Arias et al., The origins of noise in the Zeeman splitting of spin qubits in natural-silicon devices, (arxiv:2408.13707) [4] J. S. Rojas-Arias et al., Inferring charge noise source locations from correlations in spin qubits, Phys. Rev. Lett. 136, 027001 (2026) [5] J. S. Rojas-Arias et al., Scaling of silicon spin qubits under correlated noise, (arxiv:2603.03051)

Contributed talks

1. **Paolo Abiuso:** MEASUREMENT-DEVICE-INDEPENDENT CERTIFICATION FOR QUANTUM OPTICS

   We consider measurement-device-independent (MDI) protocols for the certification of quantum hardware and extend them to the continuous-variable regime. We prove MDI entanglement [1] (steering [2]) witnesses exist for all CV entangled (steerable) states, and we design practical, fully Gaussian MDI protocols that only need trusted coherent states as inputs. A similar treatment allows us to provide a practical protocols for the MDI task of certifying a quantum memory [3]. We present the experimental demonstration of these proposals in [4]. In the Gaussian regime, quantum optics cannot be used for fully device-independent protocols. MDI scenarios are, in this sense, both viable and minimal for this class of technology.

2. **Gerard Anglès Munné:** COMBINING MOMENT MATRICES, SYMMETRIC EXTENSION, AND LOVÁSZ THETA: Φ_{E8} IS ENTANGLED

   We solve an open problem posed by Yu et al., Nature Communications 12, 1012 (2021). The problem is to show, via an entanglement witness, that the 14-qubit state Φ_{E8} is entangled. Inspired by a method from quantum codes, we combine symmetric extension with moment matrices to prove that Φ_{E8} is entangled. The proof has the form of a rational infeasibility certificate for a semidefinite program, yielding an explicit witness. Our approach unifies and extends several earlier methods that involve the Lovász theta number of the Pauli anti-commutativity graph, promising scalability and flexibility in further applications.

3. **Francesco Arzani:** COMPLEX ZEROS OF THE WAVEFUNCTION AS THEORETICAL AND EXPERIMENTAL SIGNATURES OF NON-GAUSSIANITY

   We study the complex zeros of the bosonic wavefunction and show they encode non-Gaussianity. Under a mild energy condition, the wavefunction extends to an entire function, yielding a Hudson-type theorem: a pure state is non-Gaussian iff its wavefunction has a complex zero, the count of which equals the stellar rank. Under Gaussian dynamics, these zeros evolve as an integrable Calogero-Moser system, and we prove they become real under suitable phase shifts. Building on this, we introduce non-Gaussianity witnesses requiring only a single homodyne measurement, with rigorous soundness, completeness, and sample complexity guarantees. Our results establish wavefunction zeros as fundamental signatures of non-Gaussianity accessible through standard quantum optical measurements.

4. **Remigiusz Augusiak:** DEVICE-INDEPENDENT CERTIFICATION OF MAJORANA FERMIONS AND A NEW SELF-TESTING EQUIVALENCE

   Bell inequalities are a key tool for probing nonlocal correlations, but their quantum bounds are rarely known analytically. We introduce a general class of Bell inequalities whose quantum bounds can be computed exactly, based on row-orthogonal, column-normalized (ROCN) matrices. This framework generalizes the CHSH and Gisin elegant inequalities and yields Bell expressions maximally violated by arbitrary sets of pairwise anticommuting Clifford observables. Under suitable assumptions, these inequalities also enable device-independent certification of Majorana fermions. We then identify a new self-testing equivalence, arising from partial transposition of both the state and measurements, which preserves all observed correlations and extends the standard set of self-testing equivalences.

5. **Himanshu Badhani:** THERMODYNAMICS OF QUANTUM INFORMATION PROCESSING

   We introduce the resource-theoretic free energy of a quantum channel as the maximal work extractable from the thermalization of its output, while the reference is intact. We show that it is proportional to the relative entropy between the channel and the absolutely thermal channel. It attains a clear operational meaning as twice the asymptotic rates of athermality distillation and formation under Gibbs preserving superchannels, thereby revealing the asymptotic reversibility of the resource theory. We establish that the optimal extractable work in channel conversion is the difference in their free energies. Such quantizations of the thermodynamic utility of a quantum process are a key step in understanding the true costs of quantum information processing.

