

# Spring 2026 Colloquia

*Spring 2026 is ongoing; this document will be updated as more information becomes available.*

Date: Wednesday, March 11<sup>th</sup>, 2026, 12:00 – 1:00pm

Speaker: Philippe Ciuciu (CEA, France)

Title: Multifractal Formalism in Neural Field Dynamics: A New Prospect on Criticality in the Brain

Abstract: The "brain criticality hypothesis" suggests that neural systems operate near phase transitions to optimize computational power and information transmission. While scale invariance is a known hallmark of this state, standard power-law scaling often fails to capture the full complexity of intermittent neural dynamics. This talk bridges gaps between statistical physics and signal processing by introducing a robust multifractal framework for studying brain criticality. Utilizing a Landau-Ginzburg formulation of Wilson-Cowan field equations, we demonstrate that multifractality—characterized by the  $c_2$  log-cumulant—is not a trivial property but peaks specifically at the critical point of a phase transition.

To ensure these mathematical insights hold in empirical settings, we present a wavelet p-leader formalism combined with a novel segmentation-based outlier detection method to protect estimates from non-stationary noise. Finally, we validate this approach using Magnetoencephalography (MEG) data, revealing that significant multifractality is prevalent in human alpha and beta band oscillations, organized in distinct spatio-temporal gradients across the cortical surface. This work provides a new mathematical standard for quantifying the organizational principles of neural dynamics.

Date: Wednesday, April 8<sup>th</sup>, 2026, 12:00 – 1:00pm

Speaker: Mihai Fulgar (University of Connecticut)

Title: Local Positivity and Complex Bodies

Abstract: Local positivity in projective algebraic geometry is a bit of a misnomer that refers to the problem of understanding how the global geometry of a projective variety is reflected locally around a point. A family of invariants designed towards this goal are certain compact convex bodies called the Newton-Okounkov bodies. We will survey pieces of the history of the problem up to and including recent results in collaboration with Victor Lozovanu on generic infinitesimal Newton-Okounkov bodies and their relations to other invariants such as successive minima.

Date: Wednesday, April 15<sup>th</sup>, 2026, 12:00 – 1:00pm

Speaker: Rajesh Kulkarni (Michigan State University)

Title: Moduli of Binary Cubic Forms

Abstract: We will discuss the moduli of binary cubic forms. We will begin with (symmetric) multilinear forms and their ubiquity in mathematics. This will be followed by a discussion of the classification problem of such forms. We will then narrow our discussion to binary cubic forms and give a description of their moduli space in terms of a triple of an associated CM elliptic curve  $E$ , a degree-3 isogeny from  $E$  to  $E$ , and a point on  $E$ . We will also discuss an application of our construction.

Date: Wednesday, May 13<sup>th</sup>, 2026, 12:00 – 1:00pm

Speaker: Ruben Louis (University of Illinois, Urbana-Champaign)

Title: TBA

Abstract: TBA