THE GRAINGER COLLEGE OF ENGINEERING
+ COLLEGE OF LIBERAL ARTS & SCIENCES

BEYOND IID

2024 CONFERENCE

» **July 29-August 2, 2024**
The University of Illinois at Urbana - Champaign

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CONFERENCE COMMITTEES

Program Committee:

- Paula Belzig (University of Waterloo)
- Mario Berta (RWTH Aachen University; Chair)
- Andreas Bluhm (Laboratoire d'Informatique de Grenoble)
- Christoph Hirche (Technical University Munich and National University of Singapore)
- Zahra Baghali Khanian (Technical University Munich)
- Ludovico Lami (University of Amsterdam and QuSoft; Co-Chair)
- Aditya Nema (RWTH Aachen)
- Aadil Oufkir (University of Lyon)
- Uzi Pereg (Technion)
- Bartosz Regula (RIKEN Center for Quantum Computing)
- Xin Wang (Hong Kong University of Science and Technology Guangzhou)

Local Organizing Committee:

- Roy Araiza (University of Illinois)
- Eric Chitambar (University of Illinois)
- Marius Junge (University of Illinois)
- Felix Leditzky (University of Illinois; Chair)
- Amanda Young (University of Illinois)

Steering Committee:

- Holger Boche (Technische Universität München)
- Angela Capel (Universität Tübingen)
- Serge Fehr (CWI & Leiden University)
- Masahito Hayashi (Chinese University of Hong Kong Shenzhen, Shenzhen International
- Quantum Academy, & Nagoya University)
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- Ioannis Kontoyiannis (University of Cambridge)
- Marco Tomamichel (National University of Singapore)

BEYOND IID 2024 SPONSORS

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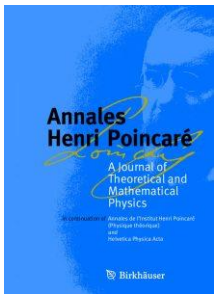
Department of Mathematics

