Fokker-Planck approach for electronic transport noise of two-dimensional antiferromagnetic semiconductors

E. Martello[1], **G. Falci**[1,2,3], **E. Paladino**[1,2,3], **F. M. D. Pellegrino**[1,2,3]

1. Department of Physics and Astronomy "E. Majorana", University of Catania, Via Santa Sofia, 64, 95123 Catania, Italy
2. INFN, Sez. di Catania, 95123, Italy 3. CNR-IMM, UoS Università, 95123, Italy

Abstract: Antiferromagnets (AFMs) are critical for electron-based quantum technologies due to ultrafast spin dynamics and no stray fields. Inspired by MPX_3 experiments, we analytically explore their Nèel temperature behavior and spin wave dynamics in 2D materials.

The pursuit of electron-based quantum technologies has garnered significant interest due to their ability to revolutionize fields such as computing, sensing, and communication. Within this context, antiferromagnets (AFMs) have become a critical area of focus because of their unique properties, such as ultrafast spin dynamics and the absence of stray fields, which make them particularly suited for quantum applications[1]. Inspired by recent experimental findings on single-layer MPX_3 compounds at the Nèel temperature, we are conducting an analytical study to elucidate their behavior. Using analytical tools akin to those applied to ferromagnets (namely, the Fokker-Planck equation), we provide a theoretical explanation for the observed phenomena and explore spin wave dynamics in these 2D materials, shedding light on the fundamental mechanisms governing their properties[2, 3].

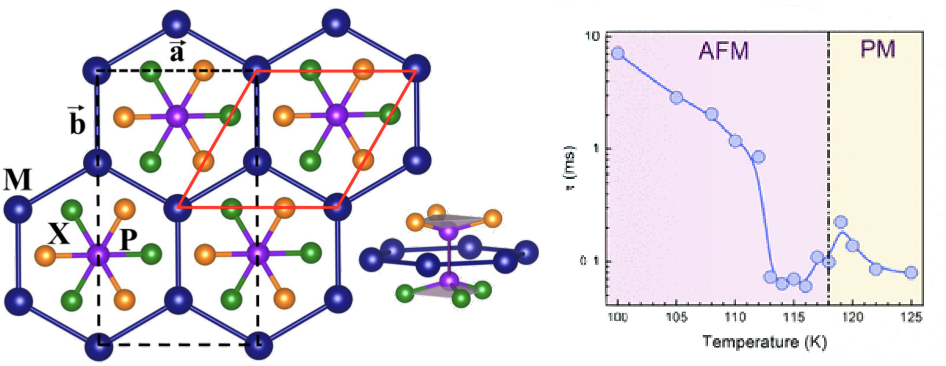

Figure 1: On the left: structure of the MPX_3 single-layer compound (adapted from Ref. [1]). On the right: behaviour of single-layer $FePS_3$ across the Nèel temperature (adapted from Ref. [3]).

References

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