

## Putative spin-nematic phase in BaCdVO(PO<sub>4</sub>)<sub>2</sub>

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We report neutron scattering and AC magnetic susceptibility measurements of the 2D spin-1/2 frustrated magnet BaCdVO(PO<sub>4</sub>)<sub>2</sub>. At temperatures well below  $T_N \approx 1\text{K}$ , we show that only 34% of the spin moment orders in a up-up-down-down strip structure. Dominant magnetic diffuse scattering and comparison to published  $\mu\text{SR}$  measurements indicates that the remaining 66% is fluctuating. This demonstrates the presence of strong frustration, associated with competing ferromagnetic and antiferromagnetic interactions, and points to a subtle ordering mechanism driven by magnon interactions. On applying magnetic field, we find that at  $T = 0.1\text{K}$  the magnetic order vanishes at 3.78T, whereas magnetic saturation is reached only above 4.5T. We argue that the putative high-field phase is a realisation of the long-sought bond-spin-nematic state.

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