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Control of Two-Dimensional Excitonic Light Emission via Photonic Crystal SANFENG WU, University of Washington, USA, SONIA BUCKLEY, Stanford University, USA, AARON JONES, JASON ROSS, University of Washington, USA, NIRMAL GHIMIRE, JIAQIANG YAN, DAVID MANDRUS, Oak Ridge National Laboratory, USA, WANG YAO, University of Hong Kong, China, FARIBA HATAMI, Humboldt University, Germany, JELENA VUCKOVIC, Stanford University, USA, ARKA MAJUMDAR, XIAODONG XU, University of Washington, USA — Monolayers of transition metal dichalcogenides (TMDCs) exhibit many novel and outstanding photonics and optoelectronic behaviors in the two dimensional (2D) limit, such as rich spin-valley interplays, tunable excitonic effects, and strong light-matter interactions. Excitonic light emission is essential for many of these novelties and potential applications. However, the manipulation of its light emission is still undeveloped. Here we demonstrate the control of excitonic light emission from monolayer tungsten diselenide (WSe2) in an integrated photonic structure, achieved by transferring one monolayer onto a photonic crystal (PhC) with nanocavity. A greatly enhanced ($\sim$ 60 times) photoluminescence of WSe2 and an effectively coupled cavity-mode emission is observed in such systems. More importantly, we are able to redistribute the emitted photons in both polar and azimuthal directions in the far field through designing PhC structures. A 2D optical antenna is thus constructed in our hybids. Our work suggests a new way of manipulating photons in hybrid 2D photonics, important for future energy efficient optoelectronics and 2D nano-lasers.

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