# RUTGERS-CAMDEN
## MATH SEMINAR SERIES
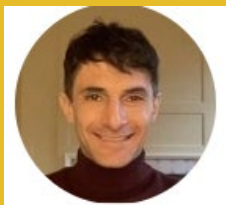
**12:45PM -1:45PM, MARCH 12$^{TH}$, 2026**

**ARMITAGE-124**

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### Nawaf Bou-Rabee
Rutgers University - Camden

**Title:** *NUTS for NUTS: Advances in No-U-Turn Sampling and the Future of Markov Chain Monte Carlo*

**Abstract:** Markov chain Monte Carlo (MCMC) is the standard approach for approximate sampling from probability distributions, yet the efficiency of classical algorithms often deteriorates in high dimensions or anisotropic geometries, exactly where the concentration of measure begins to dominate. In these regimes, probability mass collapses into thin shells, gradients and energies concentrate, and naïve random-walk exploration becomes wasteful. The No-U-Turn Sampler (NUTS) and its descendants have reshaped modern MCMC practice by learning local geometry on the fly, enabling efficient exploration even in complex, high-dimensional landscapes.

This talk revisits the mathematical foundations of NUTS and shows how they can be extended and unified within a broader adaptive framework. This perspective leads to new algorithms that preserve the self-tuning spirit of NUTS while extending its reach to curved and discrete geometries. I will share recent insights into why these methods mix so efficiently, drawing on ideas from geometry, probability, analysis, and concentration phenomena (e.g., how Hamiltonian trajectories track typical sets and how U-turn diagnostics implicitly detect concentrated "effective scales"). Along the way, we will see how No-U-Turn ideas are evolving from clever computational innovations into a principled theory of locally adaptive MCMC, bringing us closer to the long-standing goal of samplers that require minimal tuning and are provably efficient.

**Zoom:**

https://rutgers.zoom.us/j/96442897289?pwd=bPsYXaIvu0BuaxSVQxU0VTLnRUSotm.1

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