

# SEMINAR SERIES

## PHOTONICS INITIATIVE

ADVANCED SCIENCE  
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## Universal wave-control framework for extremely tunable microwave systems

**Abstract:** Wave-domain programmability emerges as technological enabler of next-generation microwave systems for wireless communications, sensing, and wave-domain computing. In this talk, I will describe our recent progress toward establishing a universal framework for controlling waves in extremely tunable microwave systems. The predominance of reconfiguration mechanisms based on tunable lumped elements leads to a universal abstraction of these systems in terms of a multiport-network representation, capable of accurately capturing all relevant electromagnetic interactions between the tunable elements. I will explain how we experimentally calibrate such models for diverse systems such as dynamic metasurface antennas and reconfigurable intelligent surfaces. Then, I will describe how we navigate the design space based on these models to identify fundamental bounds on realizable functionalities, as well as configurations closely approaching these bounds. I will outline how these results contribute to the development of a prototype-aware electromagnetic information theory for programmable channels. Finally, I will discuss principles for system design to maximize the wave-domain flexibility, including enhanced dwell times, non-local programmability, and time modulation.

**Bio:** Philipp del Hougne is currently a Nokia Visiting Professor at Aalto University (Finland) and a tenured CNRS Associate Professor (Chargé de recherche, HDR) affiliated with the Université de Rennes (France). He graduated in Physics from Imperial College London (United Kingdom) and received the Ph.D. degree in Physics from the Université Sorbonne Paris Cité (France). He subsequently held postdoctoral positions in Nice and Rennes (France), and Lausanne (Switzerland). His current research interests relate to the theory and applications of reconfigurable wave systems to mold the flow of information through tailored wave-matter interactions, spanning applications from information extraction (imaging, sensing, localization), via information processing (analog wave-based computing), to information transfer (wireless communications).



**PHILIPP DEL HOUGNE PHD**  
DEPARTMENT OF ELECTRONICS AND  
NANOENGINEERING  
**Aalto University**

**Date:**  
Monday, March 23, 2026

**Time:**  
2:00 - 3:00 p.m.

**Location:**  
ASRC — Auditorium  
85 Saint Nicholas Terrace  
New York, NY 10031

**Host:**  
Andrea Alù

**Zoom:**  
**Meeting ID: 854 4777 9784**  
**Passcode: 947054**

[Meeting Link](#)



FOR MORE INFORMATION, VISIT  
[photonicsasrc@gc.cuny.edu](mailto:photonicsasrc@gc.cuny.edu)

