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Polarization-dependent photocurrents in polar stacks of van der Waals solids[1] SONGCI LI, Univ of Washington, YULI LYANDA-GELLER, Purdue University, ANTON ANDREEV, Univ of Washington — Monolayers of semiconducting van der Waals solids, such as transition metal dichalcogenides (TMDs),acquire significant electric polarization normal to the layers when placed on a substrate or in a heterogeneous stack. This causes linear coupling of electrons to electric fields normal to the layers. Irradiation at oblique incidence at frequencies above the gap causes interband transitions due to coupling to both normal and in-plane ac electric fields. The interference between the two processes leads to sizable in-plane photocurrents and valley currents. The direction and magnitude of currents is controlled by light polarization and is determined by its helical or nonhelical components. The helicity-dependent ballistic current arises due to asymmetric photo generation. The non-helical current has a ballistic contribution (dominant in sufficiently clean samples) caused by asymmetric scattering of photoexcited carriers, and a side-jump contribution. Magneto-induced photocurrent is due to the Lorentz force or due to intrinsic magnetic moment related to Berry curvature.

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