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**A giant enhancement of multiphoton absorption in single-layer molybdenum disulfide**[1] FENG ZHOU, WEI JI[2], Department of Physics, National University of Singapore — Identifying light absorption mechanisms in nanoscale materials, which are more efficient than those observed in bulk semiconductors, are of paramount importance to next-generation, infrared photo-detection. Here, we report considerable enhancement of degenerate two-photon absorption (2PA) and three-photon absorption (3PA) through two-dimensional (2D) excitonic effects in single-layer molybdenum disulfide (1L-$MoS_2$). We theoretically predict that both degenerate 2PA and 3PA coefficients of 1L-$MoS_2$ are enhanced by 10-1000 times in the near-infrared (NIR), as compared with those of bulk semiconductors. Our theoretical prediction is validated by measuring photocurrents induced by 2PA or 3PA in a 1L-$MoS_2$ photo-detector at room temperature where excitons in the immediate vicinity of the bandgap are transferred to the conduction band by a very small amount of thermal energy and dissociated under an external electric field. Our finding lays theoretical foundation and provides experimental evidence for developing sensitive infrared multiphoton detectors for nano-photonics.

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