Electronic Supplementary Information for

Two Dimensional Janus Ru*XY* (*X, Y* = I, Br, Cl, F, *X* ≠ *Y*) Monolayers: Ferromagnetic Semiconductors with Spontaneous Valley Polarization and Tunable Magnetic Anisotropy

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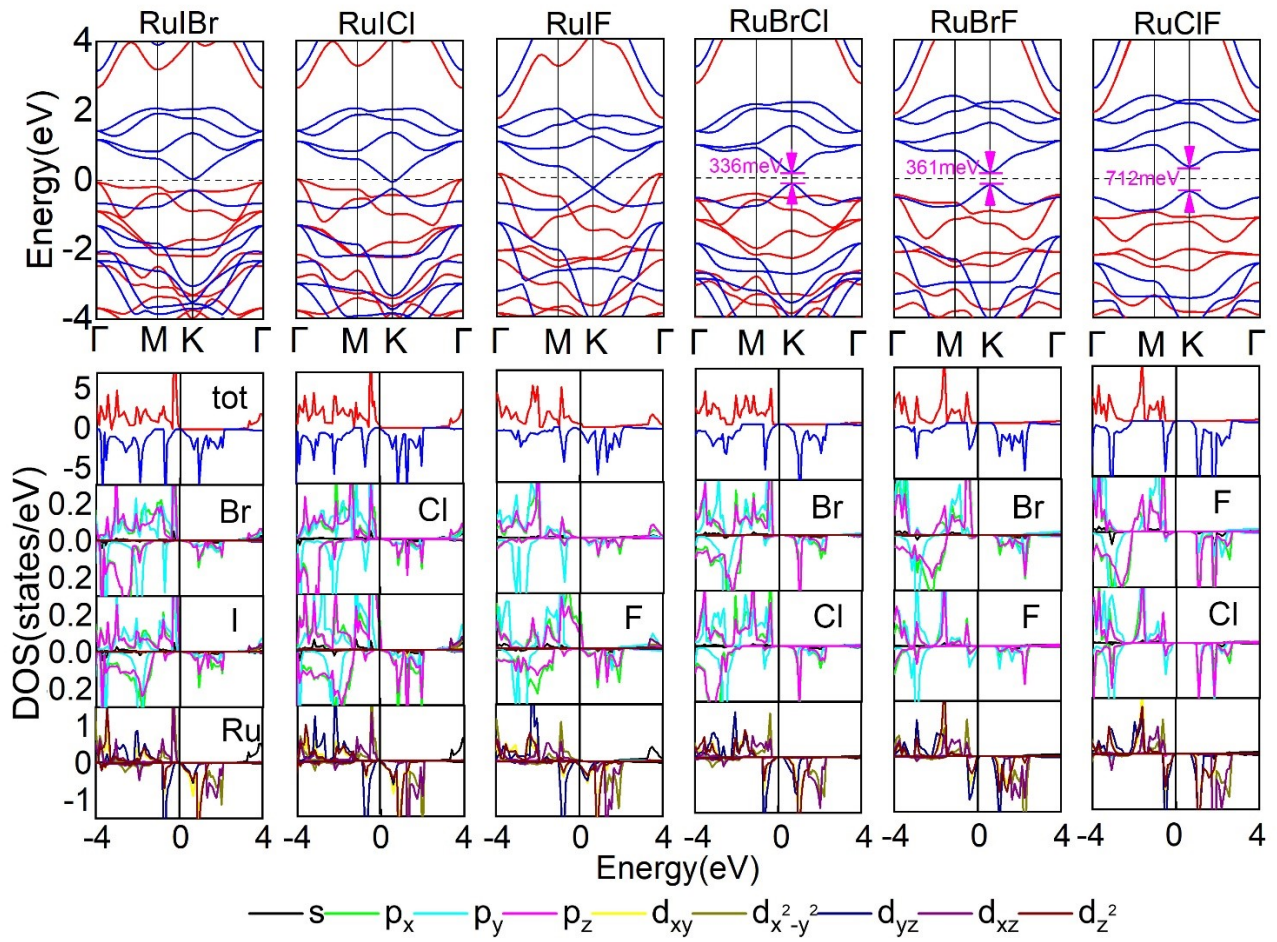E-mail: wangxc@email.tjut.edu.cn and miwenbo@tju.edu.cn

Fig. S1 The band structures and density of states of Janus Ru*XY* monolayers (*X*, *Y* = Br, I, Cl, F, *X*≠*Y*).