Illinois Quantum Information Science & Technology Center



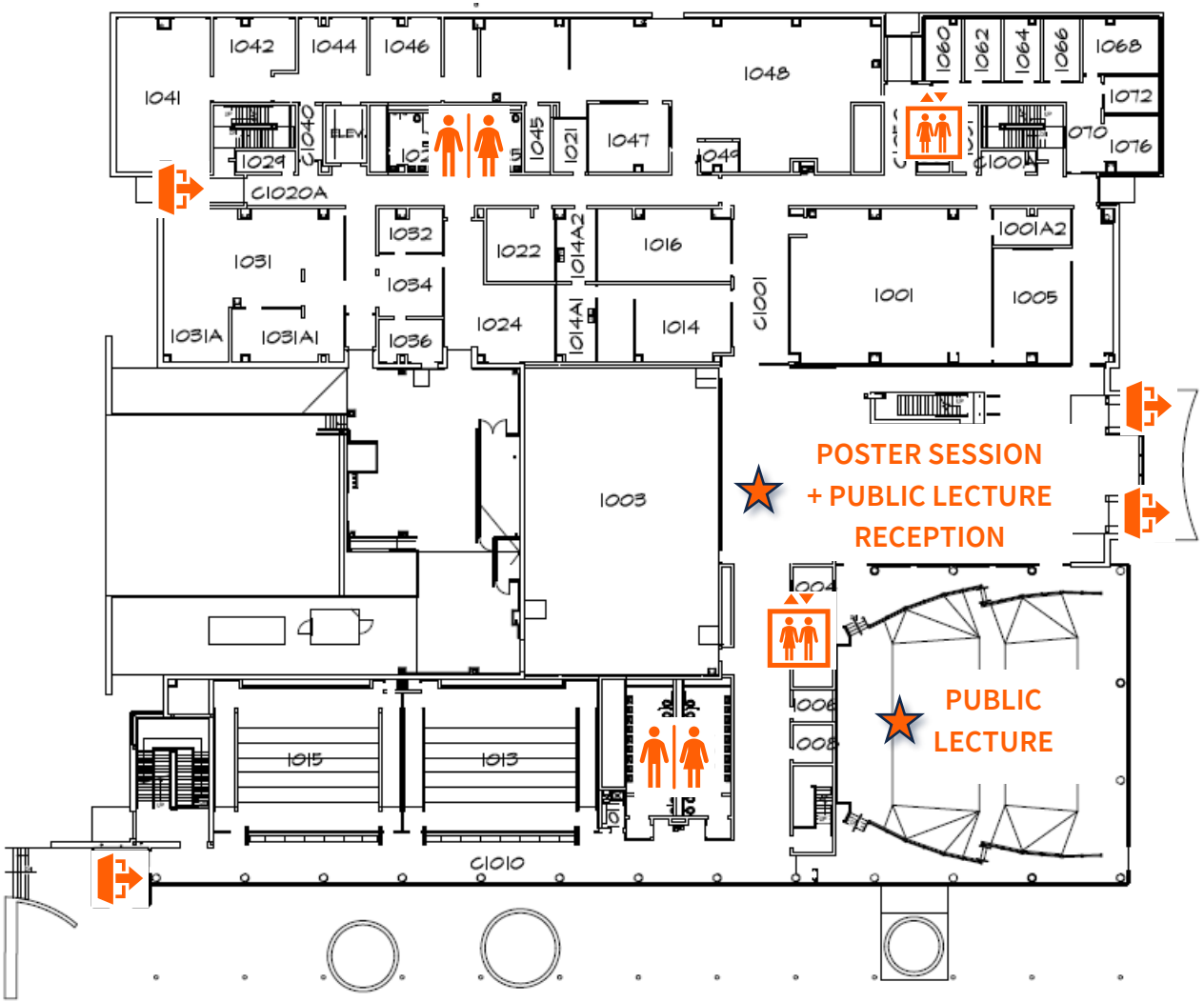
Journal of Mathematical Physics

MΠΦ

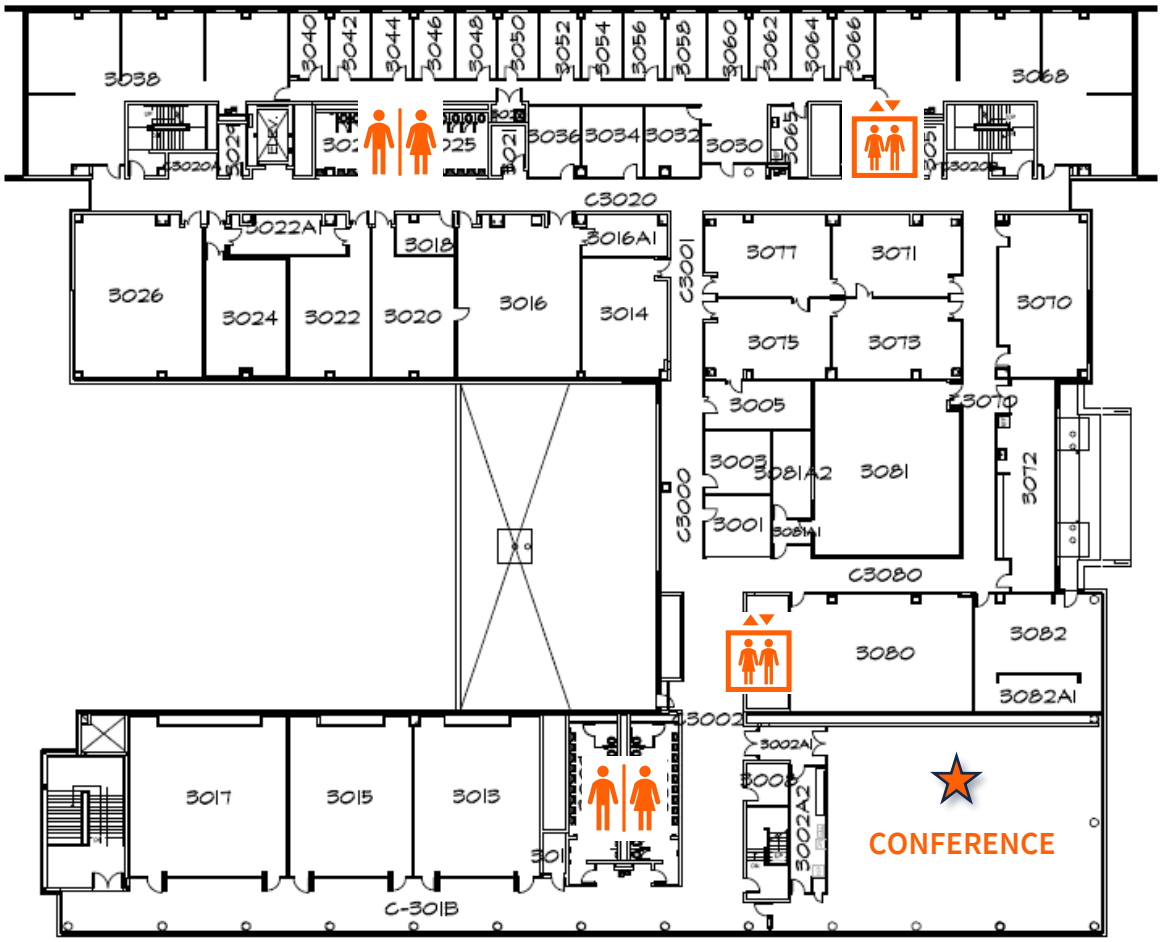
SCHEDULE AT A GLANCE

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08:30-09:00	Registration	Registration	Registration	Registration	Registration
09:00-09:30	Invited Talk *(Harrow)*	Invited Talk *(Nayak)*	Invited Talk *(Leung)*	Invited Talk *(Khurana)*	Invited Talk *(Vershynina)*
09:30-10:00					
10:00-10:30	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
10:30-11:00	Mazzola	Schmitt	Hirche	Kondra	Blakaj
11:00-11:30	Smith	Atif	Koßmann	Regula	Capel
11:30-12:00	Ji	Nema	Mishra	Zang	Fanizza
12:00-12:30	Bullock	Nuradha	Marwah	Lami	Beatty
12:30-13:00	Lunch Break	Lunch Break	Lunch Break	Lunch Break	Lunch Break
13:00-13:30					
13:30-14:00					
14:00-14:30	Kuroiwa	Jabbour		Belzig	Falco
14:30-15:00	Son	Arai		Lederman	Mele
15:00-15:30	Xuereb	LaRacuente		Nator	Coffee Break
15:30-16:00	Poster Session	Coffee Break		Coffee Break	Oliviero
16:00-16:30		Coffee Break		Coffee Break	Tanggara
16:30-17:00		Open Problem Session	Walking tour (optional)	Career Panel	
17:00-17:30					
17:30-18:00	Public Lecture *(Schumacher)*				
18:00-18:30					
18:30-19:00	Reception			Conference Dinner	
19:00-19:30					
19:30-20:00					
20:00-20:30					

FACILITY MAP



FACILITY MAP



CONFERENCE INFORMATION

ELECTRICAL AND COMPUTER ENGINEERING BUILDING

306 N. Wright St.
Urbana, IL 61801

Oral Sessions

All talks will be held at the Electrical and Computer Engineering Building in room 3002. Invited talks will be 50 minutes plus 10 minutes for questions. Contributed talks will be 25 minutes + 5 minutes for questions.

Poster Session

A poster session will take place Monday, July 29, 2024, from 3:30-5:30pm at the Electrical and Computer Engineering Building in the 1st floor atrium + lobby. Light refreshments will be served to enjoy while viewing poster presentations. A full listing of accepted posters can be found on starting on page 15. The available space on the poster boards for each poster is 48in wide x 48in tall (122 cm x 122 cm).

