Workshop I: Optimal Transport for Density Operators: Theory and Numerics

MARCH 31 - APRIL 4 , 2025

Scientific Overview

The quest to devise a non-commutative counterpart of the Monge-Kantorovich optimal transport theory began about thirty years ago with early proposals by A. Connes and D. Voiculescu. These early attempts focused mostly on the static Monge and Kantorovich formulations using duality theory. More recently, several formulations for the non-commutative counterpart of the Optimal Transport problem and Wasserstein distances have been proposed motivated by computational challenges and applications in Theoretical Chemistry and Quantum Physics.

The primary goal of this workshop is to foster collaborations and build bridges between three disjoint worlds of non-commutative (static) optimal transport, on both theoretical and computational aspects as well as potential developments in Quantum Physics and Electronic Structure Theory. This includes

- Monge-Kantorovich formulation of Non-commutative Optimal Transport
- Operator and Tensor Scaling
- Quantum Optimal Transport between quantum channels and qubits
- Optimal Transport methods in Density Functional Theory
- Developments in Reduced Density Matrix Functional Theory
- (Static) Optimal Transport Theory for von-Neumann algebras

Long Program Schedule

This workshop is part of the long program Non-commutative Optimal Transport

- Non-commutative Optimal Transport Opening Day : March 10, 2025
- Non-commutative Optimal Transport Tutorials : March 11-14, 2025
- Workshop I: Optimal Transport for Density Operators: Theory and Numerics : March 31 - April 4, 2025
- Workshop II: Dynamics of Density Operators : April 28 - May 2, 2025
- Workshop III: Statistical and Numerical Methods for Non-commutative Optimal Transport : May 19-23, 2025
- Non-commutative Optimal Transport Culminating Workshop at Lake Arrowhead : June 9-13, 2025

This workshop will include a poster session; a request for posters will be sent to registered participants before the workshop.

Participation

Additional information about this workshop including links to register and to apply for funding, can be found on the webpage listed below. Encouraging the careers of women and minority mathematicians and scientists is an important component of IPAM's mission, and we welcome their applications.

Organizers

Eugene De Prince (Florida State University)
Augusto Gerolin (University of Ottawa)
Katarzyna Pernal (Politechnika Lodzka)
Dario Trevisan (Università di Pisa)

Invited Speakers

Jason Altschuler (University of Pennsylvania)
Paul Ayers (McMaster University)
Alice Cortinovis(Stanford University)
Andreas Deuchert (Virginia Tech)
Virginie Ehrlacher (Ecole des Ponts ParisTech)
Shmuel Friedland (University of Illinois)
Tryphon Georgiou (University of California, Irvine (UCI)
Eberhard Gross (The Hebrew University of Jerusalem)
BobakToussi Kiani (Harvard University)
PeterKnowles(Cardiff University)
Julia Liebert (Ludwig-Maximilians-Universität München)
Milad Marvian (University of New Mexico)
Rafael Oliveira (University of Waterloo)
Michele Pavanello(Rutgers University-Newark)
Lorenzo Portinale (University of Bonn)
Simone Rademacher(Ludwig-Maximilians-Universität München)
Akshay Ramachandran(Universiteit van Amsterdam
Nicholas Rubin(Google Inc.)
Daniel Stilck Franca (École Normale Supérieure de Lyon)
Sarina Sutter (Vrije Universiteit)
Silvia Villa (Università di Genova)

For more information, visit the program web page:
www.ipam.ucla.edu/NOTWS1