

# YU TIAN

MPI PKS | CBG

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## RESEARCH INTEREST

Network Science, Network Dynamics and Optimisation, Mathematical Statistics and Data Science.

## ACADEMIC POSITIONS

**Max Planck Institute for Physics of Complex Systems | Cell Biology and Genetics  
(MPI PKS | CBG)** **Dresden, Germany**  
Research Fellow Oct. 2024 -  
• ELBE Postdoctoral Fellow, Center for Systems Biology Dresden (CSBD)  
• Leave for ill close relatives: Jan. - May 2025

**Nordita, Stockholm University and KTH Royal Institute of Technology** **Stockholm, Sweden**  
Research Fellow Oct. 2022 - Oct. 2024  
• Funding: Wallenberg Initiative on Networks and Quantum information (WINQ).  
• PIs: Prof. Frank Wilczek (MIT) and Prof. John Wettlaufer (Yale University).

## EDUCATION

**University of Oxford** **Oxford, UK**  
*Ph.D. Mathematics* Sep. 2018 - Oct. 2022  
*EPSRC Centre for Doctoral Training for Industrially Focused Mathematical Modelling (InFoMM CDT)*  
• Thesis: Role Extraction, Dynamics, and Optimisation on Networks; supervised by Prof. Renaud Lambiotte (Oxford), and industrial collaborators Dr. Alisdair Wallis, Dr. Sebastian Lautz (Tesco).

## HONOURS AND AWARDS

- Travel Grant from Aalto Science Institute (01/2026)
- Travel Scholarship from Wenner-Gren Foundation (10/2024)
- Simons Foundation Fellowship from Isaac Newton Institute (07 - 08/2024)
- EPSRC InFoMM CDT Studentship (fully-funded PhD studentship, 2018 – 2022)
- First Prize in China Undergraduate Mathematical Contest in Modelling (Beijing, 09/2016 & 09/2015)
- First-Class People's Scholarship (5% in academia, 2014-2016)
- National Scholarship (5% in academic, research and other activities, 2014-2015)

## PUBLICATIONS AND PREPRINTS

\*co-first author | †surname order

### Preprints

16. A. Gallo, **Y. Tian**, R. Lambiotte, and T. Carletti. *Global synchronization in matrix-weighted networks*. Preprint, arXiv:2507.12322, 2025. (Accepted by Commun. Phys.)
15. M. Strindberg, **Y. Tian**, and P. Fransson. *Whole-brain entrainment and anticipation in fMRI motor task data*. Preprint, bioRxiv 2025.01.31.635910, 2025.
14. X. Meng† and **Y. Tian**†. *Finding hypergraph immersion is fixed-parameter tractable*. Preprint, arXiv:2411.16017, 2024.
13. **Y. Tian**, Y. Liu, and X. Meng. *Multipartite entanglement routing as a hypergraph immersion problem*. Preprint, arXiv:2406.13452, 2024.

### Peer-reviewed Publication in Mathematics and Physics

12. **Y. Tian**, S. Kojaku, H. Sayama, and R. Lambiotte. *Matrix-weighted networks for modeling multi-dimensional dynamics: Theoretical foundations and applications to network coherence*. Phys. Rev. Lett., 134, 237401, 2025.
11. **Y. Tian**, and E. Estrada. *Balance with memory in signed networks via Mittag-Leffler matrix functions*. SIAM J. Matrix Anal. Appl., 46, 2, 1460–1483, 2025.
10. R. Wang, **Y. Tian**, P. Liò, and G. Bianconi. *Dirac-equation signal processing: physics boosts topological machine learning*. PNAS Nexus, 4, 5, pgaf139, 2025.
9. S. Babul, **Y. Tian**, and R. Lambiotte. *Strong and weak random walks on signed networks*. npj Complexity, 2, 4, 2025
8. L. Gyllingberg\*, **Y. Tian\***, and D. Sumpter. *A minimal model of cognition based on oscillatory and reinforcement processes*. J. R. Soc. Interface, 22, rsif.2024.0402, 2025.
7. **Y. Tian\***, Z. Lubberts\* and M. Weber. *Curvature-based clustering on graphs*. JMLR, 26 (52), 1 - 67, 2025.
6. **Y. Tian** and R. Lambiotte. *Structural balance and random walks on complex networks with complex weights*. SIAM J. Math. Data Sci., 6(2), 372 - 399, 2024.
5. **Y. Tian** and R. Lambiotte. *Spreading and structural balance on signed networks*. SIAM J. Appl. Dyn. Syst., 23(1), 50 - 80, 2024.
4. X. Meng, X. Hu, **Y. Tian**, G. Dong, R. Lambiotte, J. Gao, and S. Havlin. *Percolation theories for quantum networks*, Entropy, 25(11), 1564, 2023.
3. **Y. Tian**, Z. Lubberts and M. Weber. *Mixed-membership community detection via line graph curvature*. NeurIPS Symmetry and Geometry in Neural Representations, 2023.
2. **Y. Tian** and R. Lambiotte. *Unifying information propagation models on networks and influence maximization*. Phys. Rev. E, 106, 034316, 2022.