Public Lecture + Reception

A Public Lecture will take place on Monday, July 29, 2024, from 5:30-6:30pm in the Grainger Auditorium on the first floor of the Electrical and Computer Engineering Building. Following the lecture will be a reception until 8:30pm. Come and enjoy hors d'oeuvres and drinks while connecting with others in the Beyond IID community.

Open Problem Session

An open problem session will take place on Tuesday, July 30, 2024, from 4:30-6:00pm. In this session participants will have the chance to present their favorite open problem and engage the audience in discussions and possible solution attempts. This session has a long tradition at Beyond IID and has led to numerous new results.

Career Panel

A career panel will occur on Thursday, August 1, 2024 from 4:30-5:30pm. Panelists Mario Berta (RWTH Aachen), Emily Edwards (Duke University), Debbie Leung (University of Waterloo), Graeme Smith (IQC Waterloo), and Anna Vershynina (University of Houston) will introduce themselves in the plenary session and briefly talk about their careers. In break-out sessions, participants will have the opportunity to talk to the panelists and ask questions about careers in academia and industry.

Coffee Breaks

Coffee and light refreshments will be offered Monday-Friday mornings, plus Monday (during the poster session), Tuesday, Thursday, and Friday afternoons in the hallway outside of room 3002.

Lunch

Lunch breaks will be daily from 12:30-2pm as lunch will not be provided during the conference. Please check out options within walking distance.

CONFERENCE DINNER

Illini Union
1401 W. Green St.
Urbana, IL 61801
The conference dinner will take place on Thursday, August 1, 2024, from 6:30-9:30pm at the Illini Union Ballroom. a short 10-minute walk from the conference location.

WALKING TOUR EXCURSION

Join Experience Champaign-Urbana on Wednesday, July 31, 2024 at 4:30pm for a walking tour of our brilliant city! We will start at the Illini Union in the heart of campus, walk through Campustown, midtown at Boneyard Creek, and end in Downtown Champaign for dinner. Please note the walk is 1.3 miles (approximately 30 minutes). Staff will share fund facts and answer questions along the way. A dinning guide will be provided upon reaching Downtown Champaign for you to choose and pay for your own dinner. Bus tokens will be provided for transportation back to campus.

CONFERENCE SCHEDULE

MONDAY, JULY 29, 2024

3002 Electrical and Computer Engineering Building

8:15 am Registration Table Open

9:00 am Invited Talk: Aram Harrow, Massachusetts Institute of Technology
"Mary Beth Ruskai Memorial Lecture"

3rd Floor Hallway, Electrical and Computer Engineering Building

10:00 am Coffee Break

Shannon Theory – Session Chair: Christoph Hirche

3002 Electrical and Computer Engineering Building

10:30 am Giulia Mazzola, ETH Zürich
"Entropy of almost-iid states"

11:00 am Paula Belzig, University of Waterloo
"Fully quantum arbitrarily varying channel coding for entanglement-assisted communication"

11:30 am Kaiyuan Ji, Cornell University
"Postselected communication over quantum channels"

12:00 pm Bullock, Michael, University of Arizona
"Covert Communication over Classical-Quantum Channels"

12:30 pm Break for Lunch

Resource Theories – Session Chair: Bartosz Regula

3002 Electrical and Computer Engineering Building

2:00 pm Kohdai Kuroiwa, University of Waterloo
"Every quantum helps: Operational advantage of quantum resources beyond convexity"

2:30 pm Jeongrak Son, Nanyang Technological University
"A hierarchy of thermal processes collapses under catalysis"

3:00 pm Jake Xuereb, Technische Universität Wien
"Quantum Coding with Finite Thermodynamic Resources"

3:30 pm Conference Photograph

Atrium, Electrical and Computer Engineering Building

3:45 pm Poster Session

MONDAY, JULY 29, 2024 CONTINUED

Grainger Auditorium, Electrical and Computer Engineering Building

5:30 pm Public Lecture: Benjamin Schumacher, Kenyon College
"A brief prehistory of qubits"

