

# Avalanche photodiodes (APDs)

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Inventors: Joe Campbell et al.



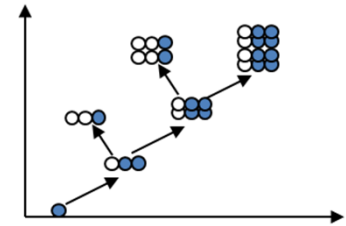
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# Avalanche Multiplication

- APD is a highly sensitive semiconductor electronic device that exploits photoelectric effect to convert light to electricity
- $k$  factor is the ratio of the electron,  $\alpha$ , and hole,  $\beta$ , ionization coefficients

Problem:

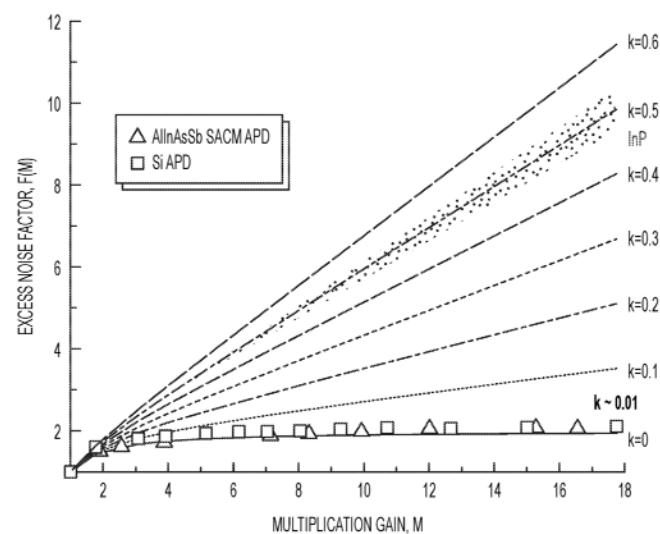
- $k$  values can lead to high excess noise
- Certain  $k$  values have gain-bandwidth products
- Sensitivity limitation stems from dark current



# AllnAsSb Avalanche Photodiode

Solution: UVA researchers have developed APDs with optimal  $k$  values and excellent gain/noise characteristics similar to Si

- Good efficiency, low dark counts
- Lattice-matching extends operating wavelength to SWIR spectrum



## Relevant Publications

- IEEE J. Quantum Electron., vol. 49, 2 154 (2013) by J.C. Campbell et al.
- Appl. Phys. Lett. 108, 081102 (2016) by J.C. Campbell et al.
- J. Lightwave Tech., 34, no. 2, 278-285 (2016) by J.C. Campbell

## Intellectual Property

- Tech ID: CAMPBELL-STAIRCASE
  - Title: AlInAsSb Staircase Avalanche Photodiode
  - US Patent 9748430 granted Aug. 29, 2017
- Tech ID: CAMPBELL-AVALANCHE
  - Title: AlInAsSb Avalanche Photodiode
  - US Patent 10032950 granted Jul. 24, 2018

## Contact

Marc Oettinger

Licensing Manager

[marc.oettinger@virginia.edu](mailto:marc.oettinger@virginia.edu)

434-982-1608