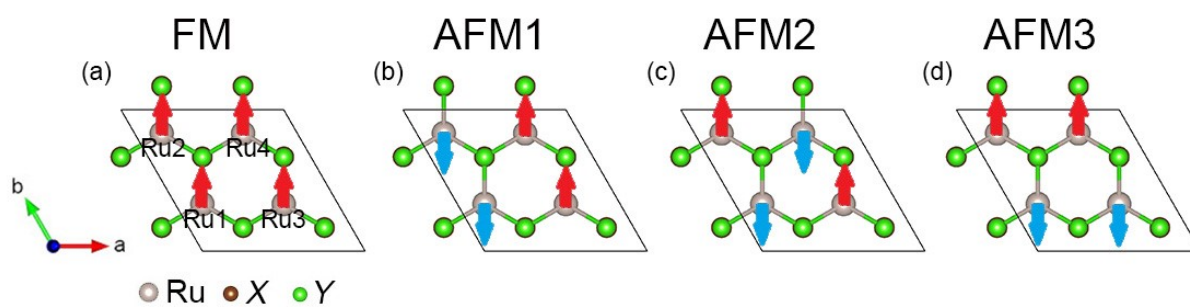
Fig. S2 The structures of Janus Ru*XY* monolayers in (a) FM, (b) AFM1, (c) AFM2 and (d) AFM3 states. Two colored arrows indicate different spin directions.
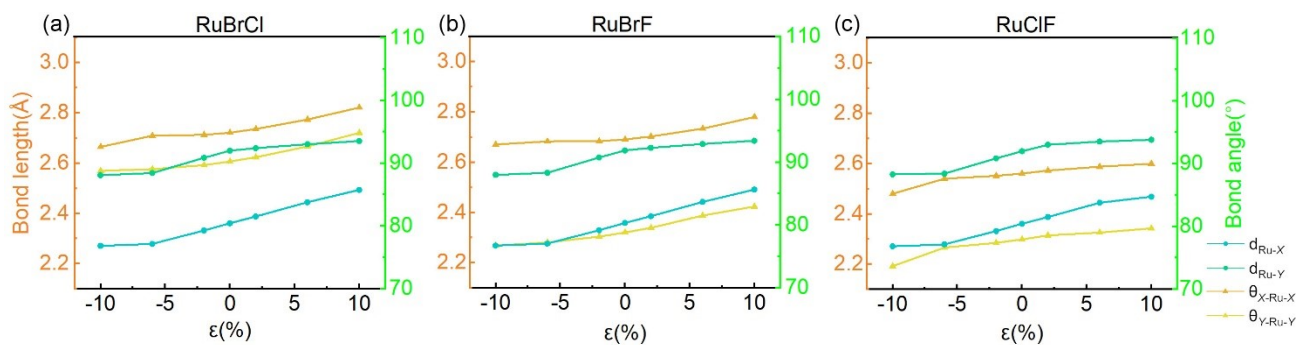
Fig. S3 Changes in bond length and bond angle of (a) RuBrCl, (b) RuBrF, (c) RuClF monolayers at different biaxial strains.
