## Symmetry-breaking induced transition among net-zero-magnetization magnets

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FIG. S1. (Color online) For  $Cr_2C_2S_3Se_3$ , the planar averaged electrostatic potential energy variation along z direction. E stands for the intrinsic polar field.



FIG. S2. (Color online) The spin-polarized energy band structures of  $Cr_2C_2S_6$  at E=0.30V/Å (a) and E=-0.30V/Å (b). In (a, b), the spin-up and spin-down channels are depicted in blue and red, and the purple color means spin degeneracy.



FIG. S3. (Color online) The enlarged energy band structures of  $CrMoC_2S_6$  (a) and  $CrMoC_2S_3Se_3$  (b). The spin-up and spin-down channels are depicted in blue and red.



FIG. S4. (Color online) The energy band structures of CrMoC<sub>2</sub>S<sub>6</sub> (a) and CrMoC<sub>2</sub>S<sub>3</sub>Se<sub>3</sub> (b) within SOC.



FIG. S5. (Color online)When a longitudinal in-plane electric field  $E_{\parallel}$  (red arrow) is applied, the Bloch carriers of K or -K valley will acquire an anomalous transverse velocity  $v_{\perp} \sim E_{\parallel} \times \Omega(k)$  and accumulate along one edge of the sample, giving rise to the AVHE.