**Objective:** Plasmonics enable truly nonphotonics components for communications, imaging and spectroscopy by exploiting localized and propagating surface plasmons that access nanometer-scale wavelengths at optical frequencies.

**Impact:** This MURI is creating (a) new plasmonic material designs (b) comprehensive design and experimental realization of subwavelength component active and passive devices and small, circuit-like networks (c) a toolbox of design methodologies for plasmonic networks and circuits.

**Relevance:** Deliverables will enable ultracompact, robust and highly efficient photonic components and networks for communications, imaging, and detection optimally suited for insertion into mobile military platforms.

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**Quantum Cascade Lasers with Plasmon Waveguide Cavities**

Unprecedented wavelength coverage (mid-IR, far-IR) by changing active region thickness: from 3 μm to 150 μm

Laser polarization is normal to layers (TM mode): has enabled first surface plasmon laser, and allows innovative plasmonic resonator designs suited for chem/bio sensing applications.

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**Plasmon–Enhanced LED Light Emission**

InGaN Quantum Wells:

- New light emission phenomenon in Si MOS transistor
- Quantum-confinement effect carrier injection into Si quantum dots: program electronics in inversion, program holes in accumulation
- Device fabricated in state-of-the-art Si CMOS foundry

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**Plasmon–Enhanced Detection in Long Wavelength Infrared Hyperspectral Arrays**

- Mid-infrared photodetectors in 90–400 nm (2–20 μm) range
- Medical diagnostics, chemical imaging
- Night vision for battlefield recognition systems
- Chip-based detection of chemical warfare agents

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**Plasmon–Enhanced Detection**

- Resonant cavity detector using in-plane geometry
- Metal contact serves dual purpose of optical waveguide and electrical read-out

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**Superlenses: Imaging Below the Diffraction Limit**

Intersubband quantum dot detectors: promising technology to normal incidence excitation and lower dark currents. InAs quantum dots in a InGaAs well (SWELL) for mid-IR detection (Kithika et al. UNLV... but presently suffer from low quantum efficiency and responsivity due to small absorption volume.

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**Ultra–Small (~λ/10) Plasmon Waveguides Below Diffraction Limit**

Force manipulation positioning of detectors: Topography: Fluorescence:

Schematic View:

Waveguide Excitation:

Dyes on waveguide excited over a waveguide distance = 1 μm

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