Spring 2026 Colloquia

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

Date: Wednesday, March 11th, 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 bridgges 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 8th, 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 15th, 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 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 triples of an associated CM elliptic curve E, a degee-3 isogeny from E to E, and a point on E. We will also discuss an application of our construction.

Date: Wednesday, April 29th, 2026, 12:00 – 1:00pm
Speaker: Iacopo Brivio (Harvard University)
Title: Extension of Pluricanonical Forms in Positive and Mixed Characteristic.
Abstract: A theorem by Siu states that pluricanonical forms on a special fiber of a smooth family of complex projective varieties can always be extended to the total space. I will explain how this result fails in positive and mixed characteristic and what this implies at the level of KSBA moduli theory, as well as how to recover a version of Siu's theorem "up to Frobenius".

Date: Wednesday, May 13th, 2026, 2:00 – 3:00pm
Speaker: Ruben Louis (University of Illinois, Urbana-Champaign)
Title: Nash Resolution of Singular Foliations and (singular) Lie Algebroids
Abstract: A foliation decomposes a smooth manifold into "layers" called leaves. In many geometric situations, for instance the fibers of a submersion where all leaves have the same dimension, the orbits of a Lie group action, the symplectic leaves of a Poisson structure, or the symmetries of a function, these layers do not all have the same dimension; one then speaks of a singular foliation. Such singularities make the geometric analysis more delicate.

I will explain how to resolve these singularities by replacing the initial foliation with a more regular model via a blow up procedure in the sense of Nash. This method, initiated by Omar Mohsen, makes it possible to understand a singular foliation as the image of an almost regular Lie algebroid, that is, the image of a Lie algebroid whose anchor is injective on a dense open subset.

This method also applies to Lie algebroids. More precisely, any Lie algebroid

$$0 \longrightarrow K \longrightarrow \mathrm{Nash}(A) \longrightarrow D \longrightarrow 0,$$

where K is a bundle of Lie algebras and D is a Lie algebroid whose anchor is injective on a dense open subset.

This construction is inspired by the work of O. Mohsen in noncommutative geometry, where he introduced a blow up construction for the holonomy groupoid of Androulidakis and Skandalis. The term "Nash" refers to the fact that this type of blow up was originally developed by J. Nash, mainly in algebraic geometry, for desingularization purposes.