Monolayer excitonic laser

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Abstract

Two-dimensional van der Waals materials have opened a new paradigm for fundamental physics exploration and device applications because of their emerging physical properties. Unlike gapless graphene, monolayer transition-metal dichalcogenides (TMDCs) are two-dimensional semiconductors that undergo an indirect-to-direct bandgap transition(1-5), creating new optical functionalities for next-generation ultra-compact photonics and optoelectronics. Although the enhancement of spontaneous emission has been reported on TMDC monolayers integrated with photonic crystals(6,7) and distributed Bragg reflector microcavities(8,9), coherent light emission from a TMDC monolayer has not been demonstrated. Here, we report the realization of a two-dimensional excitonic laser by embedding monolayer WS2 in a microdisk resonator. Using a whispering gallery mode with a high quality factor and optical confinement, we observe bright excitonic lasing at visible wavelengths. This demonstration of a two-dimensional excitonic laser marks a major step towards two-dimensional on-chip optoelectronics for high-performance optical communication and computing applications.

Keywords

KeyWords Plus: LAYER MOS2; VALLEY POLARIZATION; ENERGY-CONVERSION; ROOM-TEMPERATURE; PIEZOELECTRICITY; TRANSISTORS; DISULFIDE; DIODES; WSE2

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