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Magneto-optical Kerr switching properties and spin configurations of magnetic 2D heterostructures

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We explore the magneto-optical Kerr effect (MOKE) of $(CrI_3)_2$ bilayer and $(CrBr_3/CrI_3)$ mixed bilayers. Starting from CrX_3 (X=I,Br) monolayers, we considered collinear ferromagnetic (FM) and layered antiferromagnetic (AFM) states for $(CrI_3)_2$ and $(CrBr_3/CrI_3)$ bilayers. The AFM $(CrI_3)_2$ bilayer does not show MOKE, consistent with the presence of a symmetry operator combining inversion (I) and time reversal (T) symmetries. The FM state preserves I symmetry but breaks the T symmetry, thus allowing a non-zero Kerr angle, which is reversible by switching the FM spins. The $(CrBr_3/CrI_3)$ bilayer breaks both the I and T symmetries and thus exhibits MOKE both in the FM and, remarkably, in AFM states. In both FM and AFM configurations, the Kerr angle switches by reversing the spins in both layers. We show that MOKE spectra can help characterize different magnetic configurations in these emerging two-dimensional materials due to a different stacking of the monolayers, even in the AFM case. We propose $(CrBr_3/CrI_3)$ bilayer as a candidate for AFM spintronics, since the two time-reversed AFM states are associated with opposite Kerr rotation, *i.e.* they could be used as memory elements.