

 COLLOQUIUM DFANOVEMBER 20TH 2025 - 3 PM AULA ROSTAGNI
YOUTUBE STREAMINGRICCARDO SAPIENZA
IMPERIAL COLLEGE LONDON*Metamaterials that vary in time
unlock superluminal motion*

Abstract: Metamaterials have revolutionised the way we control light transport and generation. Yet, to date, they rely on static and passive architectures, only redistributing incident wave energy - for example a metalens that focuses light or a cloak that makes an object invisible. The next frontier is to control metamaterials in space and time, and make waves from the past and future to interact.

Riccardo Sapienza will discuss the first steps towards temporal control and experiments on double-slit time diffraction at optical frequencies in time-varying metamaterials [1]. Intertwining space and time, he will discuss the observation of scattering of light from optical modulations traveling faster than the speed of light [2], and coherent perfect absorption [3] and how this will enable the simulation of more complex spatio-temporal optical and relativistic phenomena.

Riccardo Sapienza is Professor of Physics in Imperial College London, and deputy Head of Department for Research. He has experience in light control in nanoscale architectures, complex lasers and metamaterials. He is the director of the Centre for Plasmonics and Metamaterials and has been awarded an ERC Advanced Grant in 2025 to explore programmable metamaterials. His alma mater is the University of Padua.



References:

- [1] Double-slit time diffraction at optical frequencies, Romain Tirole, Stefano Vezzoli, Emanuele Galiffi, Iain Robertson, Dries Maurice, Benjamin Tilmann, Stefan A Maier, John B Pendry, Riccardo Sapienza, *Nature Physics* 19, 999 (2023).
- [2] Super-luminal Synthetic Motion with a Space-Time Optical Metasurface A. C. Harwood, S. Vezzoli, T. V. Raziman, C. Hooper, R. Tirole, F. Wu, S. A. Maier, J. B. Pendry, S. A. R. Horsley, R. Sapienza, *Nature Communications* 16, 5147 (2025)
- [3] Optical coherent perfect absorption and amplification in a time-varying medium, Emanuele Galiffi, Anthony C. Harwood, Stefano Vezzoli, Romain Tirole, Andrea Alù, Riccardo Sapienza, *Nature Photonics* in press and ArXiv 2410.16426 (2025)