

Quantum Photodetectors

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Photodetection plays a key role in basic science and technology, with exquisite performance having been achieved down to the single photon level. Further improvements in photodetectors would open new possibilities across a broad range of scientific disciplines and enable new types of applications. However, it is still unclear what is possible in terms of ultimate performance, and what properties are needed for a photodetector to achieve such performance. In this presentation, I will discuss recent theoretical and experimental work to address this question. On the theoretical front, we present a new general framework to establish the fundamental properties of photodetectors from a fully quantum perspective, and show what basic features are needed to achieve high performance. Novel photodetector designs emerge from these considerations, and we present initial experiments with nanoscale materials to test these new designs.

