Curriculum Vitae

Dr. Edward A. Mazenc

Institute for Theoretical Physics
ETH Zürich
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(Dual French-US Citizen – English/French/German/Italian)

1 Academic Postitions

- **SwissMAP Research Fellow, ETH Zürich (2023-Present)**
  - Postdoctoral fellow at the Institute for Theoretical Physics in Prof. Gaberdiel's group, focusing on *derivations* of holographic dualities, and uncovering the underlying mechanism as to how large N gauge theories rearrange themselves into string theories.
- **Kadanoff Fellow, University of Chicago, Chicago, IL (2020-2023)**
  - Postdoctoral fellow at the Kadanoff Center for Theoretical Physics & Enrico Fermi Institute, concentrating on precision derivations of gauge/string duality, and applying holography to the cosmological setting of de-Sitter space via the so-called $T\bar{T} + \Lambda_2$ deformation.

2 Education

- **PhD in Theoretical Physics, Stanford University, Stanford, CA (2014-2020)**
  - Applications of quantum information theoretic ideas to holography, with special focus on the emergence of space-time in the context of matrix quantum mechanics and the $T\bar{T}$-deformation of (holographic) quantum field theories.
  - Thesis Committee: Prof. Sean Hartnoll (Doctoral Advisor), Prof. Steve Shenker, Prof. Eva Silverstein & Prof. Leonard Susskind
- **Master of Advanced Study in Theoretical Physics, University of Cambridge, Cambridge, UK (2013-2014)**
  - First Class Honors in Part III of the Mathematics Tripos, Department of Applied Mathematics and Theoretical Physics (DAMTP)
- **S.B. in Physics, Massachusetts Institute of Technology (MIT), Cambridge, MA (2009-2013)**
  - Honors Thesis "Multifield Inflation and Differential Geometry"
  - Thesis supervisors: Profs. Alan Guth and David Kaiser
- **Abitur, German State School for Gifted Students, Schwäbisch Gmünd, GERMANY (2008)**
  - Highest possible score of 1.0
- **Baccalauréat Scientifique, Académie de Reims, FRANCE (2007)**
  - Physics-Chemistry focus

3 Honors and Awards

- **NSF Graduate Research Fellow**, National Science Foundation
- **Alan Barett Prize** (awarded for best undergraduate or graduate thesis work in Astrophysics and Cosmology), MIT (2013)

4 Publications

- **"Strings from Feynman Diagrams"**, Gopakumar, R.; Kaushik, R.; Komatsu, S.; Mazenc, E. A.; Sarkar, D. [arXiv:2412.13397],
  - Provided precise realization of 't Hooft's vision as to how gauge theory Feynman diagrams encode the worldsheet of a dual closed string theory for the 1/2 SUSY sector of $\mathcal{N} = 4$ Super Yang-Mills. Demonstrated open-closed-open triality of this subsector of the AdS/CFT correspondence in terms of open strings on giant graviton branes.
- **"Deriving the Simplest Gauge/String Duality I: Open-Closed-Open Triality"**, Gopakumar, R. & Mazenc, E. A. [arXiv:2212.05999]
  - We show there exists two types of open/closed string duality underlying holography. By considering two stacks of branes, we derive two dual open string descriptions for the same closed string theory by exactly integrating out either stack. From it, we map a general 2-matrix chain onto the Imbibo-Mukhi matrix integral for the $c = 1$ string at self-dual radius. This establishes a useful correspondence between traces and tachyon vertex operators in the $c = 1$ string.
- **"De Sitter microstates from $T\bar{T} + \Lambda_2$ and the Hawking-Page transition"**, Coleman, E., Mazenc, E. A., Shyam, V., Silverstein, E., Soni, R. M., Torroba, G., & Yang, S., JOURNAL OF HIGH ENERGY PHYSICS, (2022)
  - Matched the Bekenstein-Hawking entropy of the de-Sitter cosmological horizon by counting certain energy eigenstates of a $T\bar{T} + \Lambda_2$ deformed holographic CFT. The solvability of the deformation plays a role akin to BPS-protection in the celebrated Strominger-Vafa derivation.
- **"The Schur Expansion of Characteristic Polynomials and Random Matrices"**, Kimura, T. & Mazenc, E.A., [arXiv:2111.02365]
  - Gave previously unobtainable, exact in N answers for arbitrary k-point correlators of (inverse) determinants in random matrix theory, including within the novel regime of $k > N$.
- *** "Heat-based Decontamination of N95 Masks Using a Commercial Laundry Dryer", Lensky Y.D., Mazenc, E.A., Ranard, D., Vilim, M., Prakash, M., Brooks B., Bradley A., Engelschenschilt, A., Plutz, J., Zellmer T., medRxiv; 2020. DOI: 10.1101/2020.07.22.20160283.
- *** "Heat and Humidity for Bioburden Reduction of N95 filtering Facepiece Respirators", Anderegg, Loïc, et al., Applied Biosafety 26.2 (2021), https://doi.org/10.1089/apb.20.0053
- **"A $T\bar{T}$-Deformation for Curved Spacetimes from 3D Gravity"**, Mazenc, E.A., Soni, R.M., Shyam, V., [arXiv:1912.09179]
  - Proposed a curved spacetime generalization of the $T\bar{T}$-deformation by relating the flow equation to a radial Wheeler-de-Witt equation and identifying the deformed partition function as an annulus amplitude in 3d topological gravity.
- **"Target Space Entanglement Entropy"**, Mazenc, E.A. & Ranard, D., [arXiv:1910.07449]
  - In first quantized theories, such as worldsheet string theory, the physical space is the target space (and not the "base space"/worldsheet). Using the theory of von Neumann algebras, we defined a novel entanglement measure to describe partitions of the target space by identifying a relevant subalgebra of operators.

