Supplementary Information: Electrically switchable anti-ferroelectric bilayer In$_2$Se$_3$ based opto-spintronics device

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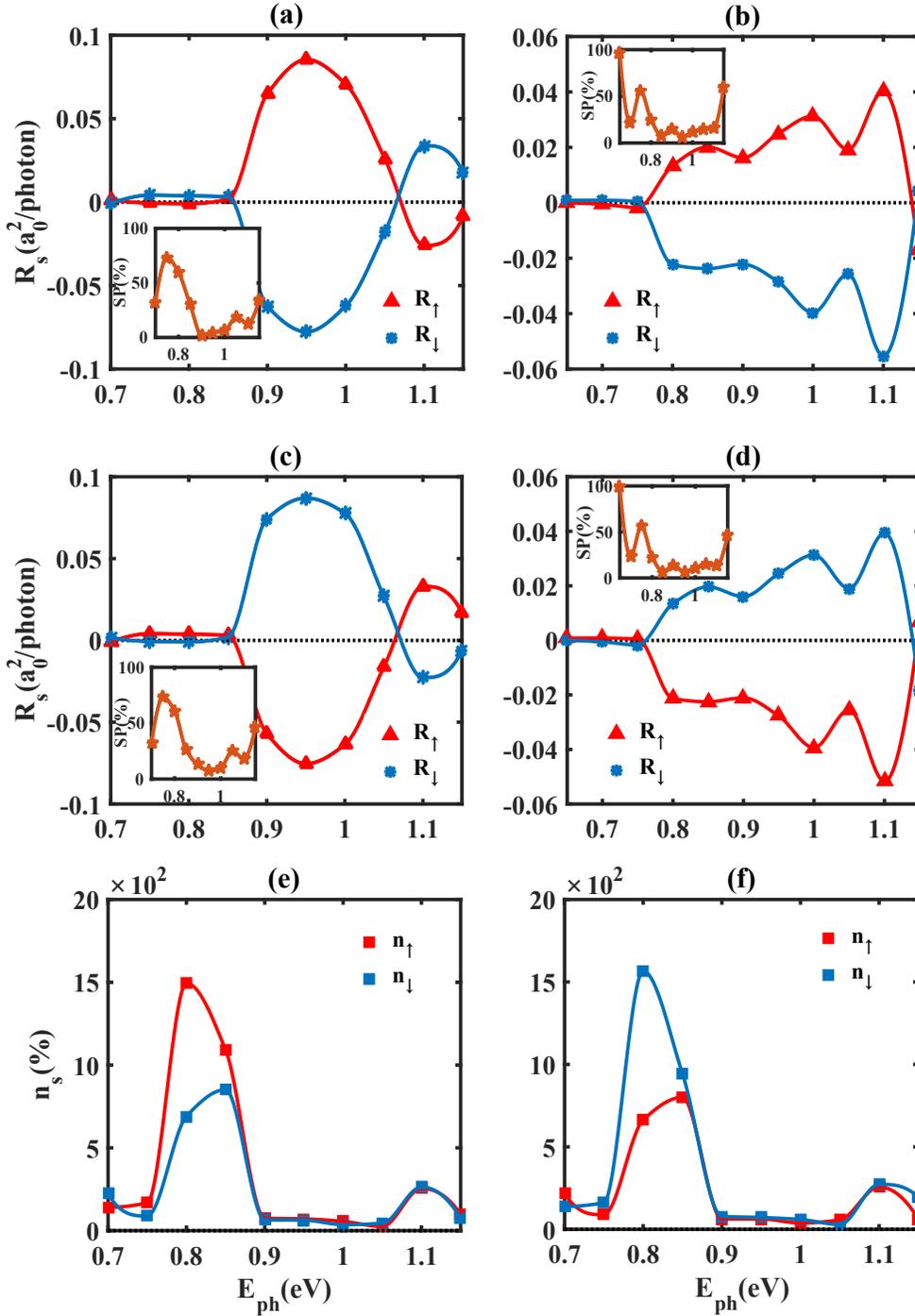
Figure S1 The spin-dependent photoresponse versus the photon energy E_{ph} of the circular polarized light. (a,c) The calculated spin dependent photoresponse for atomic structure α_{out} when the photon polarization is fixed at $\phi = 45°$ and $\phi = -45°$, respectively. (b,d) The calculated spin dependent photoresponse for atomic structure α_{in} when the photon polarization is fixed at $\phi = 45°$ and $\phi = -45°$, respectively. (e,f) The calculated spin dependent relative photoresponse change n_s versus the photon energy when the photon polarization is fixed at $\phi = 45°$ and $\phi = -45°$, respectively. Here, the red and blue lines represent the spin up and spin down components. The polarization angle ϕ is fixed $\phi = 45°$ in (a,c,e) and $\phi = -45°$ in (b,d,f). The triangle, asterisk and square points are obtained from DFT calculations and the solid lines are fitted curves based on the calculated points.
