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Valley-Polarized Interlayer Excitons in 2D Semiconductor Heterostructures PASQUAL RIVERA, KYLE SEYLER, Univ of Washington, HONGYI YU, University of Hong Kong, JOHN SCHAIBLEY, Univ of Washington, JIAQIANG YAN, DAVID MANDRUS, University of Tennessee, XIAODONG XU, Univ of Washington — Vertically stacked monolayers of $MoSe_2$ and WSe_2 feature a type-II band alignment causing the formation of interlayer excitons, where the Coulomb bound hole and electron reside in different layers. This species of exciton has lifetime many orders of magnitude longer than intralayer valley excitons, providing a unique and advantageous system for investigating valley exciton physics. Here, we optically pump the $MoSe_2$-WSe_2 heterostructure with circularly polarized light, creating interlayer valley excitons with gate-tunable spin-valley polarization lifetime up to 40 ns. This long valley lifetime enables the diffusion of the interlayer valley exciton gas to be visualized. Under increasing excitation power we observe the formation of a ring in the spatial distribution of the valley polarization, a manifestation of significant valley-selective exchange interactions at high exciton densities. The combination of long valley polarization and spatial diffusion makes the interlayer exciton in semiconductor heterostructures an exciting platform for studies of valley exciton physics.

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