*** : Volunteered in Stanford Bio-Engineering Lab, led by Prof. Manu Prakash, during the COVID-19 pandemic in 2020, working on practical methods to address the shortage of protective gear in high-risk environments. Joined the N95-Decon Consortium, an interdisciplinary group of scientists based primarily at Stanford, UCSF & Harvard, working on similar problems.

- **"A Path Integral Realization of Joint $J\bar{T}$, $\bar{J}T$ & $T\bar{T}$ Flows"**
  - Demonstrated that the joint $J\bar{T}$, $\bar{J}T$ & $T\bar{T}$ deformations of two-dimensional quantum field theories could be written as coupling the original theory to a mixture of topological gravity and gauge theory.
- **"Topological Order in Matrix Ising Models"**
  - In the search of quantum gravity models with a finite dimensional Hilbert space, we explored how a continuous matrix integral captures the physics of N^2 Ising spins in the large N limit, a phenomenon known in the condensed matter literature as "spin softening". Known phase transitions in the matrix description predicted novel phases above the onset of glassiness, diagnosed by the connectedness of the eigenvalue distribution.
- **"Matrix Quantum Mechanics from Qubits"**, Hartnoll, S. A., Huijse, L., Mazenc, E. A. , JHEP 1701 (2017) 10, [arXiv:1608.05090]
  - Constructed a concrete realization of "It-from-Qubit" by deriving a holographic matrix quantum mechanics from a large N, non-local qubit system.
- **"Entanglement Entropy in Two-Dimensional String Theory"**, Hartnoll, S. A., & Mazenc, E. A., PHYS. REV.LETT. 115 (2015) no.12, 121602 [arXiv:1504.07985]
  - Derived UV-finite bulk entanglement entropy in two-dimensional string theory from eigenvalue entanglement in the dual 0+1-dimensional "c = 1" matrix quantum mechanics.
  - Editor's Suggestion, October 2015
- **"Primordial bispectrum from multifield inflation with nonminimal couplings."**, Kaiser, D. I., Mazenc, E. A., Sfakianakis, E. I., PHYSICAL REVIEW D87, 064004 . [arXix:1210.7487]
  - Recast multifield inflation with non-trivial field space metric in geometric terms and computed primordial bispectrum in a covariant formalism.

5 Teaching

- Teaching Assistant for Introductory Mechanics, (Stanford University, PHYSICS 41)
- Teaching Assistant for Introductory Thermodynamics & Optics (Stanford University, PHYSICS 45)
- Teaching Assistant for Honors Electricity & Magnetism, (Stanford University, PHYSICS 63)

6 Outreach

- Tutored introductory Physics for MIT's Office of Minority Education, (2012-2013)
- Taught a class on "Einstein's Spacetime" as volunteer instructor for MIT's Splash program aimed at local high-school students, (2013)
- Mentored a Stanford undergraduate in Physics (now doing a PhD at MIT), culminating in a joint research paper on large N techniques applied to spin systems, (2016-2020)
- Ran physics demonstrations at the first edition of the South-side Science Festival, an outreach program geared towards children of all ages, (2022)
- Volunteer Mentor for "Strings Mentoring Program"

7 Other

- **Citizenship** : Dual US/French
- **Languages**: English (Native), French (Native), German (Fluent), Italian (Fluent)

