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Excitonic Resonant Emission-Absorption of Surface Plasmon in Transition Metal Dichalcogenides for Chip-level Electronic-Photonic Integrated Circuits ZHUAN ZHU, Univ of Houston, JIANGTAN YUAN, Rice Univ, HAIQING ZHOU, Univ of Houston, JONATHAN HU, Baylor Univ, JING ZHANG, Rice Univ, CHENGLI WEI, Baylor Univ, FANG YU, SHUO CHEN, YUCHENG LAN, Univ of Houston, YAO YANG, Rice Univ, YANAN WANG, Univ of Electronic Science and Technology of China, CHAO NIU, Baylor Univ, ZHIFENG REN, Univ of Houston, JUN LOU, Rice Univ, ZHIMING WANG, Univ of Electronic Science and Technology of China, JIMING BAO, Univ of Houston — The monolithic integration of electronics and photonics has attracted enormous attention due to its potential applications. A major challenge to this integration is the identification of suitable materials that can emit and absorb light at the same wavelength. In this paper we utilize unique excitonic transitions in WS2 monolayers and show that WS2 exhibits a perfect spectral overlap between its absorption and photoluminescence spectra. By coupling WS2 to Ag nanowires, we then show that WS2 monolayers are able to excite and absorb surface plasmons of Ag nanowires at the same wavelength of exciton photoluminescence. This resonant absorption by WS2 is distinguished from that of the Ohmic propagation loss of silver nanowires, resulting in a short propagation length of surface plasmons. Our demonstration of resonant optical generation and detection of surface plasmons enables nanoscale optical communication and paves the way for on-chip electronic-photonics integrated circuits.

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