6. **Wojciech Bruzda:** EQUIVALENCE OF GENUINE MULTIPARTITE ENTANGLEMENT AND NONLOCALITY OF NEARLY SYMMETRIC MULTIQUBIT PURE STATES

   Whether every pure genuinely multipartite entangled (GME) state necessarily exhibits genuine multipartite nonlocality (GMNL) remains an open question. By combining a particular Bell inequality with Hardy's paradox and the canonical decomposition of pure states, we analytically demonstrate that all highly symmetric, genuinely entangled multipartite qubit states exhibit genuine multipartite nonlocality, thereby supporting Gisin's conjecture in the multipartite setting. This result constitutes a step toward a general proof of the conjectured equivalence between GME and GMNL in quantum theory.

7. **Libor Caha:** LAYER CODES AS PARTIALLY SELF-CORRECTING QUANTUM MEMORIES

   We investigate layer codes—3D stabilizer code family achieving optimal scaling of code parameters and energy barrier—as candidates for self-correcting quantum memories. We introduce two decoders with guarantees against local stochastic and adversarial noise. We prove that layer codes are partially self-correcting quantum memories outperforming earlier models. We argue that partial self-correction without efficient decoding is more common than expected, sharply distinguishing partially self-correcting systems from partially self-correcting memories. We construct random layer codes from random

CSS codes and prove they achieve optimal scaling (up to log-factors) of code parameters and energy barrier. Studying memory times numerically, we find behavior consistent with partial self-correction.

8. **Fionnuala Curran:** UNAMBIGUOUS RANDOMNESS FROM A QUANTUM STATE

   Intrinsic randomness is generated when a quantum state is measured in any basis in which it is not diagonal. In an adversarial scenario, we quantify this randomness by the probability that a correlated eavesdropper could correctly guess the measurement outcomes. What if the eavesdropper is never wrong, but can sometimes return an inconclusive outcome? Inspired by an analogous concept in quantum state discrimination, we introduce the unambiguous randomness of a quantum state and measurement, solving the problem explicitly in dimension two. When the set-up is used to generate random bases for a prepare-and-measure quantum key distribution protocol (e.g., BB84), the unambiguous randomness quantifies the knowledge gained by an eavesdropper about the secret key, without causing any disturbance.

9. **Arnau Diebra Huertas:** QUANTUM ADVANTAGE IN IDENTIFYING THE PARITY OF PERMUTATIONS WITH CERTAINTY

   We establish a sharp quantum advantage in determining the parity (even/odd) of an unknown permutation applied to n particles. Classically, perfect identification requires n labels; with fewer, success is limited to random guessing. Thanks to entanglement, quantum mechanics achieves certainty using only sqrtn distinguishable states per particle. Below this threshold, not even quantum mechanics helps, and success reverts to random guessing. We provide explicit states for small n that ensure perfect identification and assess their minimum entanglement, finding it to be close to maximal, and sometimes strictly maximal. Requiring no oracles or contrived setups, this task provides a rigorous and physically natural example of genuine quantum advantage.

10. **Tamal Guha:** STRONG INEQUIVALENCE OF QUANTUM NONLOCAL RESOURCES

    In this work we present instances of quantum nonlocal correlations that are incomparable in the strongest sense. Specifically, when starting with an arbitrary many copies of one nonlocal correlation, it becomes impossible to obtain even a single copy of the other correlation, and this incomparability holds in both directions. Such incomparable quantum correlations can be obtained even in the simplest Bell scenario, which involves two parties, each having two dichotomic measurements setups. Notably, there exist an uncountable number of such incomparable correlations. Our result challenges the notion of a 'unique gold coin', often referred to as the 'maximally resourceful state', within the framework of the resource theory of quantum nonlocality.

11. **Timothée Hoffreumon:** ON THE EXPERIMENTAL FALSIFICATION OF REAL QUANTUM THEORY

    Real quantum theory (RQT), which restricts states and measurements to real symmetric operators while preserving standard composition, is known to reproduce all single-party and bipartite Bell correlations of quantum theory (QT). Renou et al. proposed a bilocal experiment to distinguish QT from RQT, arguing that near-optimal swapped-CHSH$_3$ values would refute RQT. We show this relies on an untestable assumption: equating source independence with product-state independence in RQT. Because RQT is not locally tomographic, this cannot be certified device-independently. Using a notion of independence based only on observable correlations, we show RQT able to reproduce any QT correlation. Hence, no QT-consistent network experiment can rule out RQT without additional device-dependent assumptions.

