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Compact electro-absorption modulator integrated with vertical-cavity surface-emitting laser for highly efficient millimeter-wave modulation

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APPLIED PHYSICS LETTERS

Volume: 105 Issue: 8

Article Number: 081113

DOI: 10.1063/1.4894716

Published: AUG 25 2014

[View Journal Impact](#)

Abstract

We demonstrate a compact electro-absorption slow-light modulator laterally-integrated with an 850 nm vertical-cavity surface-emitting laser (VCSEL), which enables highly efficient millimeter-wave modulation. We found a strong leaky travelling wave in the lateral direction between the two cavities via widening the waveguide width with a taper shape. The small signal response of the fabricated device shows a large enhancement of over 55 dB in the modulation amplitude at frequencies beyond 35 GHz; thanks to the photon-photon resonance. A large group index of over 150 in a Bragg reflector waveguide enables the resonance at millimeter wave frequencies for 25 μ m long compact modulator. Based on the modeling, we expect a resonant modulation at a higher frequency of 70 GHz. The resonant modulation in a compact slow-light modulator plays a significant key role for high efficient narrow-band modulation in the millimeter wave range far beyond the intrinsic modulation bandwidth of VCSELs. (C) 2014 AIP Publishing LLC.

Keywords

Keywords Plus: ACTIVE-MODE-LOCKING; VCSELS; GHZ; FREQUENCIES; BANDWIDTH; WIRELESS; NETWORKS; FIBER

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Funding

Funding Agency	Grant Number
Ministry of Education, Culture, Sports, Science and Technology of Japan	22226008
deanship of Scientific Research (DSR), King Abdulaziz University	20-130-35-RG
KAU	

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Publisher

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Categories / Classification

Research Areas: Physics

Web of Science Categories: Physics, Applied

Document Information

Document Type: Article

Language: English

Accession Number: WOS:000342753500014

ISSN: 0003-6951

eISSN: 1077-3118

Journal Information

Table of Contents: [Current Contents Connect](#)

Impact Factor: [Journal Citation Reports](#)

Other Information

IDS Number: AQ4HE

Cited References in Web of Science Core Collection: **31**

Times Cited in Web of Science Core Collection: **4**