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Interfacial Charge Transfer and Recombination Dynamics in van der Waals Heterojunctions of 2D Semiconductors[1] JUE WANG, HAIMING ZHU, ZIZHOU GONG, YOUNG DUCK KIM, MARTIN GUSTAFSSON, JAMES HONE, XIAOYANG ZHU, Columbia University — Heterojunctions of transition metal dichalcogenides (TMDC) are being explored for optoelectronics, photovoltaics and spin-valleytronics at the 2D limit. Using time-resolved microscopic transient reflectance spectroscopy, we measured the interfacial charge transfer and recombination dynamics in two dimensional MoS_2/WSe_2 heterojunctions as a function of interlayer momentum mismatch. The observed ultrafast (< 40 fs) formation of interlayer exciton is independent of the relative orientation between the two layers, indicating a hot-carrier mediated charge transfer mechanism. The lifetime of charge transfer excitons span two orders of magnitude (0.04 - 3 ns) with no clear dependence on momentum mismatch, in accordance with the defect-mediated non-radiative recombination mechanism. Our results suggest the importance of defect reduction in revealing the intrinsic properties of charge transfer excitons in two dimensional van der Waals heterojunctions.

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