12. **Santiago Llorens:** EXACT IDENTIFICATION OF UNKNOWN UNITARY PROCESSES

    Identifying faulty hardware is a fundamental requirement for reliable quantum information processing. We address this in a setting where n devices intend to apply the same unitary operation, but k malfunctioning devices apply a different, unknown unitary. Assuming complete ignorance of the applied unitary, we use representation-theoretic tools to study zero-error anomaly identification. We derive the optimal success probability for $k = 1, 2$ scenarios, showing it is independent of n. Furthermore, we present a simple, ancilla-assisted protocol achieving this optimal limit, offering operational advantages like independent device testing. Finally, we extend our analysis to arbitrary k and local dimensions, evaluating performance and conjecturing global optimality.

13. **Samgeeth Puliyil:** SEMI-DEVICE-INDEPENDENT CHANNEL IDENTIFICATION WITH COMMUNICATION MATRICES

    We investigate the task of differentiating between any two quantum channels and reconstructing them from measurement statistics, trusting only the dimension of the system d. Using the communication matrix formalism, we show that informational completeness of the setup, a necessary and sufficient condition for channel differentiation, can be certified when the communication matrix has rank=d^2. Moreover, we prove that the setup can be self-tested up to an orthogonal transformation when the information storability, another property of the communication matrix, equals d. Together, the two provide a semi-device-independent way to identify quantum channels from prepare-and-measure tasks. Finally, we study certain classes of channels using this framework under specific assumptions on the setup.

14. **Elisabet Roda-Salichs:** SEQUENTIAL ANALYSIS IN A CONTINUOUS SPIN-NOISE QUANTUM SENSOR

    Many control and detection applications require real-time analysis of signals from sensors, in order to quickly and accurately act upon events revealed by the sensors. Such signal analysis benefits from statistical models of signal and sensor behavior.

This creates a need for data analysis methods that are simultaneously model-based, computationally efficient and causal. In this work, we implement sequential techniques (ST) on a spin-noise-based quantum sensor, to perform two key tasks: hypothesis testing and quickest change-point detection. We demonstrate these methods in a realistic experimental setting and derive performance bounds for the achievable precision and response time, showing that ST enable faster and more sensitive detection, making them a powerful tool for quantum sensing.

15. **Kyrylo Simonov:** HIGHER-ORDER TRANSFORMATIONS OF BIDIRECTIONAL QUANTUM PROCESSES

    Bidirectional devices are quantum devices whose input and output ports can be exchanged. They are described by bistochastic quantum channels, i.e., completely positive, trace-preserving and identity-preserving maps. Recent work has shown that they can be used without a definite input-output direction, leading to input-output indefiniteness. We characterize the most general forms of this phenomenon through a hierarchy of higher-order transformations of bistochastic channels. Some levels have definite causal order but indefinite local input-output direction, while others allow both local and global indefiniteness. The hierarchy defines largest set of processes compatible with a time-symmetric version of quantum theory.

16. **Marco Wiedmann:** ON THE CONVERGENCE OF THE VARIATIONAL QUANTUM EIGENSOLVER AND QUANTUM OPTIMAL CONTROL

    Despite the large literature on variational approaches to quantum computing, it is largely unknown when these algorithms converge to a global optimum. We prove a sufficient criterion for the Variational Quantum Eigensolver (VQE) to converge to a ground state. More specifically, we show that if (i) a parameterized unitary transformation allows for moving in all tangent-space directions (local surjectivity) in a bounded manner and (ii) the gradient optimization terminates, then the VQE converged to a ground state almost surely. We develop constructions that satisfy condition (i) and analyze two commonly employed families of quantum circuits. Finally, we discuss regularization techniques for guaranteeing gradient descent to terminate, and draw connections to the halting problem.

17. **Marek Winczewski:** QUANTIFICATION OF THE ENERGY CONSUMPTION OF ENTANGLEMENT DISTRIBUTION

    Inspired by environmental sciences, we develop a hardware-independent framework for quantifying the fundamental energy required to distribute entanglement through noisy quantum channels. We introduce the energy consumption rate per distributed entanglement, measured in joules per ebit, and derive lower bounds showing that irreversibility in entanglement theory implies a non-zero energetic cos*t for standard distribution protocols. We also formulate axioms and a Hamiltonian model for the energy cost of classically controlled quantum operations, yielding upper bounds on this rate. Finally, we estimate the energy demands of three photonic entanglement distillation protocols and show that their costs exceed the fundamental lower bound by many orders of magnitude.

