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Two-Dimensional Multiferroics in Monolayer Group IV Monochalcogenides[1] HUA WANG, XIAOFENG QIAN, Department of Materials Science and Engineering, Texas A&M Univ. — Low-dimensional multiferroics with strongly coupled ferroic orders are highly valuable for miniaturized transducers, actuators, sensors, photovoltaics, and nonvolatile memories. However, they are very scarce owing to the stringent symmetry and chemistry requirements for practical applications at room temperature. Using first-principles theory, we predict that two-dimensional monolayer Group IV monochalcogenides including GeS, GeSe, SnS, and SnSe are a class of 2D semiconducting multiferroics with giant strongly coupled in-plane spontaneous ferroelectric polarization and spontaneous ferroelastic lattice strain. In addition, they are thermodynamically stable at room temperature, and possess strong anisotropic and excitonic in-plane photoabsorption with visible-spectrum excitonic gaps and large exciton binding energies. The interplay of low domain wall energy, small migration barrier, coupled ferroelastic-ferroelectric order, and anisotropic electronic structures suggest their great potential for tunable multiferroic functional devices by manipulating external electrical, mechanical, and optical field to control the internal responses. (Reference: Hua Wang and Xiaofeng Qian, http://arxiv.org/abs/1606.04522 (2016))

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