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Introduction to *Journal of Modern Optics* Special Issue on Single-photon: detectors, applications, and measurement methods

Single-photon detection and manipulation is becoming increasingly important for the emerging fields of quantum computation and quantum cryptography, as well as for more traditional fields requiring low-light sensitivity.* Quantum cryptography is a clear driver of much of the current interest in single-photon detection, as can be seen through the growth of the literature in this area. Single-photon detection had a long but steady presence in the scientific literature until the early 1990s, when a dramatic change occurred with the birth of quantum cryptography; requiring a log-plot to adequately present the rate of paper production. Research on single-photon detection is expected to continue to grow with the current military and civilian interest in improved security, as well as the potential of optical quantum computing. In fact, considering all the resources proposed to be devoted to these applications, the community at large may be underestimating the efforts needed on single-photon detector development.

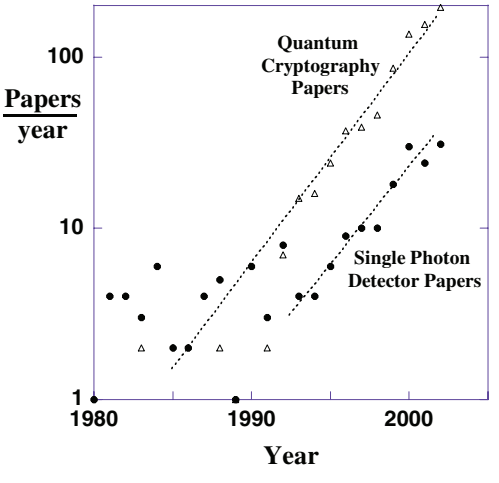

Figure 1. Growth of photon-counting-related papers as indicated by the number of papers each year on quantum cryptography and single-photon detection found in the Web of Science and Inspec databases.

*With all this activity, it is useful to put the difficulty of detecting a single photon into some perspective and remember that after all, the energy of a single photon in the visible is only about half an attoJoule!

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In support of single-photon technology, the Advanced Research and Development Activity (ARDA) and the National Institute of Standards and Technology (NIST) organized a workshop on 'Single-Photon: Detectors, Applications, and Measurement Methods' on 31 March and 1 April 2003 at NIST in Gaithersburg. The goals were to gather together people with a wide range of photon-counting related interests to clarify the current status and challenges and to exchange ideas. These goals were achieved—as the workshop attracted 88 participants, including detector manufacturers, developers, scientific users, and metrologists. Presentations from those participants are available online at http://physics.nist.gov/Divisions/Div844/events/ARDAworkshop/agenda.html. These talks and follow-up discussions highlighted photon-counting needs; including the need for detectors with high efficiency, low dark counts, high dynamic range, spectral selectivity (including IR sensitivity, solar blindness, and bandwidth selection), photon-number resolving capability, timing characteristics such as low jitter, low after-pulsing, and low deadtime, and of course, the need for easy-to-use and low-cost devices.

This special issue attempts to catch a snapshot of the photon-counting field. The volume contains 21 papers originating out of the workshop presentations, as well as additional relevant papers (and will, of course, contribute to an additional data point on the publication curve given above).

We thank ARDA and NIST for their encouragement and for providing funds for this effort and we thank all the participants of the workshop and all the authors of this issue for their excellent contributions.

Editors
Alan Migdall, NIST, Gaithersburg
Jonathan Dowling, NASA-JPL, Caltech