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Non-Invasive Optical Biomarker Detection Using Silicon Photonics

Researchers at Stanford have developed a compact, chip-based optical sensor capable of measuring key health biomarkers non-invasively and in real time, with potential for integration into everyday wearable devices.

Accurate biomarker monitoring like glucose or inflammatory proteins is essential for disease diagnosis and management. However, it requires blood draws, laboratory processing, and chemical reagents which are often invasive, time-consuming, and unsuitable for everyday use. Existing non-invasive alternatives have also struggled to achieve the accuracy and reliability needed for clinical use.

This new platform uses a specialized configuration in silicon photonic chips to analyze light that has interacted with biological tissue, extracting both color (spectroscopic) and structural (polarization) information simultaneously. By combining these two signals, the device can distinguish target molecules, e.g. glucose, from background interference with much greater accuracy than either method alone. The chip's compact design with programmable components makes it well-suited for integration into wearables, opening the door to continuous, real-time health tracking without needles or lab visits.

Stage of Development: Proof of concept

Applications

- Continuous glucose monitoring in wearables (e.g., smartwatches, patches)
- Real-time tracking of inflammatory markers and other health biomarkers
- Point-of-care diagnostics for clinical and home health settings

Advantages

- Non-invasive and label-free biomarker detection
- More accurate readings by combining two complementary sensing methods
- Compact, chip-scale design suitable for wearable devices

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