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Spin-orbit interaction driven dimerization in one dimensional frustrated magnets SHANG-SHUN ZHANG, Univ of Tennessee, Knoxville, CRISTIAN D. BATISTA, Univ of Tennessee, Knoxville and Oak Ridge National Laboratory, Oak Ridge — Spin nematic ordering has been proposed to emerge near the saturation of field of a class of frustrated magnets. The experimental observation of this novel phase is challenging for the traditional experimental probes. Nematic spin ordering is expected to induce a local quadrupolar electric moment via the spin-orbit coupling. However, a finite spin-orbit interaction explicitly breaks the U(1) symmetry of global spin rotations down to Z_2, which renders the traditional nematic order no longer well-defined. In this work we investigate the relevant effect of spin-orbit interaction on the 1D frustrated $J_1 - J_2$ model. The real and the imaginary parts of the nematic order parameter belong to different representations of the discrete symmetry group of the new Hamiltonian. We demonstrate that spin-orbit coupling stabilizes the real component and simultaneously induces bond dimerization in most of the phase diagram. Such a bond dimerization can be observed with X-rays or nuclear magnetic resonance. In addition, an incommensurate bond-density wave (ICBDW) appears for smaller values of $J_2/|J_1|$. The experimental fingerprint of the ICBDW is a double-horn shape of the the NMR line. These conclusions can shed light on the experimental search of this novel phase.

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