

Curriculum Vitae

Dr Alexey V. Krasavin

Date of birth: 16 August 1979

Research Fellow

Photonics & Nanotechnology Group
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Guest Editor (Plasmonics)

Editorial Board Member

Scientific Reports, Nature Publishing Group

Scientific profile

h-index	39
Patents	1
Book contributions	4
Journal articles	95 (including 11 Nature/Science-level publications and 3 PRLs), attracting 3000+ citations
Conference presentations	200 (including 69 invited and keynote)

Leadership

2014-present	PhD and Master student supervision (5 PhD, 11 Master)
2024-present	Associated researcher EPSRC Programme Grant “CPLAS”
2016-2021	Task leader, EPSRC Programme Grant “Reactive Plasmonics”
2010-2015	Task leader, EPSRC Programme Grant “Active Plasmonics”
2006-2010	Task leader, EC FP6 Project “PLASMOCOM”

Education

PhD	2002-2006	EPSRC NanoPhotonics Portfolio Centre University of Southampton
MSc with honours	2000-2002	Moscow Institute of Physics and Technology
BSc with honours	1996-2000	Moscow Institute of Physics and Technology

Research experience

2010-present	Research Fellow, King's College London
2006-2010	Research Fellow, Queen's University Belfast
2006	Research Fellow, University of Southampton
2002-2006	Postgraduate Research Student, University of Southampton
1999-2000	Research Assistant, IMT, Russian Academy of Science

Teaching experience

2019-present	Lecturing: Photonics and Metamaterials
King's College London	Lecturing and laboratory supervision: Experimental Methods in Physics
2011-2014	Lecturing and laboratory supervision: Experimental Methods in Physics
King's College London	Tutorials: Mathematics, Thermal and Field Physics modules
2002-2006	Laboratory supervision: 2 nd year Physics module
University of Southampton	Tutorials and Marking: Classical Mechanics, 1 st and 2 nd year Optics, Solid State Physics, Computational Physics and Astronomy modules

Analytical and numerical skills

- Frequency- and time-domain finite element method modelling of optical, thermal and electronic phenomena in photonic nanostructures and metamaterials
- Development of numerical and semi-analytical approaches treating nonlinear optical phenomena in metals related to complex dynamics of electron gas and optically-induced high electronic/phononic temperatures
- Development of analytical and semi-analytical methods addressing optical amplification and lasing at the nanoscale, particularly related to nanolasers and spasers
- Implementation of analytical and numerical methods for investigation of molecular fluorescence in the vicinity of photonic nanostructures and in metamaterials
- Quantum mechanical investigation of electron dynamics in optics and solid state physics
- Development of analytical methods in chemistry, biology and structural mechanics

Experimental skills

- Laser optics and instrumentation
- Optical characterisation of nanophotonic structures and materials
- Characterisation of nonlinear optical materials, including fast time-resolved measurements
- Microwave measurements
- SNOM, AFM, SEM operation

Other skills

- Proficiency in academic writing
- Proficiency in specialised software: finite element simulation (COMSOL Multiphysics); experiment engineering (HP VEE package); programming (MATLAB, python, Mathcad).

Awards and grants

- Two consecutive grants as a part of research teams (King's College London, Imperial College London, Queen's University of Belfast) for spin-off projects from EPSRC Programme grants "Reactive plasmonics" and "Active plasmonics"
- 2020 King's Education Award
- 3-month full-cover research funding from Queen's University Belfast
- £24000 Overseas Research Students Award for PhD studies in the UK
- Top-degree diplomas in city and regional Olympiads in Physics and Mathematics (1994-96)

Research achievements

- Pioneering concept of ‘active plasmonics’ and its application for active control of SPP waves using structural (phase) transformations. In this context, I have numerically demonstrated one of the first designs of the plasmonic switch, experimentally realised the proposed concept and introduced a novel Ga/Al nano-composite nonlinear material.
- The idea and numerical demonstration of a concept for an ultrasmall integrated nanophotonic modulator, having a size of just 100 nm and utilising a drastic nanoscale electro-optic effect in degenerate semiconductors. It redefines the boundaries of optoelectronics bringing active control of optical signals to the nanoscale and creates a prospective backbone technology for future fully-functional hybrid electronic/photonic devices.
- Implementation of a hydrodynamic time-domain numerical model describing coherent interactions of free-carrier gas in nanostructured metallic materials of an arbitrary geometry with an optical pulse of an arbitrary temporal profile. For the first time, this approach allows to address in a non-perturbative way the phenomena of multiple and resonantly-enhanced harmonic generation and reveals an interplay between the nonlocal effects and topology of the nanostructure. Furthermore, to describe incoherent Kerr nonlinearity a model taking into account excitation of hot electrons has been developed.
- Numerical demonstration of an innovative concept of SPP mode amplification via electric injection in metal-semiconductor heterostructures, opening a prospect for on-chip subwavelength data networks with an unmatched bandwidth. Furthermore, on its basis I have demonstrated the design of the first on-chip electrically-pumped coherent SPP source with subwavelength dimensions.
- Development of a double-modulation pump-probe technique to perform ultra-sensitive optical gain measurements. The technique allowed me to demonstrate all-plasmonic modulation of co-propagating SPP signals at the interface with an Er-based gain medium. Moreover, for the first time I have developed an analytical theory of this process.
- Computational and experimental demonstration of extremely versatile active plasmonic circuitry on the basis of dielectric-loaded SPP waveguides. This work has had a major impact in the field of nano-optics, already generating 1000+ citations.

Established collaborations

I have established fruitful research collaborations with internationally-leading scientific collectives, including the groups of Prof. Sergey Bozhevolnyi (University of Southern Denmark), Prof. Romain Quidant (ICFO), Prof. A. Dereux (Université de Bourgogne), Prof. Stefan Maier (Monash University, Imperial College London), Dr. Robert Pollard (University of Belfast), Dr. Davy Gérard (Troyes University of Technology), Dr. Peter Petrov (Imperial College London), Prof. P. Wang (Zhejiang University).

Other scientific activities

I take part in refereeing grant applications, as well as articles for the top scientific journals in my research area, such as *Nature Nanotechnology*, *Nature Photonics*, *Physical Review Letters*, etc, as well as in conference committee work (*CLEO Europe*, *SPIE Metamaterials*, *International Workshop on Optical Wave & Waveguide Theory and Numerical Modelling*) and degree examinations. For more than 10 years I organised a seminar series, called “Light and Matter” at the Department of Physics of King’s College London.

Referees

Prof. Anatoly V. Zayats

Head, Photonics & Nanotechnology
Group, King's College London

Co-director, London Centre for
Nanotechnology and London
Institute for Advanced Light
Technologies

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Prof. Stefan A. Maier

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Prof. Sergey I. Bozhevolnyi

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