Electronic Supplementary Information

First-principles insight into photoelectronic properties of Ge-based perovskites

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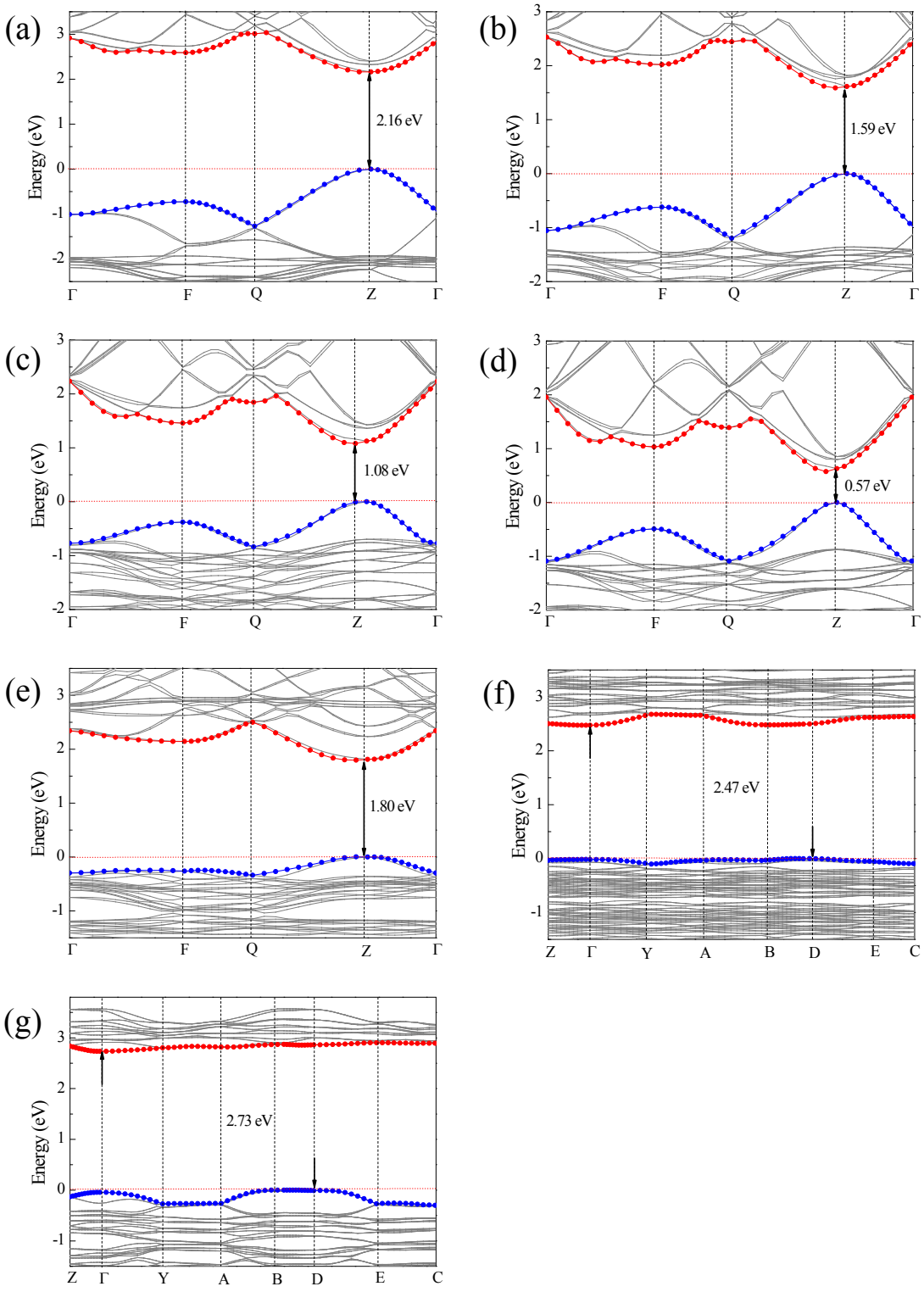

Fig. S1. The band structures of perovskites using the PBE+SOC functional: (a) $MAGeCl_3$, (b) $MAGeBr_3$, (c) $MAGeI_3$, (d) $CsGeI_3$, (e) $FAGeI_3$, (f) $MOGeI_3$, and (g) $GAGeI_3$.

