

# SPACE-TIME METAMATERIALS FOR LIGHT

Riccardo Sapienza

*Blackett Laboratory, Department of Physics, Imperial College London, London, UK*

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.

I will discuss our first steps towards temporal control and experiments on double-slit time diffraction at optical frequencies in time-varying metamaterials [1] and how we can extend the modulation of the linear refractive index to the modulation of the nonlinear response [2]. Intertwining space and time, I will discuss the observation of the temporal version of coherent perfect absorption [3] and scattering of light from optical modulations traveling faster than the speed of light [4] and how this will enable us to simulate more complex phenomena.

## References

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- [3] Optical coherent perfect absorption and amplification in a time-varying medium Authors: Emanuele Galiffi, Anthony C. Harwood, Stefano Vezzoli, Romain Tirole, Andrea Alù, Riccardo Sapienza, arXiv:2410.16426 (2024)
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