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

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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 mu 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.

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