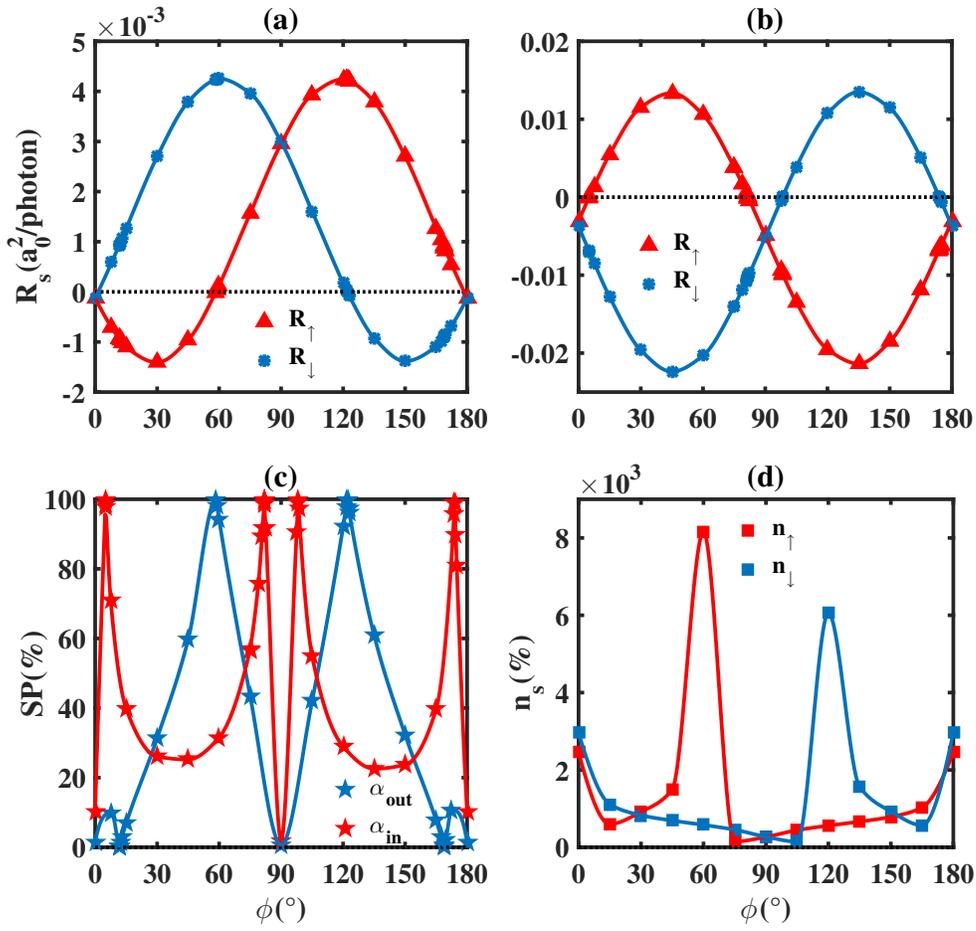
Figure S2 (a,b) The spin dependent photoresponse versus the polarization angle ϕ of CPGE for two In_2Se_3 structures α_{out} and α_{in}, respectively. (c) The corresponding spin polarization of structures α_{out} and α_{in} versus the polarization angles ϕ. (d) spin dependent relative photoresponse change versus the polarization angles ϕ. The photon energy E_{ph} is equal to 0.8 eV. The triangle, asterisk and square points are obtained from DFT calculations and the solid lines are fitted curves based on the calculated points.