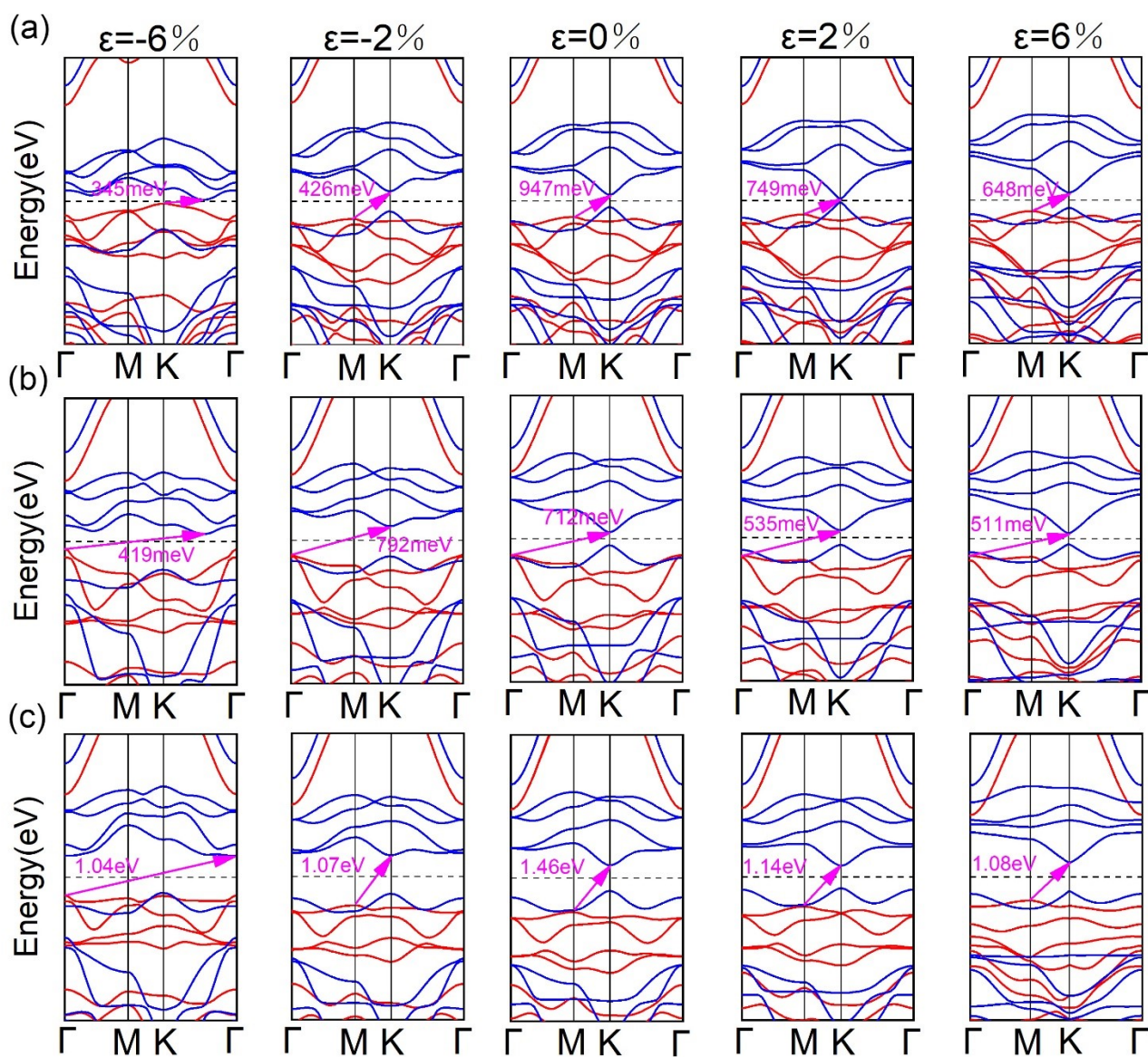
Fig. S4 The band structures without SOC of (a) RuBrF, (b) RuBrCl and (c) RuClF monolayers at different biaxial strains.
