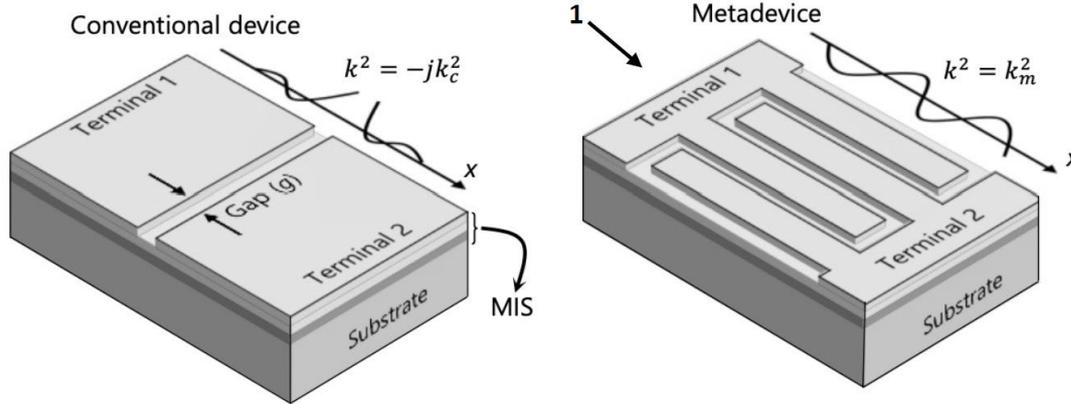


Electronic metastructures and metadevices



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Description

The innovation in electronic devices addresses the limitations of traditional semiconductor technology, particularly for terahertz applications. These issues, driven by the scaling of device dimensions, include high channel resistance, parasitic capacitances, and low breakdown voltages. Such constraints hinder the performance of conventional transistors and diodes, limiting their frequency and power capacities. The invention introduces electronic metadevices, leveraging collective electromagnetic interactions at deep-subwavelength scales to overcome these barriers. This approach shifts the paradigm from controlling electron flow to manipulating electromagnetic fields, enabling unprecedented speeds, low losses, and high power handling.

Advantages

The new electronic metadevices surpass traditional limits, achieving remarkable performance benchmarks such as cutoff frequencies exceeding 10 terahertz, picosecond switching speeds, and exceptionally high breakdown voltages. These innovations are versatile, applicable across platforms like CMOS, wide-bandgap semiconductors, and two-dimensional materials. By enabling microscopic control of electromagnetic fields, these devices enhance conductance and mitigate losses,

ensuring resilience against breakdowns and interference. This breakthrough sets the foundation for the next generation of high-speed, high-efficiency electronics, bridging the gap between optics and electronics.

Applications

- **Communication:** Ultrahigh-speed data transmission and next-generation wireless technologies.
- **Imaging:** Advanced terahertz imaging for security and medical diagnostics.
- **Semiconductor Platforms:** Compatibility with CMOS, III-V, and 2D materials, expanding the scope of device integration.
- **Power Electronics:** High-power applications with improved efficiency and reliability.
- **Research and Development:** Exploration of novel applications in physics and material sciences.