18. **Lewis Wooltorton:** CHAIN RULES FOR CONDITIONAL ENTROPIES IN QUANTUM CRYPTOGRAPHY: LIMITATIONS AND IMPROVEMENTS

    Security proofs in quantum cryptography must account for the most general attacks by an eavesdropper. Chain rules address this by relating the total entropy to a sum of entropy contributions from each round, realising entropy accumulation theorems (EATs). Applied to trusted devices, tight reductions to independent attacks are possible, and whether analogous results hold in the device-independent setting has not been addressed. We show that a natural chain rule that would answer this question affirmatively cannot hold, while an intermediate improvement is possible. We then use this to provide a slightly tighter version of the EAT in certain contexts. In addition, we provide a self-contained framework that unifies existing chain rules, framing our results in a broader context.

19. **Lin Htoo Zaw:** RIGOROUSLY AND VIGOROUSLY EXTRACTING NONCLASSICALITY CERTIFICATES FROM A FEW CHARACTERISTIC FUNCTION MEASUREMENTS

    In continuous variable (CV) quantum information, different flavours of nonclassicality are quantified by nonclassical depth, negativity volume, and robustness/distance to classical states. Meanwhile in experiments, the characteristic function of CV states are natively and routinely measured. We introduce semidefinite programmes (SDPs) that extract lower bounds of nonclassicality measures from few characteristic function measurements with error bars, and experimentally implement them on a trapped ion. With our SDPs, bounds to different nonclassicality measures can be extracted from a single dataset. Importantly, they quantify and certify the measures of interest: within the error bars of the data, the actual nonclassicality is guaranteed to be, at worst, the SDP's output.

Posters

1. **Guillermo Abad López:** ENTANGLEMENT-ASSISTED HAMILTONIAN DYNAMICS LEARNING

   In this work, we introduce an entanglement-assisted learning strategy that enhances the training of QGANs through the controlled use of an ancillary qubit. Our approach dynamically enlarges the generator's Hilbert space by coupling a randomly initialized ancilla at an intermediate stage of the optimization. We show that the combination of entanglement, randomization, and adaptive circuit extension reshapes the optimization landscape, enabling the learning process to escape stagnation and achieve higher fidelities. Through numerical simulations, we demonstrate that this method substantially improves the approximation of nontrivial target dynamics. Our results highlight a general and scalable strategy for mitigating bottlenecks in VQAs, with applications in quantum simulation and QML.

2. **Ieline Ahmed:** MULTIPARTITE BELL INEQUALITIES WITH INTERFEROMETRIC MULTIPORTS

   Bell inequalities become increasingly difficult to construct as the number of parties, measurement settings, and outcomes grows. We use a characteristic-function representation in which (d)-valued outcomes are encoded as roots of unity, allowing Bell functionals to be written as linear combinations of Fourier correlators. The formalism is naturally suited to interferometric multiport measurements, where local settings are implemented by phase shifts followed by a fixed Fourier multiport. We recover CHSH, CGLMP, and MABK as particular probes and study a fixed family of Fourier-generated probes for general ((N,m,d)) scenarios. Numerical optimization over shared states and local phases yields several violations, including cases with non-maximally entangled states.

3. **Ardra Ajitha Vijayan:** NOISE REDUCTION FOR PHASE GATES USING TWO-CHANNEL USES

   We study the purification of an unknown qubit phase gate from two sequential uses of its noisy implementation $C(p,\chi)_\varphi = (1-p)U_\varphi + pN_\chi$, where p is the level of the noise and χ its character. We design the optimal deterministic quantum comb producing a single output channel of the same form with the reduced noise parameter $q < p$, uniformly in the unknown phase. Exploiting the covariance of the phase-gate family, we perform a complete symmetry reduction of the comb operator and solve the resulting optimization numerically. Since the optimal comb depends on both the noise level p and the noise character χ, we also construct a strategy that requires no knowledge of either; although not optimal, it is almost optimal throughout the parameter range. Finally, we solve the special case of parallel strategies analytically, and show that both the optimal sequential comb and the noise-independent one outperform the optimal parallel strategy at every value of the noise parameters.

