Corrugation driven spin relaxation in graphene

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Abstract

Controlling spin relaxation rate is important to design devices intended to be applied in spintronics. Since spin injection and detection was demonstrated, graphene has been considered to be applied for spintronic devices. One reason is its low spin-orbit coupling, that allows spin to travel further while can be modified via proximity effect with other materials (such as TMDs).
However, studies report spin relaxation times orders of magnitude lower than predicted by theory. This could be due to the appearance of “local” spin orbit coupling due to ripples as reported by Guinea et al. [2]. Here we develop a KPM (Kernel Polynomial Method) real space approach [1] study to estimate the contribution of corrugation to the spin dynamics of a corrugated graphene sample in a wide range of gate voltages and make a discussion based on the main spin relaxation processes known.

References

[1] Zheyong Fan, José H. Garcia, Aron W. Cummings, Jose Eduardo Barrios-Vargas, Michel Panhans, Ari Harju, Frank Ortmann, Stephan Roche,Phys. Reports,903 (2021) 1-69

[2] Guinea, F. and Horovitz, Baruch and Le Doussal, P.,Phys. Rev. B, 77(2008), 205421.

Figures

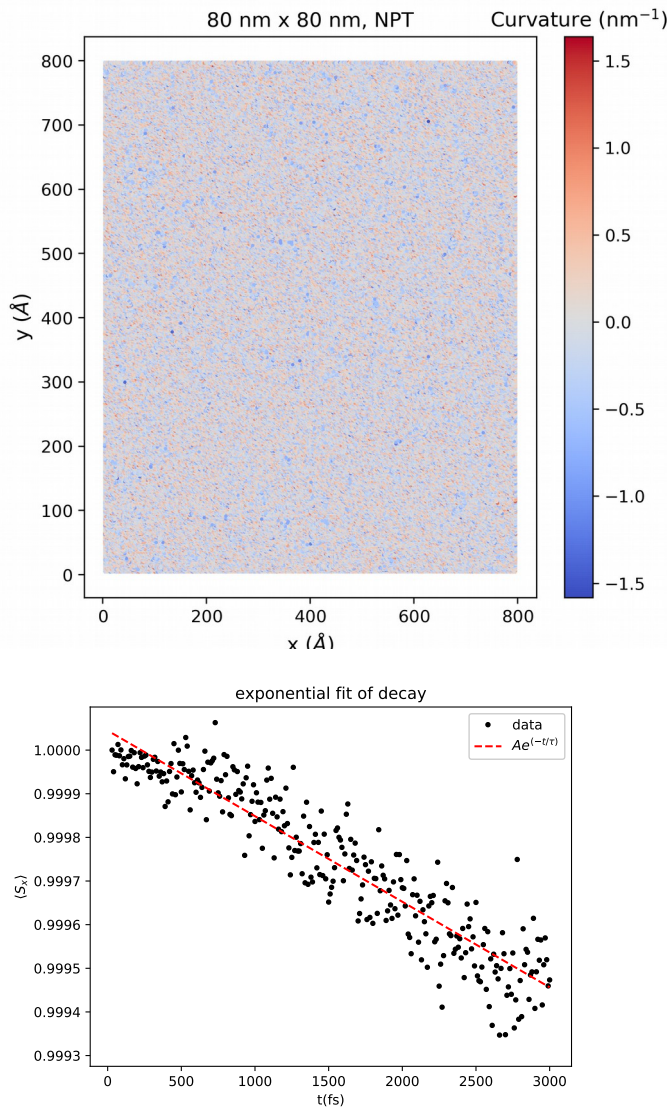

Figure 1: Spin relaxation time for a corrugated graphene sample and characterization of the sample. Top figure curvature profile where blue is for negative curvature and red for positive curvature and bottom figure is a spin relaxation graph fitted with an exponential decay used to obtain relaxation time