

Mikail Khona

Personal Info

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Address: 76A Pleasant Street, Cambridge, MA 02139

Education

2018 - 2024 **Massachusetts Institute of Technology, MA**

(expected) *PhD candidate in Physics*

Advisor: Ila Fiete, Secondary: Mehran Kardar

Graduate research in theoretical and computational systems neuroscience and deep learning.

Summer 2021 **Methods in Computational Neuroscience (MCN) Summer School, MA**

2014 - 2018 **Indian Institute of Technology (IIT), Bombay, India**

Bachelor of Technology in Engineering

Major: Engineering Physics (+honours in Physics)

minor: Mathematics

High School **The Bombay Scottish School, Mahim, India**

Publications

- [Khona, Mikail, Fiete, Ila. **Attractor and Integrator Networks in Neuroscience**. Nature Reviews Neuroscience \(in press\). \[link\]](#)
- Schaeffer, Rylan, [Khona, Mikail](#), Meshulam, Leenoy, Fiete, Ila. **No Free Lunch from Deep Learning in Neuroscience: A Case Study through Models of the Entorhinal-Hippocampal Circuit**. NeurIPS. 2022. [link]
- Schaeffer, Rylan, [Khona, Mikail](#), Fiete, Ila. **Reverse-engineering recurrent neural network solutions to a hierarchical inference task for mice**. NeurIPS. 2020. [link]
- [Khona, Mikail*](#), Chandra, Sarthak*, Fiete, Ila. **Spontaneous emergence of topologically robust grid cell modules: A multiscale instability theory**. Submitted. [link]
- Duan, Sunny*, [Khona, Mikail*](#), Bertagnoli, Adrian*, Fiete, Ila. **See and Draw: Generation of complex compositional movements from modular and geometric RNN representations**. Submitted. [link]
- [Khona, Mikail*](#), Chandra, Sarthak*, Ma, Joy, Fiete, Ila. **Winning the lottery with neurobiology: faster learning on many cognitive tasks with fixed sparse RNNs**. Submitted. [link]
- G. Madirolas, A. Al-Asmar, L. Gaouar, L. Marie-Louise, A. Garza-Enriquez, [M. Khona](#), C. Ratzke, J. Gore, A. Pérez-Escudero. **A taste for numbers: *Caenorhabditis elegans*. foraging follows a low-dimensional rule of thumb**. Submitted. [link]
- Schaeffer, Rylan*, Bordelon Blake*, [Khona, Mikail*](#), Pan, Weiwei, Fiete, Ila. **Efficient Online Inference for Nonparametric Latent Variable Time Series**. UAI. 2021. [link]

Awards / Achievements

2022 - 2023 K. Lisa Yang ICoN Graduate Student Fellow (\$100k)

2021 - 2022 MathWorks Science Fellowship (one of 20 across the School of Science at MIT) (\$100k)

2018 - 2019 Seigel Fellowship, Department of Physics (\$100k)

2016 - 2018 Institute Academic Award for the highest GPA among undergraduates in the Physics department at IIT Bombay (9.95/10)

2016 - 2017 DAAD-WISE scholarship for an undergraduate project in Germany in 2017 [declined].

2014 An All India Rank of 562/1.4M (Percentile 99.96) in the **IIT - JEE** 2014.

Peer-Review Conference and Workshop Posters

- Khona, Mikail, Schaeffer, Rylan, and Fiete, Ila. **Self-Supervised Learning of Efficient Algebraic Codes generates Grid Cells**, NeurIPS Self-Supervised Learning: Theory and Practice Workshop, 2022.
- Khona, Mikail, Chandra, Sarthak, Konkle, Talia and Fiete, Ila. **Modelling the formation of the human visual cortical hierarchy with bottom-up growth**. Cosyne Abstracts 2022.
- Khona, Mikail, Chandra, Sarthak, Acosta, Francisco, Fiete, Ila **The emergence of discrete grid cell modules from smooth gradients in the brain**. Cosyne Abstracts 2021.
- Khona, Mikail, Xu, Qianli and Fiete, Ila. **A model of oscillatory gating of information flow between neural circuits as a function of local recurrence**. Cosyne Abstracts 2020.
- Schaeffer, Rylan, Khona, Mikail, and Fiete, Ila. **No Free Lunch from Deep Learning in Neuroscience: A Case Study through Models of the Entorhinal-Hippocampal Circuit**, ICML AI4Science Workshop. 2022.

Invited Talks

September 2022 brAln seminar: Carnegie Mellon University

August 2022 Harvard Vision lab

Academic Services

2022 Reviewer for NeurReps: Symmetry and Geometry in Neural Representations, Workshop, NeurIPS 2022, Reviewer for NeurIPS 2022 Workshop: Self-Supervised Learning - Theory and Practice

Teaching and Mentoring

Fall 2019 8.01L: Physics I

Spring 2021 8.592: Introduction to Biological Physics

Fall 2021 Physics Mentorship program, Physics Department, MIT

Technical Skills

- Deep learning with Python: Pytorch
- Scientific computing with Python (NumPy, SciPy) and MATLAB.
- Scientific illustration with Adobe Illustrator.