VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Gobinath Jegannathan**

The public defense will take place on **Tuesday, 31st August 2021 at 1:00pm.**

To join the digital defense, please click here
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CURRENT-ASSISTED SPAD SENSORS FABRICATED IN CONVENTIONAL CMOS PROCESS

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Abstract of the PhD research

A major revolution in light-detection is on-going. Whereas in the past, the electrical signal from light incident on a detector had to be amplified with a permanent dissipative analog amplifier, today there exist single photon avalanche diodes (SPADs) that natively detect single photons. Detecting the smallest measure of light is the ultimate achievable feat of photodetection. Although one might think that single-photon detectors are niche scientific instruments for fundamental research, it is rather a tool used in many day-to-day applications. 3-D image sensors, PET scanners and proximity sensors in mobile phones all use single-photon detection.

Moreover, SPADs are single-photon detectors which are very popular because they can be mass-fabricated in CMOS technology. The recent demonstration of a 1-megapixel SPAD from EPFL and Canon testifies the advancement of SPAD sensors, giving insight in the imaging possibilities yet to come.

In this work, a novel SPAD sensor is presented where the novelty arises from the integration of a large absorption volume and a very small avalanche multiplication volume. Such a detector topology allows to have a thick absorption layer which leads to higher quantum efficiencies for NIR wavelengths. This integration is enabled by “current-assistance” principle where a drift field is created in the substrate by applying a potential gradient. This “current-assisted SPAD” is fabricated in a cost-effective CMOS process which is commercially available.