

Department Lecture Series



The Photon-Counting Quanta Image Sensor

Dr. Eric Fossum

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for Emerging Technologies,
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Thursday, November 1st 4:30 pm Scott Hall 6142

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Abstract:

The talk will begin with a discussion on the CMOS image sensor – its invention, underlying principles, and commercialization. The Quanta Image Sensor (QIS) is a possible 3rd generation solid-state image sensor technology that is based on photon-counting. Primarily focused on scientific and defense applications, it may also be useful for consumer applications. The specialized QIS pixel device and its deep subelectron read noise will be discussed. The specialized pixel uses ultra-low capacitance rather than avalanche multiplication to achieve single photoelectron detection capability. The high frame rate, low power readout will also be described. Recent results on a 1Mpixel QIS with 1.1um pixel pitch, deep sub-electron read noise ($<0.3e^-$ rms), 1000fps readout at $<25mW$ total power dissipation at room temperature will be reported. The device was implemented in a backside-illuminated stacked CMOS image sensor process with room temperature dark current less than $1e^-/sec$. The QIS opens new possibilities for computational imaging by computer scientists and others.

Bio:

Dr. Eric R. Fossum is best known for the invention of the CMOS image sensor “camera-on-a-chip” used in billions of cameras, from smart phones to web cameras to pill cameras and many other applications. He has been a Professor with the Thayer School of Engineering since 2010. He also serves as Dartmouth’s Associate Provost for Entrepreneurship and Technology Transfer. Honors include the 2017 Queen Elizabeth Prize, considered by many as the Nobel Prize of Engineering, induction into the National Inventors Hall of Fame, and election to the National Academy of Engineering. He also received the NASA Exceptional Achievement Medal, the IEEE Andrew Grove Award and Medal, the Royal Photographic Society’s Progress Medal, and the SMPTE Camera Origination and Imaging Medal. The CMOS image sensor technology was invented while Fossum was at JPL, and he led its development and subsequent transfer of the technology from JPL to US industry. Fossum co-founded Pasadena-based Photobit Corporation with other JPL-ers to commercialize the technology and served in several top management roles including Chairman and CEO. He also served as CEO of Siimpel Corporation to commercialize MEMS-based autofocus in cell phone cameras. He and his students recently co-founded Gigajot Technology to commercialize the photon-counting image-sensor technology invented at Dartmouth.

(RECEPTION FOLLOWING: SCOTT HALL ATRIUM)