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# Emerging Research Topics in Advanced Solid-State Image Sensors

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The impressive advancements in CMOS technologies over the last few decades have resulted in image sensors being a ubiquitous part of everyday life. However, there are always new challenges keeping research alive in the field of solid-state image sensors, with an increasing demand for imaging systems able to provide extra-information with respect to the standard digital cameras output. Among them there is the continuous progress of Single-Photon Avalanche Diode (SPAD) fabricated using standard CMOS technologies, which allow adding more and more, processing features onto the same chip while the pixel dimensions are shrinking. This kind of sensors, capable of resolving the photons time-of-arrival on a sub-nanosecond time scale, can be exploited in life science research for real-time fluorescence lifetime imaging and positron emission tomography. Another hot-topic, nowadays emerging in consumer market applications, concerns scannerless three-dimensional imaging, where a new class of sensors capable of measuring both the intensity map and the depth map of a scene is needed. Finally, a recently emerging challenge is the extension of the detectable frequency spectrum beyond the visible range, getting closer to the radio waves range in the so-called Terahertz region where the properties of the radiation become extremely interesting for many applications. In this talk, recent developments achieved on these topics worldwide and at FBK will be presented and discussed.

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