

RESEARCH HIGHLIGHT

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# Highly-efficient VCSEL breaking the limit

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VCSELs have become indispensable in the realms of datacenter networks and three-dimensional sensing thanks to their high-energy efficiencies, low-cost and the scalability of their two-dimensional arrays. VCSELs boast high energy-efficiency, exceeding 50% at low bias currents, superiority over edge-emitting lasers, particularly for optical interconnects within datacenter networks. However, there has been no breakthroughs in the efficiency of VCSELs for over a decade. With the swift evolution of AI clusters in datacenters and 3D-sensing for autonomous driving, where VCSELs are predominantly favored, the demand for ultra-high-efficiency VCSELs has become paramount. A team of researchers from Sichuan University and Suzhou Everbright Photonics Co., Ltd., have found a novel approach based on multiple-tunnel junctions within the active region. They demonstrated a record high-efficiency of 74% with

prospects reaching as high as 88%. This breakthrough has the potential to reshape the 3D-sensing and data-center ecosystems, providing a low-cost, energy-efficient, and reliable forthcoming generation of green photonics. The structural simplicity combined with its exceptional performances opens up a new era of VCSEL photonics with boundless opportunities for further research and innovation.

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