

8. Accession number:20123915468749

Title:Indirect modulation of a terahertz quantum cascade laser using gate tunable graphene

Authors:Badhwar, Shruti (1); Puddy, Reuben (1); Kidambi, Piran R. (2); Sibik, Juraj (3); Brewer, Anthony (1); Freeman, Joshua R. (4); Beere, Harvey E. (1); Hofmann, Stephan (2); Zeitler, J. Axel (3); Ritchie, David A. (1)

Author affiliation:(1) Department of Physics, University of Cambridge, United Kingdom; (2) Center for Advanced Photonics and Electronics, University of Cambridge, United Kingdom; (3) Department of Chemical Engineering, University of Cambridge, United Kingdom; (4) Laboratoire Pierre Aigrain, Paris, France

Corresponding author:Badhwar, S.(sb732@cam.ac.uk)

Source title:IEEE Photonics Journal

Abbreviated source title:IEEE Photon. J.

Volume:4

Issue:5

Issue date:2012

Publication year:2012

Pages:1776-1782

Article number:6199991

Language:English

ISSN:19430655

Document type:Journal article (JA)

Publisher:Institute of Electrical and Electronics Engineers Inc., 445 Hoes Lane / P.O. Box 1331, Piscataway, NJ 08855-1331, United States

Abstract:We bring together two areas of terahertz (THz) technology that have benefited from recent advancements in research, i.e., graphene, a material that has plasmonic resonances in the THz frequency, and quantum cascade lasers (QCLs), a compact electrically driven unipolar source of THz radiation. We demonstrate the use of single-layer large-area graphene to indirectly modulate a THz QCL operating at 2.0 THz. By tuning the Fermi level of the graphene via a capacitively coupled backgate voltage, the optical conductivity and, hence, the THz transmission can be varied. We show that, by changing the pulsing frequency of the backgate, the THz transmission can be altered. We also show that, by varying the pulsing frequency of the backgate from tens of Hz to a few kHz, the amplitude-modulated THz signal can be switched by 15% from a low state to a high state. © 2009-2012 IEEE.

Number of references:20

Main heading:Graphene

Controlled terms:Modulators - Optical conductivity - Quantum cascade lasers

Uncontrolled terms:Amplitude-modulated - Back-gate - Backgate voltage - Capacitively coupled - Indirect modulation - Plasmonic - Pulsing frequencies - Single layer - Terahertz - Terahertz quantum-cascade lasers - Terahertz technology - THz frequencies - THz radiation - THz signal

Classification code:713.3 Modulators, Demodulators, Limiters, Discriminators, Mixers - 741.1 Light/Optics - 744.1 Lasers, General - 761 Nanotechnology - 804 Chemical Products Generally

DOI:10.1109/JPHOT.2012.2215312

Database:Compendex

Compilation and indexing terms, Copyright 2012 Elsevier Inc.