Atrium, Electrical and Computer Engineering Building

6:30 pm Public Lecture Reception

8:30 pm Reception Concludes

TUESDAY, JULY 30, 2024

3002 Electrical and Computer Engineering Building

8:30 am Registration Table Open

9:00 am Invited Talk: Ashwin Nayak, University of Waterloo
"State distinguishability and learning"

3rd Floor Hallway, Electrical and Computer Engineering Building

10:00 am Coffee Break

One-Shot Shannon Theory – Session Chair: Uzi Pereg

3002 Electrical and Computer Engineering Building

10:30 am Lukas Schmitt, ETH Zürich
"Cutting circuits with multiple two-qubit unitaries"

11:00 am Touheed Anwar Atif, University of Michigan
"Quantum soft-covering lemma with applications to rate-distortion coding, resolvability and identification via quantum channels"

11:30 am Aditya Nema, RWTH Aachen
"One shot multiple access channel simulation"

12:00 pm Theshani Nuradha, Cornell University
"An invitation to the sample complexity of quantum hypothesis testing"

12:30 pm Break for Lunch

Mathematical Physics – Session Chair: Mario Berta

3002 Electrical and Computer Engineering Building

2:00 pm Michael Jabbour, Université libre de Bruxelles
"Tightening continuity bounds on entropies and bounds on quantum capacities"

2:30 pm Hayato Arai, RIKEN Center for Quantum Computing
"One-shot and asymptotic classical capacity in general physical theories"

TUESDAY, JULY 30, 2024 CONTINUED

3:00 pm Nicholas LaRacuente, University of Indiana Bloomington
"Approximate Unitary k-Designs from Shallow, Low-Communication Circuits"

3rd Floor Hallway, Electrical and Computer Engineering Building

3:30 pm Coffee Break

3002 Electrical and Computer Engineering Building

4:30 pm Open Problem Session

6:00 pm Session Concludes

WEDNESDAY, JULY 31, 2024

3002 Electrical and Computer Engineering Building

8:30 am Registration Table Open

9:00 am Invited Talk: Debbie Leung, University of Waterloo & Perimeter Institute for Theoretical Physics
"Christopher King Memorial Lecture"

3rd Floor Hallway, Electrical and Computer Engineering Building

10:00 am Coffee Break

Quantum Entropies – Session Chair: Ludovico Lami

3002 Electrical and Computer Engineering Building

10:30 am Christoph Hirche, Leibniz Universität Hannover
"Quantum Rényi and f-divergences from integral representations"

11:00 am Gereon Koßmann, RWTH Aachen
"Optimising the relative entropy under semi definite constraints – A new tool for estimating key rates in QKD"

11:30 am Hemant K. Mishra, Cornell University
"On the optimal error exponents for classical and quantum antidistinguishability MERGED WITH Multivariate Fidelities"

12:00 pm Ashutosh Marwah, Université de Montréal
"Universal smooth min-entropy chain rules from entropic triangle inequalities"

12:30 pm Session Concludes + Free Afternoon

4:30 pm **Walking Tour Excursion (optional)**
Meet on the north side of the Illini Union

THURSDAY, AUGUST 1, 2024

3002 Electrical and Computer Engineering Building

8:30 am Registration Table Open

9:00 am Dakshita Khurana, University of Illinois Urbana-Champaign
"Cryptographic Hardness in a Quantum World"

3rd Floor Hallway, Electrical and Computer Engineering Building

10:00 am Coffee Break

Entanglement Theory – Session Chair: Eric Chitambar

3002 Electrical and Computer Engineering Building

10:30 am Tulja Varun Kondra, Heinrich Heine University Düsseldorf
"Catalytic and asymptotic equivalence for quantum entanglement"

11:00 am Bartosz Regula, RIKEN Center for Quantum Computing
"Connecting entanglement distillation and entanglement testing with restricted measurements"

11:30 am Allen Zang, University of Chicago
"No-Go Theorems on Universal Entanglement Purification"

12:00 pm Ludovico Lami, University of Amsterdam & QuSoft
"Computable entanglement cost"