4. **David Amaro Alcala:** SYMMETRY-SECTOR FILTERING FOR PASSIVE BOSONIC RANDOMIZED BENCHMARKING

   Extracting a single symmetry sector from experimental data is a recurring problem in passive bosonic systems. We give a representation filter for extracting one sector from randomized benchmarking data. For n photons in m modes, the channel representation decomposes under SU(m); Kostant's relation turns immanants into zero-weight traces, and full-sector traces give character filters. Character orthogonality gives unit variance, and polynomial-time character algorithms evaluate the filters. The construction avoids Clebsch-Gordan tables and state-dependent projectors and extends to loss and gain through a direct-sum Hilbert space. In tests, weak coherent states and intensity measurements recover target fidelity within a few percent in the high-fidelity regime.

5. **Piotr Bereza:** FROM MINIMAL S-TIGHT IC MEASUREMENTS TO ORTHOCENTRIC

   The class of s-tight informationally complete (IC) measurements in geometric generalised probabilistic theories (GGPTs) contains both morphophoric and tight IC measurements as special cases. Notably, the formula that can be seen as a generalisation of the Urgleichung, which plays a crucial role in QBism, retains a simple form when extended to this class of measurements. Just as SIC-POVMs are defined via SICs, s-tight IC measurements are defined in terms of scalable frames. We discuss the relationship between minimal s-tight IC measurements in GGPTs and a class of orthocentric simplices. In particular, we examine this correspondence for morphophoric and tight IC measurements. These results were obtained using a new, yet equivalent, approach to the GGPT formalism.

6. **Kaushik Das:** QUANTUM COMPUTATION OF ELECTRONIC STRUCTURES USING VQE

   In recent times, quantum computation has been used as a useful tool to calculate band structures of various materials. This work represents the use of the Variational Quantum Eigensolver (VQE) for calculating electronic structures from tight-binding and k-p Hamiltonians. Pennylane and Qiskit platforms are used to implement the simulation, and they are executed on IBM real hardware. In this work, multiple ansatz were used to check the accuracy , convergence, and circuit complexity. Here, all the simulations ran on NISQ devices, so to improve the simulation result, some error mitigation techniques are used . The research results show the potential of VQE in the calculation of the band structures.

7. **Gabor Drotos:** MINIMUM HILBERT-SPACE DIMENSION FOR ATTAINING TSIRELSON BOUNDS OF BIPARTITE CORRELATION-TYPE BELL EXPRESSIONS

   We construct bipartite correlation-type Bell expressions for a total number of measurement settings of any $m > n(n+1)/2$ such that attaining the Tsirelson bound requires a rank-n real vector representation. By Tsirelson's Clifford algebra construction [Vértesi and Pál, 2008, doi:10.1103/PhysRevA.77.042106], this implies a lower bound $2^{n/2}$ on the local Hilbert-space

dimension of any tensor-product quantum realization attaining the bound. The Tsirelson bound can always be attained in a Hilbert space of lower dimension if there are fewer measurement settings, according to a theorem of Tsirelson proved by Gribling et al. [2017, doi:10.1016/j.laa.2016.10.015]. We point out connections with a recent work of Michalski et al. [2025, arXiv:2511.17764v1].

8. **Veres Gergő:** TOWARDS AN ASSESSMENT OF TOLERANCE AGAINST IMPERFECTIONS IN SEMI-DEVICE-INDEPENT CERTIFICATION OF SINGLE QUALITATIVE PROPERTIES

   In an SDI framework, single qualitative properties of configurations of prepared states and/or measurement settings can be certified by exceeding the maximum value of a witness, constructed for self-testing, that is attainable in the absence of the given property [Drótos et al, 2024, doi:10.1088/1367-2630/ad4e5c; Taoutioui et al, 2025, doi:10.1088/1367-2630/ae1ce3]. However, how to characterize tolerance against imperfections has not yet been considered and is the topic of our present investigation. This is related to but goes well beyond the traditional concept of robustness. Our numerical example is provided by the certification of asymmetry in three-qubit configurations in a prepare-and-measure scenario.

