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Contents

SESSION 5 SMARTPHONES, DATA FUSION AND RAMAN

SESSION 6 TERAHERTZ TECHNOLOGIES AND APPLICATIONS

POSTER SESSION

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

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6 Terahertz Technologies and Applications
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Introduction

The past twenty-five years have seen a massive investment in photonics, electronics, and MEMS aimed at developing new telecommunications capabilities and innovative consumer products. This has led to advances in miniature optics, light sources, tunable filters, array detectors, fiber optic sensors, and a range of other photonic devices across the whole electromagnetic spectrum, along with technologies for their mass production. Similarly, in recent years, there have been remarkable developments in handheld consumer electronics, especially mobile devices ("smartphones"). Today's devices contain advances in RF technology, processors, displays, operating systems, user interfaces, memory, Bluetooth, WiFi, GPS, cameras, accelerometers, etc. These technologies are increasingly being exploited in new spectroscopic instruments, and are now poised to be the basis of next-generation handheld scientific instruments.

Advances in array detectors (CCD, CID, InGaAs, InSb, SLS, MCT, CMOS, etc.) are enabling a new generation of faster imaging spectrometers with both laboratory and field applications. Lower-cost microbolometer infrared arrays have been developed, employing MEMS techniques. New laser-based sources (quantum cascade lasers, interband cascade lasers, supercontinuums, terahertz, etc.), particularly in the mid-infrared, are being used in combination with advances in detector technology to create new spectroscopic platforms. Novel designs also enable very compact spectrometers and imagers, suitable for use on airborne platforms, including drones. The concurrent improvements in analytical theory, data analysis methods, algorithms, and the power of portable processors enable instrument designers to 'put a PhD scientist in the box' and empower field spectroscopic devices to give specific actionable answers.

Portable and handheld instruments tend to be more targeted at specific applications than their laboratory predecessors. They may have performance (measured as resolution, spectroscopic range, signal-to-noise, etc.) that is 'good enough' for field screening applications. However, they are often more selective, smaller, cheaper, more robust, and designed to give these actionable answers to non-scientist operators in the field. Spectroscopy-based systems are now making critical judgments in environments and applications that were unreachable twenty years ago, from hazardous materials to the operating theater, and from field geologists to customs and border personnel.

This conference focused on advanced technologies for spectroscopic instrumentation, particularly the UV-visible, infrared, near-infrared, and Raman molecular techniques, but also included advances enabling miniature and portable spectrometers across the electromagnetic spectrum, including x-ray fluorescence, laser induced fluorescence, laser induced breakdown spectroscopy (LIBS), Terahertz, nuclear magnetic resonance, and mass spectrometry. The 2017 conference included special sessions on terahertz technologies and applications.

This conference premiered at Optics East 2007 in Boston, Massachusetts (United States), and it is now part of the Commercial + Scientific Sensing and Imaging Symposium within the DCS Meeting. The conference is now rotating between three sites, Baltimore, Maryland (United States), Anaheim, California (United States), and Orlando, Florida (United States); with the 2017 conference being in Anaheim. It spanned two days and was divided into sessions focused on: Novel Laser Spectroscopy; Novel Spectrometers; Novel Imaging Instrumentation; Smartphones, Data Fusion and Raman; Terahertz Technologies and Applications. The Conference Chairs believe that this Conference in 2015 had the first SPIE session devoted to “Smartphone Spectroscopy”, and we anticipate that this will be a continuing and growing part of this Conference. In all, 40 papers were presented, 19 of which are included in this volume.

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