Physics AT QUEENS COLLEGE

Colloquium Notice

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From cells to brains: symmetry fibrations for biological and artificial neural networks

Symmetry is the cornerstone of theoretical physics, yet it goes silent when explaining (artificial) life, despite life emerging from physical law. Here, we attempt to bridge the gap between physics, biology and AI using symmetries, but with a twist. The traditional symmetry groups of physics are global and too rigid to escribe biological networks. Instead, the notion of symmetry fibration derived from Grothendieck's fibrations in category theory, are local, flexible, and adaptable to evolutionary pressures, providing a framework for understanding biological networks but also how AI works through symmetry and symmetry breaking in inference and learning. On the application front, fibrations compress LLMs up to 10x in parameter size with no loss of performance providing a plausible solution to the impending collapse of the scaling era.

Makse, Boldi, Sorrentino, Stewart, Symmetries of Living and Artificial Intelligence Systems: Fibrations and Synchronization in Networks (Cambridge University Press, forthcoming 2027) https://arxiv.org/abs/2502.18713

Monday
November 2, 2026
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326
This talk is accessible via **Zoom** or use
meeting ID 829 2687 2594 and **passcode 866995** to join