9. **Arash Ghoreishi:** MULTIPLE-SHOT LABELING OF QUANTUM OBSERVABLES Quantum labeling tasks ask one to recover the missing associations between classical outcome labels and the effects forming the POVM. We study labeling in the multiple-shot regime, allowing a finite number of uses of the device and the most general tester-based strategies, including adaptivity. For binary observables, we show that if perfect labeling is impossible in a single shot, then it remains impossible with any finite number of shots. In particular, we derive the formula for minimum-error performance and highlight its "even-odd" behavior. For non-binary observables, we derive the optimal single-shot minimum-error success probability in closed form, and show that entanglement assistance does not improve this optimum. We also provide finite-shot schemes for (perfect or partial) labeling and give illustrative examples, including the qubit trine POVM, where we compute the optimal two-shot classical-adaptive success probability and exhibit a genuine entanglement-assisted improvement.

10. **Tamal Guha:** MINIMAL HELP, MAXIMAL GAIN: ENVIRONMENTAL ASSISTANCE

    Quantum channels with output dimension smaller than their input necessarily lose part of the encoded classical information to the environment, leading to suboptimal communication. We show that within a generalised framework of classical communication, minimal environmental assistance can optimally recover this lost encoding capability, even for channels whose conventional environment-assisted classical capacity remains suboptimal. Strikingly, this advantage cannot be reproduced even by sharing the PR correlation. Our results further establish that minimal environmental assistance unlocks the full encoding strength of all known examples of channels with suboptimal environment-assisted capacity, revealing a fundamentally broader operational role of the environment in classical communication.

11. **Anna Jenčová:** HIGHER ORDER PROCESSES IN THE POLYTOPE GPT

    Higher-order processes and indefinite causal order (ICO) attract growing interest in quantum information and foundations. Since ICO also arises in higher-order classical theory, it is natural to ask how it behaves in general probabilistic theories (GPTs), where such processes are much less studied. We construct higher-order processes over a GPT of polytopic systems with the maximal tensor product, which in particular contains all Boxworld state spaces. As these systems arise from classical ones via linear constraints, the processes form subsets of certain positive cones cut by affine subspaces. This is similar to the quantum case, where the Choi matrices of processes obey positivity with affine constraints. We compare our construction with existing definitions in Boxworld.

12. **Kartik Kakade:** MAXIMUM ENTROPY PRINCIPLE FOR QUANTUM CHANNELS

    The primary objective of this study is to extend and implement the principle of maximum entropy within the context of incomplete quantum process estimation tasks. We use the process entropy function defined as the von Neumann entropy of the Choi state of the corresponding process. Utilizing this definition of channel entropy, we study estimation of qubit channels. Given only partial information regarding the mean values of projective measurements on both input and output states, we aim to identify the qubit channel that maximizes this entropy. We find that the channels that transform the Bloch sphere into a line segment, whose orientation and length depend on the constraints, constitute the set of channels having maximum entropy.

13. **Ram Krishna Patra:** CERTIFICATION OF ABSOLUTELY ENTANGLED SETS IN PREPARE-AND-MEASURE SCENARIOS

    Absolutely entangled states (AES) constitute a key resource for reference-frame-independent quantum information processing. Here, we develop a semi-device-independent framework for the certification of AES in a prepare-and-measure scenario, solely based on an assumption about the underlying Hilbert-space dimension. Within this framework, we derive a class of prepare-and-measure witnesses, and any violation of these witnesses provides a certification of the presence of an AES. In addition, we formulate a general procedure for constructing AES witnesses and certifying arbitrary target AES in prepare-and-measure settings. We further illustrate the applicability of the proposed framework through several representative examples of target AES.

14. **Leevi Leppäjärvi:** ADVERSARIAL INFORMATION GAIN IN NON-IDEAL QUANTUM MEASUREMENTS

Performing a quantum measurement yields two different outcomes: a classical measurement outcome and the post-measurement quantum state. Quantum devices that provide both outcomes can be described through quantum instruments. In a realistic scenario, one can expect that the observer's outcomes are non-ideal: this can be due to experimental limitations, but also due to adversarial interference, i.e., a second party that disturbs the device through a concealed measurement. The second scenario can be interpreted through quantum compatibility, as it implies that both the observer's instrument and the adversary's measurement can be performed jointly. In this work, we show how the noise of the observer's device relates to the amount of information that the adversary can obtain.