8 Invited Talks & Conferences

- Workshop on "Recent Developments in String Theory", Aspen Center for Physics, Aspen, USA, Aug-Sept 2025
- Physics Sessions Initiative 2025, Pollica, Italy, June 2025
- Workshop on String Field Theory and Related Aspects, "Open-Closed-Open Triality", IGAP SISSA, Trieste, Italy, March 2025
- Departmental Theory Colloquium, "Emergent Spacetime and Random Matrices", University of Catania, Catania, Italy, March 2025
- EPFL High Energy Seminar, "Strings from Feynman Diagrams", Lausanne, CH, Feb. 2025
- Workshop on Statistical mechanics, Algebra, and Geometry, "Strings from Feynman Diagrams", Les Diablerets, CH, Feb. 2025
- Solving Holographic Theories Conference, "Strings from Feynman Diagrams", Imperial College, London, UK, Dec. 2024
- PCTS Confinement Workshop, "Open-Closed-Open Triality", Princeton, NJ, USA, Nov. 2024
- King's College Theory Seminar, "Strings from Feynman Diagrams", London, UK, Oct. 2024
- Inaugural KIAS-Saclay Strings Workshop, "Strings from Feynman Diagrams", Seoul, South Korea, Sept. 2024
- Annual SwissMAP meeting, "Strings from Feynman Diagrams", Les Diablerets, Switzerland, Sept. 2024
- Integrability in Gauge and String Theory (IGST) 2024, "Strings from Feynman Diagrams", ICTP-SAIFR, São Paulo, Brazil, June 2024
- Strings Maths 2024 (Short Talk), "The Simplest Gauge/String Duality", ICTP Trieste, Trieste, Italy, June 2024
- Simons Confinement Meeting, "Strings from Feynman Diagrams", Les Diablerets, Switzerland, May 2024
- LMU Theory Seminar, "Strings from Feynman Diagrams", Munich, Germany, May 2024
- Caltech Theory Seminar, "Open-Closed-Open Triality", Pasadena, CA, USA, April 2024
- NYU Theory Seminar, "Strings from Feynman Diagrams", NYC, NY, USA, April 2024
- SCGP Theory Seminar, "The Simplest Gauge/String Duality", Stony Brook, NJ, USA, April 2024
- Berkeley Theory Seminar, "Deriving Gauge/String Duality", Berkeley, CA, USA, March 2024
- MIT Theory Seminar, "Deriving Gauge/String Duality", Boston, MA, USA, March 2024
- KITP Program "What is String Theory?", "Deriving Gauge/String Duality", March 2024
- Joint Paris *Rencontres* Theory Seminar, "The Simplest Gauge/String Duality", Paris, France, Feb 2024
- Hirosi Ooguri-Fest, Caltech, October 2022
- "Deriving the Simplest Possible Gauge/String Duality", Stanford Institute for Theoretical Physics, Stanford University, May 2022
- "Deriving the String Dual to a Matrix Model", Center for Theoretical Physics, MIT, May 2022
- "Finite N Matrix Dualities as Exact String Dualities", Kadanoff Seminar, Enrico Fermi Institute, June 2021
- "Target Space Entanglement Entropy", Yukawa Institute for Theoretical Physics, Kyoto University, June 2019
- Long-term visitor, It-from-Qubit/YITP "Quantum Information and String Theory" Workshop, Yukawa Institute for Theoretical Physics, Kyoto University, May-June 2019
- "Entanglement Entropy in JT gravity from BF Theory", It-from-Qubit Seminar, Stanford University, October 2018

- "From Qubits to Spacetime", Prospects in Theoretical Physics, Institute for Advanced Study, July 2018
- Cargèse Summer School on Quantum Gravity, Strings & Fields, Institut d'Etudes Scientifiques de Cargèse, July 2018
- It-From-Qubit "Complexity & Black Holes" Workshop, Stanford University, March 2017
- "Bulk Entanglement Entropy from the c = 1 Matrix Model", UC Davis High Energy Theory Seminar, January 2017
- "Holographic Matrix Quantum Mechanics from Qubits", Stanford Institute for Theoretical Physics, Quantum Gravity Seminar, January 2017
- "Entanglement Entropy in Two-Dimensional String Theory", University of Groningen, High Energy Theory Seminar, March 2016
- "Spring School on Superstring Theory and Related Topics", ICTP Trieste, March 2016
- "Density Perturbations: Seeds of Large-scale Structure", MIT-Kenyon Cosmology Conference, July 2012

9 References

• Prof. Sean Hartnoll (*Doctoral Advisor*)
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