Benjamin Vial

Posdoctoral Research Asssistant | Microwave Engineering and Photonics

Contact

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Information

date of birth 09/11/1984
French citizenship

Languages

French mother tongue
English fluent
Spanish basic

Programming

operating systems
Linux, Windows
languages and scripts
Python, Matlab, Mathematica, LaTeX, C, C++, Q#, HTML, CSS
applications
git, Comsol Multiphysics, Fenics, Gmsh, GetDP, Gimp, LibreOffice, Labview

Interests

professional
microwave engineering
Photonics
THz physics
quantum computing
Transformation Optics
invisibility cloaking
light-matter interraction
computational EM
numerical modelling
optimization techniques
inverse design
machine learning
finite element method
Fourier modal method
FDTD
modal analysis
wave physics
fabrication
characterization
open source science
personal
playing the guitar
listening to music
football, snowboard, hiking
traveling, cooking

Education

Apr. 2013 — **PhD** in Physics — Institut Fresnel, CNRS, Centrale Marseille, Aix Marseille Université, Marseille, France
Optics, Photonics and image processing

Oct. 2009 — **Master's degree** in Physics — Centrale Marseille / Laboratoire de Mécanique et d'Acoustique, CNRS, Marseille, France
Mechanics, Physics and Engineering, specialization in Acoustics

Oct. 2009 — **Master's degree** in Engineering — Centrale Marseille, Marseille, France
High level scientific and technical training

Research activities

Jan. 2019 – Now — **Postdoctoral Research Assistant** — Queen Mary, University of London, London, UK
ANIMATE project: nonlinear coupling model and homogenization of ferroelectric metamaterials, inverse design for tunability enhancement, microwave and THz material characterization.

Jan. 2017 – Dec. 2018 — **Postdoctoral Research Assistant** — Queen Mary, University of London, London, UK
AOTOMAT project : Optimization tools and machine learning for the design of electromagnetic devices and materials.

Jul. 2014 – Dec. 2016 — **Postdoctoral Research Assistant** — Queen Mary, University of London, London, UK
QUEST project: Quest for Ultimate Electromagnetics Using Spatial Transformations. Transformation Optics applied to the design, fabrication and characterization of novel electromagnetic devices using metamaterials. Development of simulation tools and optimization techniques.

Nov. 2013 – Jan. 2014 — **Postdoctoral Research Assistant** — Institut Fresnel, Marseille, France
Numerical study of the coupling of light to subwavelength resonant optical antennas and control of the local density of states.

May 2013 – Oct. 2013 — **Postdoctoral Research Assistant** — Institut Fresnel, Marseille, France
Development of simulation tools for ray tracing in complex media, inverse problem of finding index distribution to make light follow a prescribed path, deshomogenization technique with graded index photonic crystals.

Oct. 2009 – Apr. 2013 — **PhD in Physics** — Institut Fresnel – Silios Technologies, Marseille, France
Study of open electromagnetic resonators by modal approach. Application to infrared multispectral filtering. (*joint academia/industry funding*)
FEM modelling of metamaterials, spectral analysis quasi-normal mode expansion. Application to the design of infrared filters for multispectral imaging devices. Fabrication and characterization of reflexion bandcut and transmission bandpass filters.

Teaching/supervising experience

2011-2012 — **Internship supervisor** — Institut Fresnel, CNRS, Centrale Marseille, Marseille, France
Optimization of diffractive spectral infrared filters (1 engineer student, 6 months).
Optimization of absorption in solar cells (4 engineer students, 3 months).

2019 — **Teaching Assistant** — Queen Mary, University of London, London, UK
Quantum Programming. Lectures and tutorials on quantum gates and circuits. Coding laboratory and projects in Q# an Python (10 Master students, 6 months).

Awards and honours

Best PhD thesis 2014 award from the Doctoral School 352, Physics and Condensed Matter Science

Best PhD thesis 2014 award from CNano PACA, finalized research category

Publications

Articles in peer-reviewed journals

B. Vial et al. *Resonant metamaterial absorbers for infrared spectral filtering: Quasimodal analysis, design, fabrication, and characterization.* J. Opt. Soc. Am. B. *31.6, 2014, p. 1339.*

V. Debierre et al. *Absorption in quantum electrodynamic cavities in terms of a quantum jump operator.* Phys. Rev. A. *90.3, 2014, p. 033806.*

B. Vial et al. *Adaptive perfectly matched layer for Wood's anomalies in diffraction gratings.* Opt. Express. *20.27, 2012, p. 28094.*

B. Vial and Y. Hao. *High frequency meta-ferroelectrics by inverse design.* Opt. Mater. Express. *11.5, 2021, p. 1457.*

B. Vial and Y. Hao. *Enhanced tunability in ferroelectric composites through local field enhancement and the effect of disorder.* J. Appl. Phys. *126.4, 2019, p. 044102.*

Y. Liu et al. *Direct manipulation of wave amplitude and phase through inverse design of isotropic media.* New J. Phys. *19.7, 2017, p. 073010.*

R. Foster et al. *Beam-Steering Performance of Flat Luneburg Lens at 60 GHz for Future Wireless Communications.* Int. J. Antenn. Propag. *2017, 2017, pp. 1–8.*

B. Vial, M. M. Torrico, and Y. Hao. *Optimized microwave illusion device.* Sci Rep. *7.1, 2017, p. 3929.*

B. Vial et al. *A class of invisible inhomogeneous media and the control of electromagnetic waves.* Phys. Rev. B. *94.24, 2016, p. 245119.*