15. **István Márton:** PREPROCESSED BRANCH-AND-BOUND COMPUTATION OF LOCAL BOUNDS FOR CORRELATION-TYPE BELL INEQUALITIES

    This poster presents an improved branch-and-bound algorithm for the exact computation of local bounds of correlation-type Bell inequalities with large Bell matrices. The method augments the standard branch-and-bound procedure with certain preprocessing steps, which substantially reduce runtimes and make the performance more predictable across different instances of given matrix size. The algorithm is implemented in C using OpenMP for shared-memory parallelism. Applied to recent candidate matrices, it enables exact local-bound computations for larger Bell matrices than previously accessible. This, in turn, leads to improved lower bounds on finite-order Grothendieck constants and stronger correlation-type Bell tests for quantum nonlocality.

16. **Simon Morelli:** SEQUENTIAL PARAMETER TESTING

    Sequential strategies in hypothesis testing use a variable number of measurement rounds, allowing a decision to be made as soon as the observed data provide a prescribed level of error tolerance. Although sequential testing is well established for a discrete set of hypotheses, extending this framework to a continuous parameter space poses additional challenges and has remained largely unexplored. In this article, we introduce sequential parameter testing, a framework for determining an unknown parameter up to a prescribed tolerance by ruling out sufficiently distant competing values with a target error tolerance. We clarify its operational distinction from conventional parameter estimation and develop sequential tests for continuous families of hypotheses, introducing the twin-peaks test as a natural and computationally efficient analog of sequential likelihood-ratio testing. We apply the framework to two paradigmatic quantum tasks: testing the phase and the purity of a qubit. For phase testing, we show numerically that adaptive projective measurements achieve the same average sample cost as collective covariant measurements with a fixed number of copies. For purity testing, local measurements are optimal, and sequential parameter testing yields significant average sample savings over fixed sample-size protocols. Our results establish parameter testing as an operationally meaningful framework for resource-efficient certification tasks involving continuous parameters.

    https://arxiv.org/abs/2608.01248

17. **Jake Muff:** QUANTUM INSTRUMENTS ON NOISY QUBITS: JOINT MEASUREMENT, REPEATED MEASUREMENT, AND SEQUENTIAL TOMOGRAPHY

    Mid circuit measurements, dynamics circuits and feedforward operations have become increasingly popular tools in quantum computation, but, they are often described with POVMs with the post-measurement state left implicit. Therefore, we turn to quantum instruments. In this work we implement and demonstrate the Lüders instrument for an unsharp σ_x effect on superconducting qubits via a single-ancilla construction and demonstrate three use cases: (i) joint measurement of incompatible σ_x and σ_z, (ii) repeated measurement that sharpens an unsharp effect by majority vote, (iii) sequential implementation of quantum tomography. We discuss the practicalities of running quantum instruments on near-term quantum hardware and their role in quantum algorithms and quantum computation.

18. **Miguel Navascués:** CAUSALITY AND REALIZABILITY OF LOCAL OPERATIONS IN QUANTUM FIELD THEORY

19. **Soham Sau:** DEMULTIPLEXING GENERALIZED INFORMATION VIA QUANTUM TRANSMISSION LINES

    Demultiplexers are the fundamental primitives of network architecture, enabling perfect routing of an input classical signal to a designated one, among multiple output ports. Quantum transmission lines, having access to the quantum systems directly, are able to transmit both the classical and quantum information encoded in quantum systems. A natural question therefore emerges that whether the scrambled classical and quantum information in a quantum system can be perfectly demultiplexed in the designated classical and quantum output ports? Here we answer this question by introducing a quantum to quantum-classical device, namely the quantum demultiplexer (Q-DEMUX).

20. **Michal Sedlák:** SEQUENTIAL REALIZATION OF QUANTUM INSTRUMENTS

    In adaptive quantum circuits classical results of mid-circuit measurements determine the upcoming gates. This allows POVMs, quantum channels or more generally quantum instruments to be implemented sequentially, so that fewer qubits need to be used at each of the N measurement steps. In this paper, we mathematically describe these problems via adaptive sequence of instruments (ASI) and show how any instrument can be decomposed into it. Number of steps N and number of ancillary qubits n_A needed for actual implementation are crucial parameters of any such ASI. We show an achievable lower bound on the product $N.n_A$ and we determine in which situations this tradeoff is likely to be optimal. Contrary to common intuition we show that for quantum instruments which transform n to $m(>n)$ qubits, there exist N-step ASI implementing them just with $(m-n)$ ancillary qubits, which are remeasured $(N-1)$ times and finally used as output qubits.

