TECHNOLOGY

For Low Light Imaging, CMOS Sensors Take the Lead

OVERVIEW

For sensitive low light imaging applications, photomultiplier tubes (PMTs) have been the quality gold standard for their superior noise performance and robust single-photo detection capability. Unfortunately, PMT arrays are large, expensive, delicate, and lack high spatial resolution. Alternatively, complimentary metal-oxide-semiconductor (CMOS) image sensors are rugged, relatively inexpensive, and capable of much higher spatial resolutions. However in low light applications, CMOS sensors have suffered from prohibitive levels of thermally generated noise, also known as dark current, which becomes amplified throughout associated circuitry and can't be removed by typical means.

Researchers at the University of Maryland have developed a new method of greatly reducing dark current noise in CMOS sensor arrays. By using floating gate technology and iterative feedback, a non-volatile electronic charge is stored at the individual pixel level, compensating for biasing and device mismatch across an entire sensor array. In particular, the new method works by decreasing the reverse bias of each pixel's p-n junction to zero, which reduces the total noise from thermally generated dark currents. The application of this technology allows for the use of relatively inexpensive, high resolution, and rugged CMOS image sensors in low light environments while providing PMT equivalent signal-to-noise ratio.

Advantages
10x reduction of biasing mismatch
5x reduction of dark current across a CMOS array (equivalent to costly PMTs)
Smaller form factor
Robust to environmental conditions
Maximized signal-to-noise ratio (SNR)

Applications
Low-light environment image sensing
Bio-chemical testing of fluorescence or bioluminescence
Cameras in telescopes for applied astronomy or cosmology
Medical diagnostic systems

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Additional Information

INSTITUTION

University of Maryland, College Park

PATENT STATUS

Patent(s) pending

LICENSE STATUS

Available for exclusive or non-exclusive license

CATEGORIES

- Imaging devices
- Microelectronics

EXTERNAL RESOURCES

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