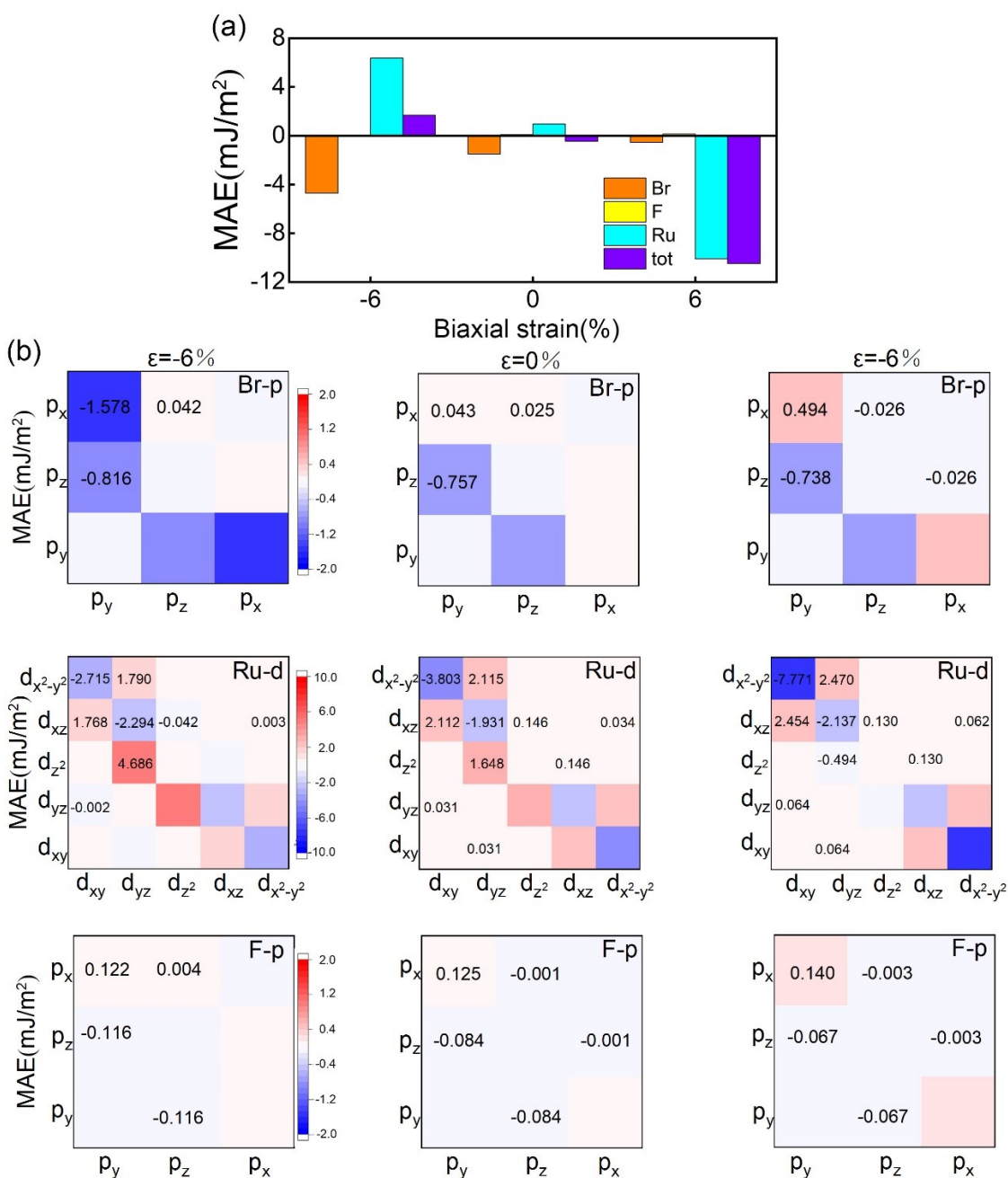
Fig. S5 (a) Total MAE and (b) the orbital-resolved MAE in RuBrF monolayer at different biaxial strains. The positive and negative values indicate PMA and IMA, respectively.