12:30 pm Break for Lunch

Shannon Theory Beyond IID – Session Chair: Aditya Nema

3002 Electrical and Computer Engineering Building

2:00 pm Graeme Smith, University of Waterloo
"A class of non-degradable channels with additive maximal coherent information"

2:30 pm Meir Lederman, Technion
"Secure Communication with Unreliable Entanglement Assistance: Interception and Loss"

3:00 pm Hosen Nator, Technion
"Quantum Coordination in Multi-User Networks"

3rd Floor Hallway, Electrical and Computer Engineering Building

3:30 pm Coffee Break

3002 Electrical and Computer Engineering Building

4:30 pm Career Panel

6:00 pm Career Panel Concludes

THURSDAY, AUGUST 1, 2024 CONTINUED

Illini Union Ballroom, 1401 W. Green St., Urbana, IL 61801

6:30 pm Conference Dinner

9:30 pm Conference Dinner Concludes

FRIDAY, AUGUST 2, 2024

3002 Electrical and Computer Engineering Building

8:30 am Registration Table Open

9:00 am Invited Talk: Anna Vershynina, University of Houston
"Quantum resource theory of coherence"

3rd Floor Hallway, Electrical and Computer Engineering Building

10:00 am Coffee Break

Quantum States and Learning Theory – Session Chair: Ian George

3002 Electrical and Computer Engineering Building

10:30 am Vjosa Blakaj, Technische Universität München
"On the set of reduced states of translation invariant, infinite quantum"

11:00 am Xinan Chen
"Entanglement distribution from a central source"

11:30 am Marco Fanizza, Universitat Autònoma de Barcelona
"Learning finitely correlated states: stability of the spectral reconstruction"

12:00 pm Emily Beatty, ENS Lyon
"Order p quantum Wasserstein distances from couplings"

12:30 pm Break for Lunch

Continuous Variables and Error Correction – Session Chair: Paula Belzig

3002 Electrical and Computer Engineering Building

2:00 pm Alessandro Falco, Scuola Normale Superiore di Pisa
"The multimode conditional quantum Entropy Power Inequality and the squashed entanglement of the extreme multimode bosonic Gaussian channels"

2:30 pm Francesco Anna Mele, Scuola Normale Superiore di Pisa
"Learning quantum states of continuous variable systems"

3rd Floor Hallway, Electrical and Computer Engineering Building

3:00 pm Coffee Break

FRIDAY, AUGUST 2, 2024 CONTINUED

3002 Electrical and Computer Engineering Building

3:30 pm	Salvatore F.E. Oliviero, Scuola Normale Superiore di Pisa “Magic-induced computational separation in entanglement theory”
4:00 pm	Andrew Tanggara, National University of Singapore “Strategic Code: A Unified Spatio-Temporal Framework for Quantum Error-Correction”
4:30 pm	Session Concludes

POSTER SESSION PROGRAM

1. Laura Burri, ETH Zürich
   "Doubly minimized Petz Renyi mutual information"

2. Jihong Cai, University of Illinois Urbana-Champaign
   "Upper and Lower bounds for Simulating the Quantum Birth-Death Process"

3. Xinan Chen, University of Illinois Urbana-Champaign
   "Entanglement distribution from a central source"

4. Ian George, University of Illinois Urbana-Champaign
   "Time-Constrained Local Quantum State Discrimination"

5. Haiyun He, Cornell University
   "Information-Theoretic Generalization Bounds for Deep Neural Networks"

6. Tulja Varun Kondra, Heinrich Heine University Düsseldorf
   "Coherence Manipulation in Asymmetry and Thermodynamics"

7. Yun-Feng Lo, Georgia Institute of Technology
   "Degradability of Modified Landau-Streater Type Low-Noise Quantum Channels in High Dimensions"

8. Florian Meier, Technische Universität Wien
   "Autonomous Quantum Processing Unit: What does it take to construct a self-contained model for quantum computation?"