### Peer-reviewed Publication in Interdisciplinary Research

1. **Y. Tian**, S. Lautz, A. Wallis and R. Lambiotte. *Extracting complements and substitutes from sales data: a network perspective*. EPJ Data Sci., 10:45, 2021.

## SELECTED COMMUNICATIONS

### Invited talks

- Seminar at Statistical Physics Youth Communications (Virtual). (Oct. 2025)
- Seminar at Technical University of Dresden, Dresden, Germany (Oct. 2025)
- Math and AI Meeting jointly at MPI for Mathematics in Sciences, ScaDS.AI, and MPI for Human Cognitive and Brain Sciences, Leipzig, Germany (Oct. 2025)
- Computational Science Seminar at Frankfurt School, Frankfurt, Germany (Aug. 2025)
- SIAM Conference on Mathematics of Data Science, Atlanta, US. (Oct. 2024)
- Isaac Newton Institute Satellite Programme on Hypergraphs: theory and applications, London, UK. (July 2024)
- NERDS (NEtworks, Data, and Society) Seminar, IT University of Denmark, Copenhagen, Denmark. (Apr. 2024)
- Seminar at Technical University of Denmark, Copenhagen, Denmark. (Apr. 2024)
- Seminar at Niels Bohr Institute, Copenhagen, Denmark. (Apr. 2024)
- Nordic Workshop on Statistical Physics: Biological, Complex and Non-equilibrium Systems, Stockholm, Sweden. (Mar. 2024)
- Seminar at Vermont Complex Systems Center (Virtual), Vermont, US. (Mar. 2024)
- Seminar at Binghamton Center of Complex Systems (Virtual), New York, US. (Feb. 2024)
- Applied and Interdisciplinary Seminar at University of Bath, Bath, UK. (Feb. 2024)
- NetPLACE Seminar (Virtual). (Feb. 2024)
- Seminar at Imperial College London, London, UK. (Feb. 2024)
- CASA Seminar at University College London, London, UK. (Feb. 2024)
- Seminar at Queen Mary, University of London, London, UK. (Jan. 2024)
- Seminar at Linköping University, Linköping, Sweden. (Sep. 2023)
- Seminar at Indiana University (Virtual), Bloomington, US. (Sep. 2023)
- Seminar at Northwestern University (Virtual), Chicago, US. (Aug. 2023)
- BrainNet workshop at KTH, Stockholm, Sweden. (May, 2023)
- SIAM Conference on Applications of Dynamical System, Portland, US. (May 2023)

- Seminar at Uppsala University, Uppsala, Sweden. (May 2023)
- Soft Matter Seminar at Nordita, Stockholm, Sweden. (Oct. 2022)
- Seminar at Technical University of Munich (Virtual), Munich, Germany. (May 2022)
- Seminar at Dartmouth College (Virtual), Hanover, US. (Jan. 2022)
- Oxford Networks Seminar (Virtual), University of Oxford, UK. (May 2021)

