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Introduction

The conference on Advanced Photon Counting Techniques is a relatively recent addition to the roster of SPIE conferences. Having begun just three years ago at Optics East, the conference made a successful transition this year to the Defense, Security + Sensing Symposium in Orlando. Given the strong overlap between the broad set of applications addressed by photon counting and the topics represented at the DSS Symposium, this new venue proved to be highly appropriate.

The two-and-a-half day conference began with three sessions dedicated to the applications and techniques of photon counting. The role of time-of-flight measurements with single photon sensitivity was discussed in the context of high performance lidar and lidar systems. End applications involving communications were represented by quantum cryptography—in which the quantum states of single photons are exploited—as well as photon-starved free space links that require single photon sensitivity. Biomedical applications comprise a very significant focus for photon counting technology, particularly in the use of fluorescence techniques, and these were treated in several papers.

The remaining six sessions of the conference covered a variety of the most promising device technologies used in single photon detection. Four invited papers reported progress in the development of superconducting nanowire single photon detectors, and this session proved to be an excellent summary of the state-of-the-art for this device technology.

The most broadly represented photon counting device was the single photon avalanche diode (SPAD), and four sessions covering SPAD technology filled a full day of the conference. A variety of material systems were employed—including Si, SiC, InP/InGaAsP, quantum dots, and superlattices—to sense single photons with wavelengths ranging from the ultra-violet through the midwave-infrared. The sizable number of papers focused on the development of arrays of SPADs (also referred to as Geiger-mode avalanche photodiodes) provided a comprehensive assessment of the current state of this technology. The implementation of SPADs generally requires specialized back-end electronic circuitry, and recent progress in these circuits was the focus of one of the SPAD sessions.

Because SPADs are frequently the most practical single photon detector for many applications, there is considerable effort engaged in circumventing their present limitations. The final session of the conference included papers describing recent approaches to achieving improved single photon detection with novel structures based on avalanche photodiodes (APDs) such as self-quenching SPADs and linear mode APDs.

As an emerging technology for advanced sensing, the field of single photon detection is growing rapidly. As evidenced by the content of these proceedings, the third annual conference on Advanced Photon Counting Techniques proved to be an excellent addition to the 2009 DSS Symposium. We anticipate that this conference will continue to be an important event in this field in years to come.

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