

WILLIAM HART

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RESEARCH STATEMENT

My research focuses on methods and applications in near-field imaging. I showed for the first time that mid-IR s-SNOM can map chemicals (e.g. medical drugs) inside human cells at 10 nm resolution. This could augment, or even replace, electron microscopy for cellular imaging. I have recently been developing a simple model for surface wave hotspots in sub-wavelength 2D geometries, which is being validated by observing plasmon interference with s-SNOM in graphene. Furthermore, I have developed a high-performance metamaterial superlens, which is currently being fabricated for experimental study.

PROFESSIONAL WORK EXPERIENCE

Imperial College London, Research Associate in Experimental Solid State Group 2018 – present

EDUCATION

Imperial College London, PhD in Spectroscopic Near-field Imaging (Physics) 2014 – 2018

University of Warwick, **First Class**, Physics MPhys BSc 2010 – 2014

RESEARCH SKILLS

- Infrared scattering-type near-field optical microscopy (**s-SNOM**) – **4yrs experience as sole user**
- Optical setup and alignment of QCLs, Ti:Sapph, HeNe lasers, and fibre coupling - 4yrs experience
- Modelling of metamaterials and plasmonics using **MATLAB & Python** – 3yrs experience
- Finite-difference time-domain (FDTD, Lumerical) simulations of metamaterials – 2yrs experience
- Writing and graphic production for scientific publication – 2yrs experience
- **Grant writing** (successful) – 1yr experience

PUBLICATIONS

Mid-infrared Chemical Nano-imaging for Intra-Cellular Drug Localisation, **W. S. Hart et al., 2018**, *in review at Nature Communications* (Pre-print: <http://arxiv.org/abs/1805.11466>)

Wide-Band Nano-Imaging of Plasmon Dispersion and Hotspots in Quasi-Free-Standing Epitaxial Graphene, **W. S. Hart et al., 2018**, (Pre-print: <http://arxiv.org/abs/1805.10102>)

Ultra low-loss super-resolution with extremely anisotropic semiconductor metamaterials, **W. S. Hart et al., 2018**, AIP Advances, DOI: [10.1063/1.5013084](https://doi.org/10.1063/1.5013084)

New IR Imaging modalities for Cancer detection and for Intra-Cell Chemical mapping with a sub-diffraction mid-IR s-SNOM, **H. Amrania et al., 2016**, *Faraday Discuss.*, DOI: [10.1039/C5FD00150A](https://doi.org/10.1039/C5FD00150A)

GRANTS AND FUNDING

£300 Student Travel Grant to speak at conference in Thessaloniki, Greece – awarded by IPEM, 2018

£100 Travel Grant to attend conference in Paris, France – awarded by CR Barber Trust Fund (IoP), 2018

\$1,350 Grant for open access publication of superlens theory paper - Imperial Open Access Fund, 2018

AWARDS & PRIZES

- Best Poster Prize**, London Plasmonics Forum, London, UK, 2018
- Best Poster Prize**, Advances in Biophotonics Conference, London, UK, 2018
- Best Poster Award**, EUPROMETA XXXI Summer School, St Petersburg, Russia, 2016
- Young Researcher Award**, Nanosciences & Nanotechnologies Conference, Thessaloniki, Greece, 2015

ORAL CONFERENCE CONTRIBUTIONS

- Keynote Talk**, Mid-infrared chemical nano-imaging for intra-cellular cancer research, W. S. Hart et al., Nanotech France, 2018, Paris, France, 2018
- Oral**, Mid-infrared chemical nano-imaging for sub-cellular drug localisation, W. S. Hart et al., Nanosciences & Nanotechnologies Conference 18, Thessaloniki, Greece, 2018
- Invited Speaker**, Biochemical imaging at the nanoscale with s-SNOM in the mid-infrared, W. S. Hart et al., PhysBio2016, Paris, France, 2016

POSTER CONFERENCE CONTRIBUTIONS

- Nano-imaging in the mid-IR for Intra-cellular Drug Localisation, BioMedEng18, **London, UK**, 2018
- Ultra low-loss super-resolution with extremely anisotropic semiconductor metamaterials, Nanosciences & Nanotechnologies 18, 2018, **Thessaloniki, Greece**, 2018
- Wide-Band Nano-Imaging of Plasmon Dispersion and Hotspots in Quasi-Free-Standing Epitaxial Graphene, Nanosciences & Nanotechnologies 18, 2018, **Thessaloniki, Greece**, 2018
- From graphene plasmon hotspots to low-loss hyperbolic metamaterials: Applications and techniques for super-resolution imaging in the mid-infrared, London Plasmonics Forum, **London, UK**, 2018
- Infrared nano-imaging for intra-cellular cancer research and analysis of drug delivery, Advances in Biophotonics, **London, UK**, 2018
- Quantum metamaterials and graphene plasmonics: Applications of mid-IR s-SNOM, EUPROMETA XXXI, **St Petersburg, Russia**, 2016
- Intracellular Chemical Imaging with a mid-IR QCL illuminated s-SNOM, Nanosciences & Nanotechnologies 15, **Thessaloniki, Greece**, 2015

OUTREACH & PUBLIC UNDERSTANDING

- London's Natural History Museum Science Uncovered event, 2015 – Exhibitor
- Schrödinger Lecture event at Imperial College, 2014 – Exhibitor

ACADEMIC TEACHING

- 2nd Year Computing** – 2017/18 Python
- 2nd Year Tutorials** – 2016 Atomic, Solid State, Nuclear and Particle Physics
- 2nd Year Tutorials** – 2015 Fourier Analysis and Ordinary Differential Equations
- 1st Year Tutorials** – 2014/15 Functions and Vector Calculus

PROFESSIONAL AFFILIATIONS

- Member of the Institute of Physics (IoP), UK, MInstP
- Associate Member of the Institute of Physics and Engineering in Medicine (IPEM), UK