#### Contributed talks

- HOOC (Higher Order Opportunities and Challenges) Workshop, Aachen, Germany (Aug. 2025)
- Conference on Network Sciences, Maastricht, Netherlands. (June 2025)
- Conference on Network Sciences, Quebec city, Canada. (June 2024)
- British NetSci Symposium, London, UK. (May 2024)
- WINQ Mini-Workshop at Nordita, Stockholm, Sweden. (Feb. 2023)
- The 4th IMA Conference on The Mathematical Challenges of Big Data, University of Oxford, UK. (Sep. 2022)
- SIAM Workshop on Network Science (Virtual). (Sep. 2022)
- Conference on Network Sciences (NetSci) (Virtual), Shanghai, China. (July 2022)
- Industrial Mathematics in the 21st Century: A cornucopia of unsolved problems, University of Oxford, UK. (June 2022)
- InFoMM Annual Meeting, University of Oxford, UK. (June 2022)
- SIAM UKIE National Student Chapter Conference, Edinburgh, UK. (June 2022)
- The 13th International Conference on Complex Networks (CompleNet) (Virtual), Exeter, UK. (May - June 2022)
- The 10th International Conference on Complex Networks and their Applications (CNA), Madrid, Spain. (Nov. 2021)
- Conference on Complex Systems (CCS), Lyon, France. (Oct. 2021)
- InFoMM Annual Meeting (Virtual), University of Oxford, UK. (July 2021)

## TEACHING EXPERIENCE

### MPI CBG | Dresden International PhD Program

*Co-Lecturer*

Dresden, Germany

Sep. 2025 - Nov. 2025

- Physical Principles in Biology, 2025  
Topics: Dynamics Systems; Complex Systems and Networks

### University of Oxford

*Tutor*

Oxford, UK

Oct. 2021 - Dec. 2021

- Introduction to Statistics, Michaelmas Term 2021

### Teaching Assistant

Oct. 2019 - Apr. 2020

- Networks, Hilary Term 2020
- Graph Theory, Michaelmas Term 2019

## PROFESSIONAL EXPERIENCE

### Reviewers

- **Journals:** Science Advances, Scientific Reports, PNAS Nexus, PLOS Complex Systems, Physica A: Statistical Mechanics and its Applications, Advances in Complex Systems.
- **Conferences:** International AAAI Conference on Web and Social Media, NeurIPS New Perspectives in Graph Machine Learning.

### Organisers

- WINQ Workshop on Complex Dynamical Networks, Nordita Apr. 2024 - May 2024
- Session at INFORMS 2023 Annual Meeting, Phoenix Oct. 2023  
*Session Title: Networks in Machine Learning and Data Science*
- WINQ Mini-Workshop, Nordita Feb. 2023

- WINQ Seminar, Nordita Oct. 2022 - Oct. 2024
- Oxford Networks Seminar, University of Oxford Oct. 2021 - June 2022

#### Service and Outreach

- Equity, Diversity and Inclusion (EDI) Committee Member, Nordita Oct. 2023 - Oct. 2024

### INDUSTRIAL EXPERIENCE

#### University of Oxford

Oxford, UK

InFoMM CDT Mini-Project: Inter-District Packaged Gas Optimisation.

Jul. - Sep. 2019

Supervisors: Prof. Raphael Hauser (Oxford), Dr. Peter Connard, Dr. Harsida Jenkins (Air Products)

- Formulated the problem of both inventory management and transshipment of products as a mixed integer programming, and reviewed state-of-the-art techniques.
- Proposed several relaxation methods based on Lagrangian relaxation to improve solving efficiency.

InFoMM CDT Mini-Project: Halo Effect and Demand Transfer on Products.

Apr. - Jun. 2019

Supervisors: Prof. Renaud Lambotte (Oxford), Dr. Alisdair Wallis (Tesco).

- Devised a method combining Poisson processes with time series analysis to identify the product relationships from aggregated sales data quantitatively.
- Applied regression techniques, and proposed several validation methods with real data.

### TECHNOLOGY SKILLS

- **Programming:** Proficiency in Python (pandas, numpy, scipy, networkx, statsmodels, scikit-learn etc), MATLAB; Familiarity with R Language, C Language.
- **Optimisation:** MOSEK, Lingo.

### MEMBERSHIPS

- The Institute for Operations Research and the Management Sciences (INFORMS), Member
- Society for Industrial and Applied Mathematics (SIAM), Early Career Member
- Institute of Mathematics and its Applications (IMA), Associate Member