21. **Samrat Sen:** ENTANGLEMENT OF FLOWER STATES

We use 'flower states' of dimension $d = 2k$ to probe the landscape of entanglement theory. We compute their exact and standard non-entangling (NE) costs, showing both equal $\log(1+\sqrt{k})$. Remarkably, their NE distillable entanglement is just 1 ebit, achievable via a one-shot, deterministic, one-way LOCC protocol. This establishes the largest known NE irreversibility gap of $\Theta\left(\frac{1}{2}\log d\right)$ and proves that squashed entanglement is not an NE monotone. Finally, we determine the exact LOCC cost via the regularized Schmidt number. Leveraging cyclic group uncertainty relations proved by Tao and Meshulam, we prove that the Schmidt number is additive and equals $\min_{r|k} \log\left(r + \frac{k}{r}\right)$, reducing to $\log(k+1)$ for prime k.

22. **Jedrzej Stempin:** QUANTUM CAPACITY OF A GRAPH

The classical capacity of a graph quantifies the amount of information that can be transmitted through a noisy channel whose confusability structure is described by a graph. We investigate a quantum counterpart of the graph capacity problem. Considering quantum channels whose error model is described by the anticommutativity graph of Pauli errors, we study the asymptotic rate at which logical qubits can be protected. We derive semidefinite programming bounds on the existence of pure stabilizer codes and introduce graph products that characterize quantum capacity. These results provide a graph-theoretic framework for quantum error correction and quantum communication.

23. **Konrad Szymański:** LOOK MUM NO HANDS: REACHABILITY IN AUTONOMOUS QUANTUM CONTROL

Quantum control usually means turning knobs in time. What if they are set once, and left alone? Given $|\mathrm{i}\rangle$, $|\mathrm{f}\rangle$ and a Hamiltonian family $H(\lambda)$, is there a $\lambda \in R^k$ with $|f> \propto exp(-iH(\lambda))|i>$? From the spectrum of $H(\lambda)$ we build two criteria. One matches the eigenstate distributions of $|\mathrm{i}\rangle$ and $|\mathrm{f}\rangle$ by optimizing over λ; the other matches only the mean and variance of H, needs no optimization, and directly certifies unreachability. For hopping particles and spin strings, a nonzero fraction of Haar-random targets is reachable even when the family is not fully controllable: the reachable set has full dimension but does not fill state space; full reachability needs time-dependent $\lambda(t)$, so it is not a contradiction. Each orbit fills a torus and sweeping λ gives reachable sets of varying dimension.

24. **Abdelmalek Taoutioui:** CERTIFYING ASYMMETRY IN THE CONFIGURATION OF A FINITE SET OF QUBITS

We present a method for certifying asymmetric finite configurations of qubit states in the prepare-and-measure scenario. Starting from a linear witness that self-tests a target set of qubit states, we optimize the same witness over all mirror-symmetric configurations, obtaining a mirror-symmetry bound. Any violation of this bound certifies that the underlying configuration admits no mirror-symmetry plane. The gap between the quantum maximum and the mirror-symmetry bound gives an operational quantifier of asymmetry. Based on numerical results obtained from a conic relaxation of the non-convex witness optimization under mirror-symmetry constraints, we conjecture that the resulting mirror-symmetry bounds are tight and attained by pure qubit preparations.

25. **Marek Winczewski:** ENERGY COST OF A QUANTUM OPERATION: FROM AXIOMS TO A HAMILTONIAN FRAMEWORK

We present an axiomatic, platform-agnostic framework for determining the energy cost of a quantum operation. The cost is the minimal energy supplied by classical control to implement an operation, optimized over admissible implementations. It is constrained by subadditivity under sequential composition and locality under adding idle subsystems. To make the definition operational, we introduce a Hamiltonian model where a quantum system is coupled to a mesoscopic interface driven by classical fields and baths. The resulting time-dependent Liouvillian assigns work and heat flows to control channels, and the protocol cost is the time integral of positive incoming power flows. For a fixed platform, this gives a computable architecture-dependent upper bound on the fundamental cost.


Cave
Tanzberg
Penzion Vivaldi
Galant
Venue
Hotel Maroli
~ 1km
Boutique Hotel Templ
Penzion Terasa
Hill
Mikulov