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Amplitude-modulated magnetic order and persistent spin dynamics in frustrated multiferroic FeTe2O5Br

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Exotic magnetic ground states are often induced by geometrical frustration, imposing unbalance into the system and thus making it highly susceptible to all kinds of perturbations. As a result, frustrated systems may develop incommensurate magnetic long-range orders (LRO), highly disordered static spin-glass phases or even dynamic spin-liquid states. Moreover, complex magnetic LRO can induce ordering of other degrees of freedom (e.g., electric polarization in multiferroics) or may even be accompanied by persistent spin dynamics (PSD). The two extraordinary phenomena are rare and still lack a comprehensive description.
We focus on a layered FeTe¬2O5Br system, which below TN1=11K develops an amplitude-modulated incommensurate magnetic LRO [1], which is below the second transition, at TN2=10.5K, accompanied by electric polarization [1]. The incommensurate modulation appears to originate form surprisingly strong Fe-O-Te-O-Fe exchanges, forming a magnetic exchange network composed of Fe3+ (S=5/2) spin chains coupled by weaker frustrating interactions [2].
Here presented results [3,4] reveal that complex magnetic ordering has a weak perpendicular component, leading to an overall elliptical structure. Nevertheless, the amplitude modulation is preserved and is accompanied by spin fluctuations, persisting at lowest accessible temperatures, hereby offering a well-defined framework and a coherent explanation for the coexistence of LRO and PSD [4].

[1] M. Pregelj et al., PRL 103, 147202 (2009), M. Pregelj et al., PRB 82, 144438 (2010).
[2] M. Pregelj et al., PRB 86, 054402 (2012).
[3] M. Pregelj et al., PRB 87, 144408 (2013).
[4] M. Pregelj et al., PRL 109, 227202 (2012)

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