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Photoluminescence Saturation and Exciton Decay Dynamics in Transition Metal Dichalcogenide Monolayers DONG HAK KIM, MIN JU SHIN, DAEYOUNG LIM, Department of Applied Physics, KyungHee University — We study the photoluminescence saturation and exciton decay dynamics in monolayer transition transition-metal dichalcogenides (TMDs). Monolayer $MoSe_2$ shows a PL saturation at a very low excitation intensity, more than two orders of magnitude lower than monolayer MoS_2. Transient reflection spectroscopy shows that nonlinear exciton-exciton annihilation is the dominant exciton decay mechanism in monolayer $MoSe_2$, in contrast to the exciton decay in monolayer MoS_2 Furthermore, we measure exciton lifetime >125 ps for monolayer $MoSe_2$ much longer than the several-ps exciton lifetime in MoS_2. We find that that the difference in their exciton lifetime can explain both the dramatically different exciton decay mechanism and PL saturation behavior of $MoSe_2$ and MoS_2 monolayers.

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