Spin relaxation in graphene induced by corrugations

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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. In the other hand, atomic disorder in graphene have been predicted by Guinea et al. [2] to possibly have a deep impact in spin orbit interaction. Here we develop a KPM (Kernel Polynomial Method) real space approach [1] combined with Molecular dynnamics relaxations to deal with such real space deformation and study them 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

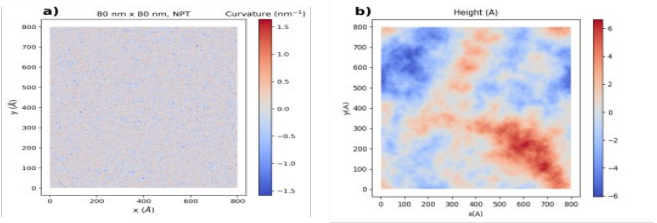

Figure 1: Characterization of the MD sample in curvature (left) at left and heighs (right)

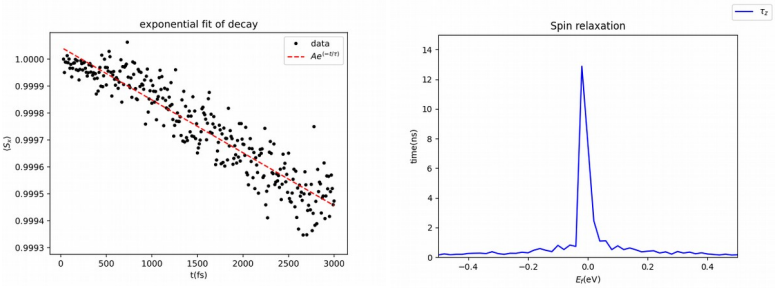

Figure 2: Spin relaxation time depending on the gate voltage at right fitted form spin decay(right)