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Universal Programmable and Self-Configuring Optical Filter

Stanford researchers have developed a groundbreaking universal programmable and self-configuring optical filter. This innovative technology addresses the limitations of traditional optical filters by allowing full customization after fabrication, enabling adaptation to changing environmental conditions or application requirements.

The filter operates by splitting input light into multiple waveguides of varying lengths and using a programmable interferometer mesh to control the spectral response. This "forward-only" architecture avoids undesired resonances, supporting simple setup and control algorithms. It can be self-configured to optimize for specific wavelengths without complex calibration, making it ideal for applications in optical communications and environmental sensing.

Stage of Development: Proof of concept

Applications

- Optical fiber communications for wavelength division multiplexing
- Environmental sensing for monitoring atmospheric gases
- Scientific applications such as spectroscopy
- Tunable mirrors for laser systems

Advantages

- Programmable spectral response after fabrication
- Compact design using integrated photonics
- Self-configuring capability for automatic wavelength optimization
- Adaptability to environmental changes and application-specific requirements

- Potential for mass manufacture using existing silicon photonics foundries

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