

## Tunable THz Generation In Chip-Scale Graphene

Tech ID: 27408 / UC Case 2016-954-0

### SUMMARY

UCLA researchers in the Department of Electrical Engineering have developed a novel tunable and efficient terahertz (THz) plasmon generation on-chip via graphene monolayers.

### BACKGROUND

Generating, confining, and controlling graphene plasmons on optoelectronic chips would be groundbreaking but remains elusive to date. Recently, graphene plasmons have been generated via optical nonlinearity. However, it is still challenging to achieve graphene plasmons in chip-scale integrated photonics and optoelectronics because of the complicated nanofabrication, sensitive free-space calibration, and lack of specific source and detectors.

### INNOVATION

Researchers led by Professor Chee Wei Wong have developed a novel graphene heterostructure semiconductor chip, where single THz surface plasmons are generated using 'C+L' light sources. The THz frequency and intensity is tunable via external gate voltage and the optical-to-THz conversion is at least an order of magnitude more efficient than prior THz sources. By controlling the optical and electrical conditions, the photon efficiency of the graphene plasmons reaches  $\sim 10^{-4}$ , with a Q factor approaching 60. This innovative platform will lead to chip-scale room-temperature THz sources, switches, modulators, detectors, lasers, polarizers, and sensors based on graphene.

### APPLICATIONS

- ▶ Optoelectronic devices
- ▶ Photonic devices

### ADVANTAGES

- ▶ Tunable THz plasmon generation
- ▶ Tunable gate
- ▶ All-optically generated
- ▶ On-chip plasmon generation
- ▶ Highly efficient
- ▶ 'C+L' light sources

### STATE OF DEVELOPMENT

Prototype graphene-based semiconductor chips have been fabricated and extensively tested.

### PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,901,243	01/26/2021	2016-954

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### INVENTORS

- ▶ Wong, Chee Wei

### OTHER INFORMATION

#### KEYWORDS

Graphene, terahertz, THz plasmon generator, tunable plasmon, semiconductor chip, room-temperature, switches, modulators, detectors, lasers, polarizers, sensors

#### CATEGORIZED AS

- ▶ **Optics and Photonics**
  - ▶ All Optics and Photonics
- ▶ **Engineering**
  - ▶ Engineering
  - ▶ Other
- ▶ **Materials & Chemicals**
  - ▶ Electronics Packaging
  - ▶ Nanomaterials
  - ▶ Other
- ▶ **Nanotechnology**
  - ▶ Electronics
  - ▶ Materials
  - ▶ Other

#### RELATED CASES

2016-954-0

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