

# Editorial: Selected Papers from the 10th UK-Europe-China Workshop on Millimetre-waves and Terahertz Technologies (UCMMT) 2019

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## Introduction

The manuscripts in this Special Issue are extended versions of selected papers from the 10th UK-Europe-China Workshop on Millimetre-waves and Terahertz Technologies (UCMMT) held at the Graduate Centre, Queen Mary University of London on 20–22 August 2019. The UCMMT was created in 2008 to stimulate and strengthen scientific collaboration and knowledge, and cultural exchange. The workshop is held annually, alternating between Europe and China. This conference is now well established and has become a special premier international forum for the exchange of ideas on state-of-the-art research in mmWave and THz science and technologies. The conference theme covered two main areas, THz Metrology and THz communications. The five accepted papers span developments in coherent millimetre wave sources, waveguide components through to advances in analytical coding for the assessment of electromagnetic performance of antenna systems. A brief discussion of each paper and the authors' contributions are presented below.

## Papers in the special issue

MacLachlan *et al.* in their paper 'Excitation and Coupling of Volume and Surface Fields on Complex Electrodynamical Surfaces at Mm-wave and THz Frequencies', analytically describes the resonant excitation and coupling of volume and surface fields on the surface of two dimensional complex electrodynamic structures. The analysis is valid from mm to submm wavelengths (i.e. THz), and even micron (optical) wavelengths. Planar periodic structures are experimentally assessed from 140–220 GHz with a vector network analyser, and comparison is made of resonant eigenmode formation in two periodic surface lattice structures; one two periodic surface lattice is etched onto a metal-backed substrate and the other arranged to have an equivalent air separation. The results and theory are fundamental to some of the routes to the innovation of high power, mm-wave and THz sources.

Hu *et al.* in their paper 'A THz Sparse Periodic Array Imaging System Using Compressed Sensing', report on the efficiency of compressed sensing (CS) for imaging based on a linear sparse periodic antenna array. Experimental demonstration shows a reduction in sampling while retaining an image quality comparable to that provided by the traditional technique of Generalized Synthetic Aperture Focusing.

Chen *et al.* in their paper 'Theoretical and experimental verification of a fast 2-D Gaussian beam mode analysis method', report development in the application of Gaussian beam mode analysis as a means of efficiently and quickly assessing the aberration performance of quasi-optical systems. Assessment of selected 2-D multi-reflector systems is made against the standard commercial software package, GRASP10.

Shu *et al.* in their paper 'A W-band Grooved-Wall Circularly Polarized Horn Antenna', present a novel design capable of generating a circular polarisation wave without any extra polarizer and anticipate its utility for wideband mmWave applications.

Zhang *et al.* in their paper 'A 400 GHz Broadband Multi-Branch Waveguide Coupler', describe the challenge in fabricating and optimising the bandwidth performance of a 5-branch hybrid coupler. The outcome is a structure nearly matching that of a

traditional 7-branch hybrid coupler but which is more readily machine-able.

## Editor Biographies



**Adrian W Cross** is presently a Professor in the Atoms, Beams and Plasmas Group (ABP), Department of Physics, University of Strathclyde. He received the BSc degree (Honors) in physics and the PhD degree from the University of Strathclyde, Glasgow, UK, in 1989 and 1993, respectively. He joined the ABP group at the University of Strathclyde in 1993 initially as a Research Fellow and then as a Lecturer in 2000, Senior Lecturer in 2005 and a Reader in 2007 in the Department of Physics. From 2002 to 2007 Adrian Cross was an Engineering and Physical Science (EPSRC) Advanced Fellow. He has been involved in various aspects of research on gyrotrons, cyclotron autoresonance masers, free-electron lasers, superradiant sources, gyrotron travelling wave amplifiers and plasma applications. More recently, he has primarily been concerned with research on THz radiation sources and pseudospark physics.



**Robert Donnan** is presently a Reader in Terahertz Engineering Physics in the School of Electronic Engineering & Computer Science at Queen Mary, University of London. He received his PhD (Solid State Physics) in 2000 from the University of Wollongong, NSW, Australia. Under an EPSRC contract in 2001, he commenced as a post-doctoral research assistant in the Department of Electronic Engineering, Queen Mary, University of London, developing diffracted Gaussian beam optics for design-verification of quasi-optical radiometric systems. In March 2003 he was appointed to a Lectureship in the Department. His research, broadly, is in development of mm/submm-wave and THz measurement systems to serve basic and applied research in spectroscopic metrology of materials, metamaterials and biomaterials.



**Liang Zhang** received the BSc degree in applied physics from the University of Science and Technology of China, Hefei, China, in 2004 and the MSc degree in application of nuclear techniques from the China Academy of Engineering Physics, Chengdu, China, in 2007, and the PhD degree in physics from the University of Strathclyde, Glasgow, UK in 2012. He is currently a Research Fellow with the Scottish Universities Physics Alliance, Department of Physics, University of Strathclyde. His main research interests include: pulse-power technology; Gyrotron

travelling wave amplifiers/backward-wave oscillators/klystrons; microwave undulators; electron beam generation and beam-wave interactions; low-pressure gas discharges; plasma filled high power microwave sources and free electron lasers.

### **Acknowledgments**

We would like to extend our thanks to all participants of the 10th UCMMT and especially to the reviewers for their timely assistance in assessing the many submissions for this Special Issue of the IET Journal, *Microwaves, Antennas & Propagation*. We trust this Special Issue will invigorate and sustain international cooperation in this important and fast-developing area underpinning communications science and engineering. We especially extend our thanks to the Editor-in-Chief of IET MAP and the team of the Editorial Office for their support throughout the editorial process.