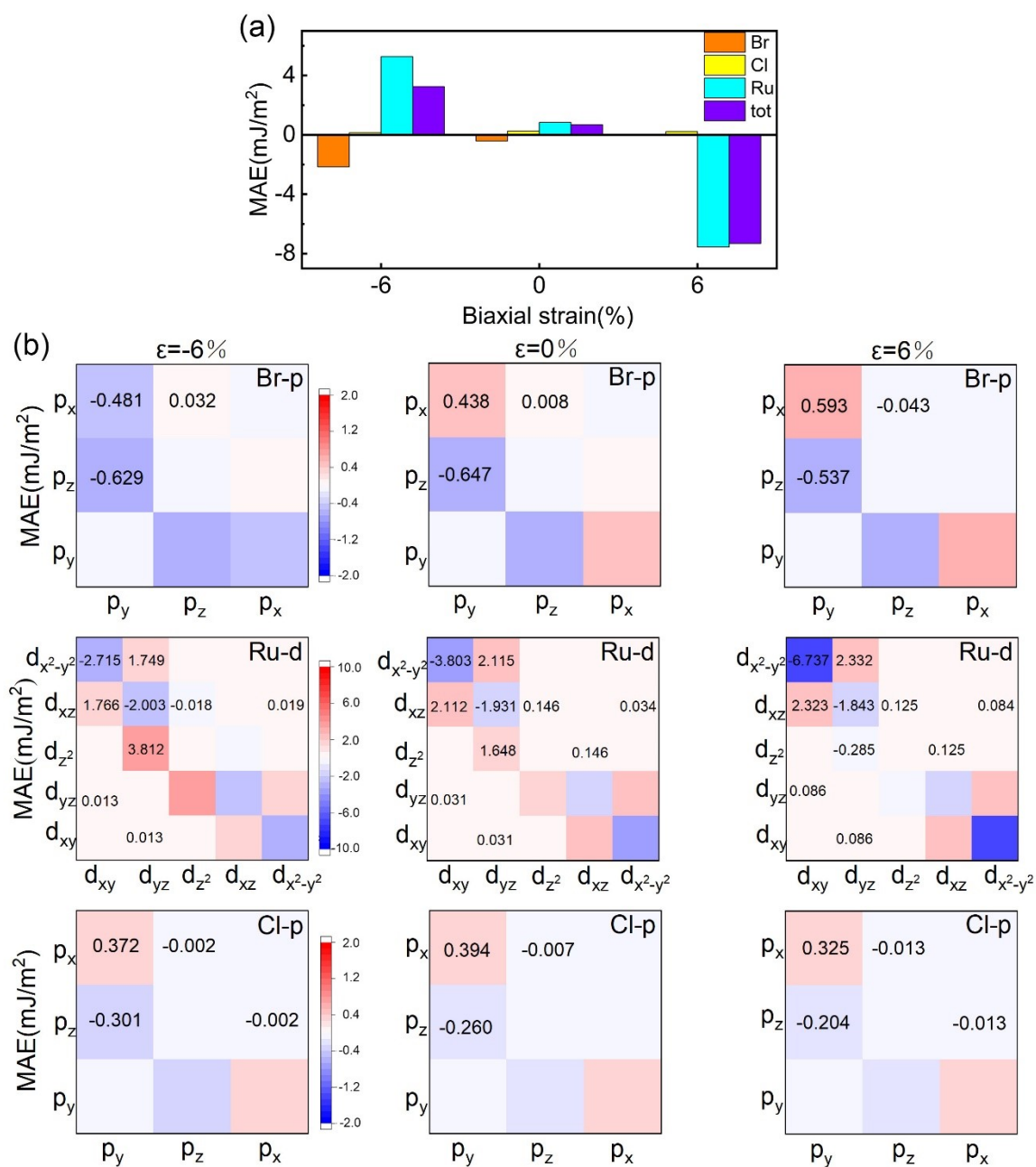
Fig. S6 (a) Total MAE and (b) the orbital-resolved MAE in RuBrCl monolayer at different biaxial strains. The positive and negative values indicate PMA and IMA, respectively.

Table S1 The total energy(eV) of the Ru*XY* monolayers with the different magnetic configuration.

	E_{AFM1} (eV)	E_{AFM2} (eV)	E_{AFM3} (eV)	E_{FM} (eV)	Magnetic ground state
RuIBr	-37.324	-37.325	-37.325	-37.562	FM
RuICl	/	/	/	/	/
RuIF	/	/	/	/	/
RuBrCl	-41.427	-41.427	-41.427	-41.873	FM
RuBrF	-45.916	-45.916	-45.916	-46.695	FM
RuClF	-48.582	-48.582	-48.582	-49.247	FM