



# THE UNIVERSITY OF CHICAGO

## COMPUTATIONAL AND APPLIED MATHEMATICS COLLOQUIUM

---

MILES STOUDENMIRE

Flatiron Institute

Tensor Networks: From Quantum Physics to Applied Mathematics

THURSDAY, December 6, 2018, at 4:00 PM

Jones 226, 5747 South Ellis Avenue

### ABSTRACT

The field of many-particle quantum mechanics poses serious challenges for computational and applied mathematics. The core issue, known as the "quantum many-body problem", can be viewed as the issue of working with tensors having many (essentially an infinite number of) indices. But over the last 25 years, there have been great strides in addressing this problem, which has led to a technology known as tensor networks. Recently, it is becoming clearer that tensor networks are in fact a very general tool for factorizing very large tensors, with applications beyond physics. These applications include supervised machine learning; computing eigenvectors of exponentially large sparse matrices; and development of families of wavelet functions, to name just a few.

After introducing the basics of tensor networks, including the seminal example of the matrix product state (a.k.a. tensor train) factorization, I will discuss which theoretical aspects are already well understood and where key challenges remain. I will conclude by discussing where tensor network methods could have the largest impact in future applications.



---

#### Organizers:

Daniel Sanz-Alonso, Department of Statistics, [sanzalonso@uchicago.edu](mailto:sanzalonso@uchicago.edu)

CAM Colloquium URL: <https://cam.uchicago.edu/seminars/index.shtml>.

For further information and inquiries about building access for persons with disabilities, please contact Zellencia Harris, [zellenciah@uchicago.edu](mailto:zellenciah@uchicago.edu). If you wish to subscribe to our email list, please visit the following website: [https://lists.uchicago.edu/web/subscribe/cam\\_colloquium/](https://lists.uchicago.edu/web/subscribe/cam_colloquium/).