9. Hailey Murray, University of Illinois Urbana-Champaign
   "Quantum Channel Masking"

10. Theshani Nuradha, Cornell University
    "Fidelity-Based Smooth Min-Relative Entropy: Properties and Applications"

11. Dhrumil Patel, Cornell University
    "Quantum Neural Estimation of Entropies"

12. Aby Philip, Cornell University
    "Device Independent Certification of Tripartite Distillable Entanglement"

13. Huang RuoCheng, Nanyang Technological University
    "Quantum Pattern Engine"

14. Vishal Singh, Cornell University
    "Limitations on one-way secret-key distillation via unextendibility"

15. Jeongrak Son, Nanyang Technological University
    "Quantum dynamic programming from quantum instructions"

POSTER SESSION PROGRAM CONTINUED

16. Jun Su, The University of Hong Kong
    "Effect of Feedback on the Capacity of the Continuous-time ARMA(1,1) Gaussian Channel"

17. Chris Vairogs, University of Illinois Urbana-Champaign
    "Localizable multipartite entanglement"

18. Rabins Wosti, University of South Carolina
    "Optimal lower bound for lossless quantum block encoding"

19. Shiv Akshar Yadavalli, Duke University
    "Noisy Quantum Trees: Infinite Protection without Correction"

20. Julius Zeiss, RWTH Aachen
    "Approximating Fixed Size Quantum Correlations in Polynomial Time"

21. Yanbao Zhang, Oak Ridge National Laboratory
    " An efficient method for spot-checking quantum properties with sequential trials"

22. Stephen Zhou, University of Illinois Urbana-Champaign
    "On the distinguishability of geometrically uniform quantum states"

INVITED SPEAKER ABSTRACTS

In order of appearance in program

Invited Speaker: Aram Harrow
Title: *Mary Beth Ruskai Memorial Lecture*
Abstract: TBD

Invited Speaker: Benjamin Schumacher
Title: *A brief prehistory of qubits*
Abstract: Wernher von Braun is supposed to have said, "Research is what I'm doing when I don't know what I'm doing." The path to a new idea is seldom straight, and travelers seldom know what their actual destination will be. I intend to illustrate all this by describing the origin of the word "qubit" and the concept of quantum data compression in the early days of quantum information theory. The story will have some elements familiar to explorers: setting out, wandering around, getting lost, finding clues, getting stuck, giving up, changing course, reaching goals -- and finding oneself in a huge new territory that even now, thirty years on, is not fully understood.

Invited Speaker: Ashwin Nayak
Title: State distinguishability and learning
Abstract: A basic problem in quantum communication is that of recovering classical information encoded in quantum states. Several problems in learning theory may naturally be cast into this form. We will describe some problems of this nature, specifically the coupon collector problem and its variants. We will present more efficient algorithms as well as lower bounds for these problems, along with implications for learning. Based on work with Shima Bab Hadiashar and Pulkit Sinha.

Invited Speaker: Debbie Leung
Title: *Christopher King Memorial Lecture*
Abstract: TBD

Invited Speaker: Dakshita Khurana
Title: *Cryptographic Hardness in a Quantum World*
Abstract: A flurry of exciting recent work has shown that the mathematical assumptions required to realize cryptosystems (beyond QKD) in a quantum world can be significantly weaker than their classical counterparts. This talk will discuss recent progress and some remaining challenges in understanding the assumptions that enable cryptography in a quantum world. The talk will not assume any prior background in cryptography.

Invited Speaker: Anna Vershynina
Title: *Quantum resource theory of coherence*
Abstract: Coherence describes the existence of quantum interference. We will discuss both static and dynamic quantum resource theory of coherence. Quantum resource theory considers some resources (states in the static theory and channels in the dynamic one) as free and the rest as a non-free resource. Accompanying these free resources are free quantum operations on them (quantum channel in the static theory and super-channels in the dynamic one), which leave the set of free resources invariant. The resource theory then studies information processing tasks that become possible using these operations. I will talk about the often used coherence measures of states, and will present new measures of the coherence of channels