B. Vial and Y. Hao. *A coupling model for quasi-normal modes of photonic resonators.* J. Opt. *18.11, 2016, p. 115004.*

B. Vial and Y. Hao. *Topology optimized all-dielectric cloak: Design, performances and modal picture of the invisibility effect.* Opt. Express. *23.18, 2015, p. 23551.*

M. Commandré et al. *Design, fabrication and characterization of resonant metamaterial filters for infrared multispectral imaging.* Thin Solid Films. *592, 2015, pp. 296–304.*

M. Abbarchi et al. *Wafer Scale Formation of Monocrystalline Silicon-Based Mie Resonators via Silicon-on-Insulator Dewetting.* ACS Nano. *8.11, 2014, pp. 11181–11190.*

B. Vial et al. *Transmission enhancement through square coaxial aperture arrays in metallic film: When leaky modes filter infrared light for multispectral imaging.* Opt. Lett. *39.16, 2014, p. 4723.*

B. Vial et al. *Quasimodal expansion of electromagnetic fields in open two-dimensional structures.* Phys. Rev. A. *89.2, 2014, p. 023829.*

Contribution to book chapter

T. Antonakakis et al. *Gratings: Theory and Numeric Applications. AMU (PUP), 2012, Marseille.*

Proceedings of international peer-reviewed conferences

B. Vial and Y. Hao. *Coupled model for the study of effective parameters of ferroelectric metamaterials.* 2019 13th European Conference on Antennas and Propagation*, 2019, Krakov, Poland.*

B. Vial and Y. Hao. *Tailoring near and Far Electromagnetic Fields Through Optimization.* 12th European Conference on Antennas and Propagation (EuCAP 2018)*, 2018, London, United Kingdom.*

B. Vial et al. *Scattering free graded index profiles and the control of electromagnetic fields.* 2017 11th European Conference on Antennas and Propagation (EUCAP)*, 2017, Paris, France.*

A. Nicolet et al. *Quasi-modal analysis of segmented waveguides.* 2014 IEEE Conference on Antenna Measurements & Applications (CAMA)*, 2014, Antibes Juan-les-Pins, France.*

B. Vial et al. *3D FEM Quasimodal Analysis of the Haroche QED Cavity.* Nineteenth COMPUMAG Conference on the Computation of Electromagnetic Fields*, 2013, Budapest, Hungary.*

A. Nicolet et al. *Perfectly matched layers via transformation electromagnetism for the computation of quasi-modes.* 2012 International Conference on Electromagnetics in Advanced Applications*, 2012, Cape Town, South Africa.*

B. Vial et al. *Transformation optics PML and quasi-mode analysis: Application to diffraction gratings.* TaCoNa-Photonics*, 2012, Bad Honnef, Germany.*

B. Vial et al. *Resonances determination in microstructured films embedded in multilayered stacks.* Advances in Optical Thin Films IV*, 2011, Marseille, France.*

B. Vial et al. *Analysis of diffraction gratings via their resonances.* TaCoNa-Photonics*, 2011, Bad Honnef, Germany.*

International peer-reviewed conferences

B. Vial and Y. Hao. *Effective parameters of ferroelectric-dielectric mixtures.* Progress In Electromagnetics Research Symposium*, 2019, Rome, Italy.*

L. La Spada, B. Vial, and Y. Hao. *Electromagnetic waves control and manipulation by metasurfaces.* Progress In Electromagnetics Research Symposium*, 2017, Singapore.*

B. Vial and Y. Hao. *Study of graded index metamaterials: Transparency and control of electromagnetic waves.* International Congress on Advanced Electromagnetic Materials in Microwaves and Optics*, 2017, Marseille, France.*

B. Vial et al. *A class of invisible graded index profiles and the control of electromagnetic waves.* International Congress on Advanced Electromagnetic Materials in Microwaves and Optics*, 2016, Chania, Greece.*

B. Vial and Y. Hao. *A mode coupling model for meta-molecules.* International Congress on Advanced Electromagnetic Materials in Microwaves and Optics*, 2015, Oxford, United Kingdom.*

B. Vial and Y. Hao. *Optimization of metamaterials for microwave devices.* Progress In Electromagnetics Research Symposium*, 2015, Prague, Czech Republic.*

F. Bedu et al. *Nanofabrication of optical structures (filters, resonators and sensors).* 4th National Days On Emerging Technologies in Micronanofabrication*, 2015, Lyon, France.*

B. Vial et al. *Exact PML and the numerical computation of quasi-modes in electromagnetic open structures.* 2nd Radio and Antenna Days of the Indian Ocean (RADIO)*, 2014, Mauritius.*

B. Vial et al. *Analysis of diffraction gratings via their quasi-modes.* XXII Symposium on Electromagnetic Phenomena in Nonlinear Circuits (EPNC)*, 2012, Pula, Croatia.*

B. Vial et al. *Engineering eigenmodes in open microstructured resonators for far infrared filtering applications.* Workshop on Metallic Nano Objects*, 2012, Saint-Étienne, France.*

PhD thesis

B. Vial. *Study of open electromagnetic resonators by modal appoach. Application to infrared multispectral filtering. Ecole Centrale Marseille, 2013.*

Open source software and code

B. Vial. *nannos: Fourier modal method for multilayered metamaterial with automatic differentiation. nannos.gitlab.io, 2021.*

B. Vial. *gyptis: Computational Photonics in Python with the finite element method. gyptis.gitlab.io, 2020.*

B. Vial. *tdsxtract: Tools for material parameters extraction from THz time domain spectroscopy measurements. tdsxtract.github.io/tdsxtract, 2020.*

In preparation

B. Vial and Y. Hao. *Topology optimization of tunable metamaterials. 2021.*

B. Vial et al. *Optimization and experimental validation of a bi-focal lens. 2021.*