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Light Emission from Light Detectors

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Visible light emission from both photomultipliers (PMT) and semiconductor p-n junctions in reverse bias has been known for over half a century. As photomultipliers and silicon photomultipliers (SiPM) are sensitive, their own light emission has a feedback, which needs to be understood. Furthermore it can be used to develop new evaluation tools.
With light emission microscopy we can show that the avalanche size in SiPM is finite. With a new method, it is also possible to measure the cross-talk morphology via the light emission. When developing small size cells, these results have to be taken into account, e.g. the timing resolution has a lower limit.
PMTs show fast spurious signals, correlated to an incident photon. As sensitive light detectors, their own light emission can cause fast afterpulses. We show how the electrons interact with the dynode material, time resolved on the nanosecond scale. Wavelength dependent light emission proves that not only the dynodes, but also their support structure emits light.
The performed experiments help to understand the fundamental effects of light emission in light detectors, applied to afterpulses and backscattering in PMTs and cross-talk in SiPMs in particular.

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