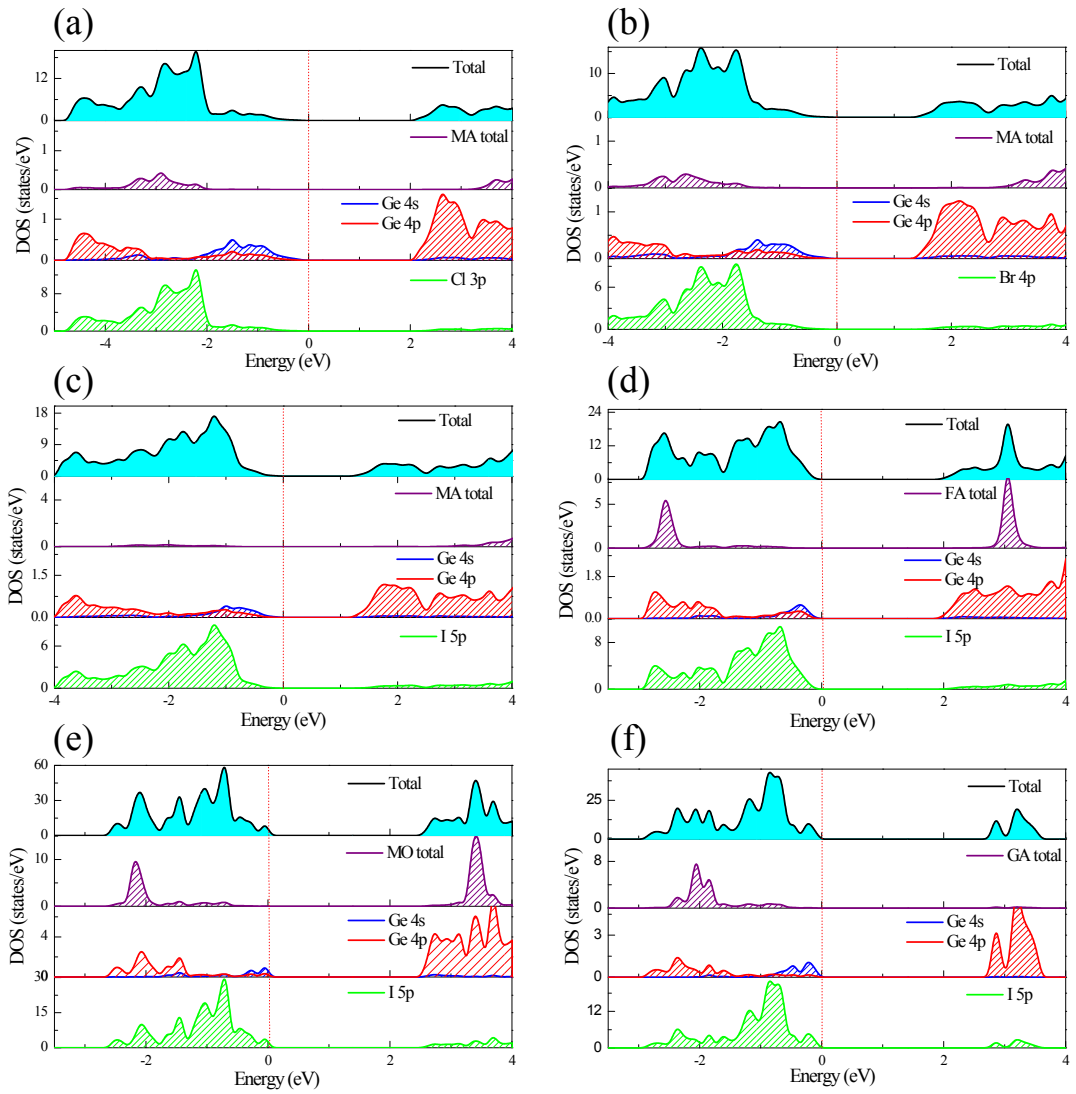

Fig. S2. The DOS of (a) $MAGeCl_3$, (b) $MAGeBr_3$, (c) $MAGeI_3$, (d) $FAGeI_3$, (e) $MOGeI_3$, and (f) $GAGeI_3$ perovskites.

Table S1. The effective masses of electron and hole (m_e* and m_h*, relative to the electron static mass m_o) along the Z (0 0 0.5)→Γ (0 0 0) direction in the trigonal perovskites by using the PBE and PBE+SOC functionals (in brackets), respectively.

Effective masses	$CsGeI_3$	$MAGeCl_3$	$MAGeBr_3$	$MAGeI_3$	$FAGeI_3$
m_e*/m_o	0.22 (0.25)	0.77 (0.73)	0.33 (0.44)	0.27 (0.28)	0.66 (0.65)
m_h*/m_o	0.23 (0.23)	0.39 (0.45)	0.33 (0.35)	0.29 (0.30)	0.76 (0.85)