

**Metamaterials with Extreme Parameters:
Diffraction-free Propagation of Light and Electron Waves**

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Abstract:

In this set of lectures, the speaker will present an overview of the research work of his group on electromagnetic and semiconductor metamaterials with extreme material parameters. The speaker will discuss the tunneling of electromagnetic waves through ultranarrow irregular channels filled with metamaterials with permittivity near zero, and highlight the unusual potentials of metamaterials with either extreme anisotropy or very large index of refraction. In particular, the speaker will show how the extreme anisotropy property can enable waveguiding with no diffraction, and illustrate how this property can be instrumental to boost the interaction between electromagnetic waves with matter, and permit quantum levitation and a dramatic enhancement of the Cherenkov emission by a beam of charged particles. Finally, the speaker will discuss the exotic physics and potential applications of novel quantum metamaterials based on graphene and semiconductor superlattices, wherein the electron waves are super-collimated along a preferred direction of motion.

About the speaker:

Prof Mário G. Silveirinha received the Licenciado degree in Electrical Engineering from the University of Coimbra, Coimbra, Portugal, in 1998, and the Ph.D. degree in Electrical and Computer Engineering (with a minor in Applied Mathematics) from the Instituto Superior Técnico (IST), Technical University of Lisbon, Lisbon, Portugal, in 2003. Currently, he is an Associate Professor at the University of Coimbra, Portugal. He is also the leader of the Radio Microwave and Millimeter Waves research group in the Coimbra site of Instituto de Telecomunicações (www.it.pt). He was a Visiting Professor at the University of Pennsylvania during several periods in 2004-2005 and 2010-2011.

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