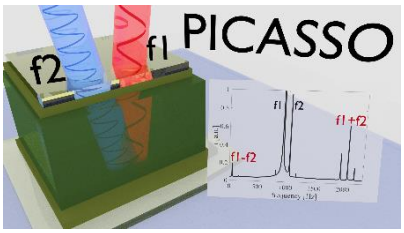
Substitute for LIDAR sensors

Nonlinear photodiode

Invention

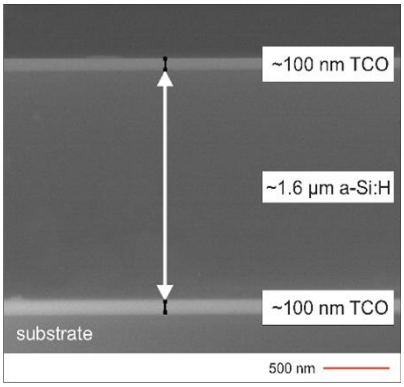
Optical components like photodiodes have a variety of uses in sensors and telecommunications technology. Even with time-of-flight sensors, the light reflected by objects has to be converted into electrical signals in order to compute the distance or speed of said objects.



PICASSO: Photo-Induced Current and Sensitivity Amplification in an Optical Detector

A new invention from the University of Siegen is an intrinsic frequency-mixing photodiode with an optically controllable response. This special a-Si:H PIN diode is lit with different wavelengths simultaneously, with sensitivity in the blue end of the spectrum significantly increased by adding red light.

The effect is surprisingly pronounced, and an initial demonstration produced amplification of up to two orders of magnitude, making it possible to raise sensitivity with values from silicon diodes with long-term optimization. This allows very weak frequency-modulated signals in the blue channel to be significantly raised out from background noise. When the light sources are modulated differently, the diode intrinsically generates signal amplitudes in sum and difference frequencies.



Sample detector structure

Commercial Opportunities

This technology can be used to create sensors based on frequency mixing for 3D distance measuring in passenger vehicles, robots, industrial automation and augmented reality applications. Since these optoelectronic components would be inexpensive and relatively easy to manufacture, they could be a promising alternative to LIDAR sensors. With the current lab prototypes, distances of over 100 m can be measured down to the centimeter. By utilizing their inherently nonlinear behavior, these components can be used for entirely new applications in optical data processing. In neuromorphic computing, neuronal networks are implemented directly in the hardware for a considerable performance advantage for AI applications compared to purely software-implemented solutions run on conventional processors. Further applications as active components in optical communications technology or as electro-optical transistors are conceivable.

Current Status

An application was submitted to the German Patent and Trademark Office on 07/21/2021, with subsequent applications in other countries possible in the priority year. An initial prototype has been built that demonstrates the advantages of this technology. Components producing the effect described by the invention can be reproducibly manufactured. On behalf of the University of Siegen, we are offering interested companies the opportunity to license property rights and help continue to develop this technology alongside the inventor as part of a research project.

Relevant Publications

The first scientific publications are scheduled for the start of 2022.

Competitive Advantages

- Light-controlled sensitivity
- Suitable for optical distance measuring
- Inexpensive component
- Variety of possible applications

Technology Readiness Level

1 2 3 4 5 6 7 8 9

Experimental proof of concept

Industries

- Optoelectronics
- Automotive
- Computing / IT

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