Impact of the regularization parameter in the Mean Free Path reconstruction method: Nanoscale heat transport and beyond

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Magnon-mediated longitudinal spin-Seebeck effect in YIG films

This data was obtained by Guo *et al* measuring the thickness dependence of the longitudinal-Spin Seebeck effect (LSSE) in YIG films.[1] The suppression function used in the reconstruction was the cross-plane Fuchs-Sondheimer model presented in Eq. (4). In **Figure S1*a*** it is easy to see that the different values of μ have an impact mainly in the accumulation function, being the case of the lower value of μ that affects the most both the accumulation function and the recovered LSSE, as shown in Figure S1***b***. The reconstructed function for the optimal value μ_{opt} = 0.8856 at T=250 K is shown in Fig. 10. The optimal value of the reconstruction parameter was calculated for all the temperatures measured, obtaining a different value for each of them (see **Figure S2**).

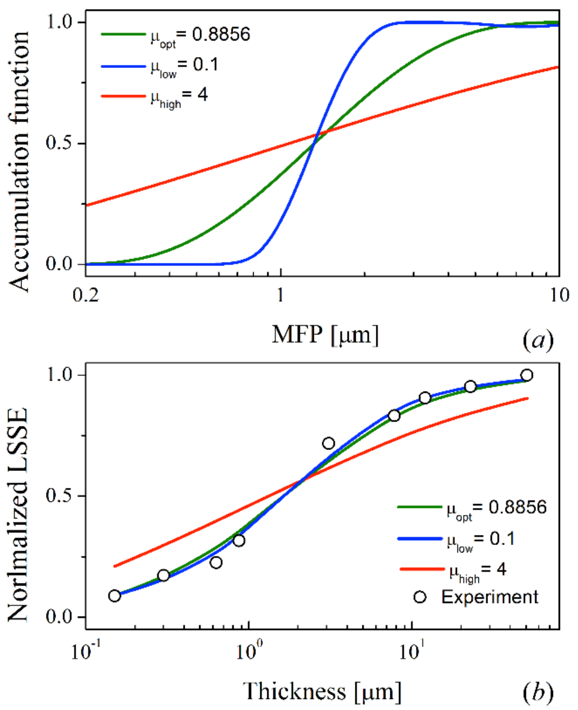

Figure S1 *(a) Magnon mean free path distribution of the accumulation function reconstructed for m$_{opt}$ (green line) for spin Seebeck effect experiments. The blue and red lines are the result obtained using a low and high value of m, respectively. (b) Normalized Longitudinal Spin-Seebeck coefficient for different thickness of the YIG sample.*[1]

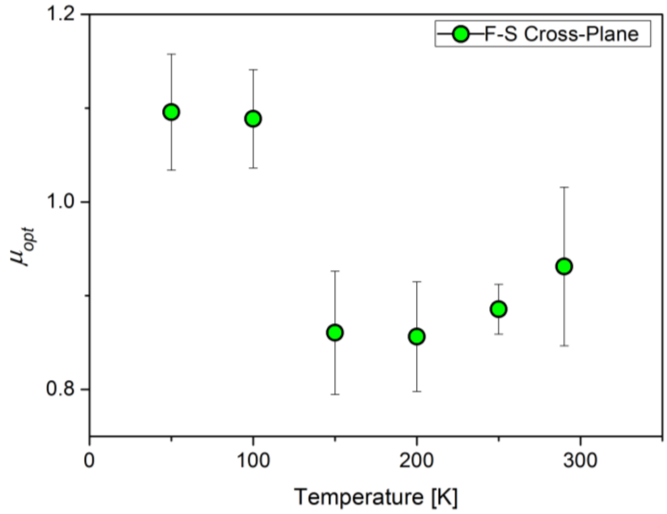

Figure S2 *Optimal values of μ for the Magnon-MFP reconstruction at different temperatures for LSSE experiments.*

Spin diffusion length in Pt films

This case is an example of the application of this technique to a completely different transport phenomena, namely, the spin diffusion length. The experiment consisted of measuring the thickness dependence of the spin-Hall torque coefficient, ξ, in platinum.[2]
In this case, the suppression function is derived from the drift-diffusion model [3], and given by [4]

$$S(\chi) = 1 - \frac{1}{\sinh(1/\chi)} \tag{S1}$$

This case differs from the previous phenomena, having a narrow span of the MFP distribution. For the optimal value of μ, the accumulation function's range goes from around 0.7 to 2 nm, and for μ = 0.1 it shrinks to be from 1 to 2 nm (see Figure S3). This indicates that the method is very sensitive even for very narrow MFP distributions, which allows it to be applied to a wide range of transport phenomena.

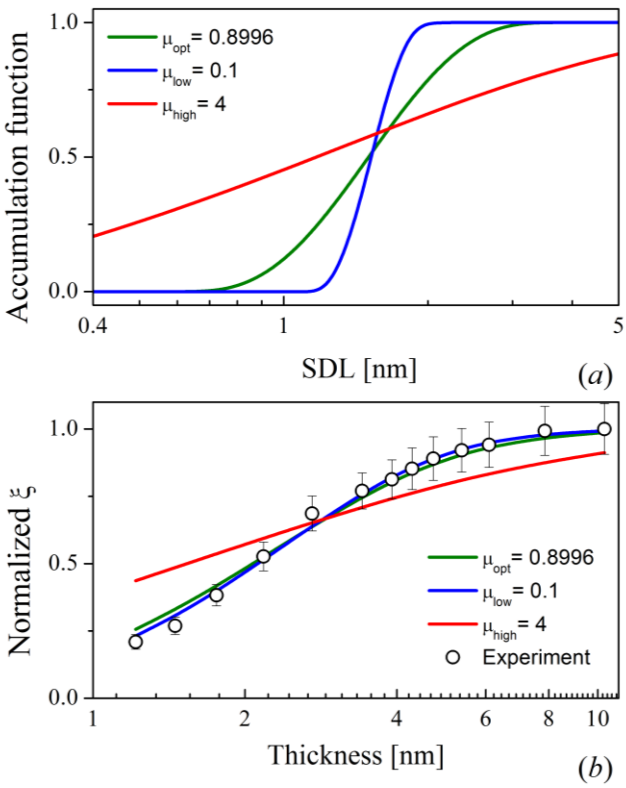

Figure S3 *Spin diffusion length distribution of the accumulation function reconstructed for spin-Hall torque experiments. The blue and red lines are the result obtained using a low and high value of μ, respectively. The green line represent the MFP distribution reconstructed using μ_{opt}. (b) Normalized Longitudinal spin-Hall torque coefficient for different thickness of the Pt filmvalues of μ for the Magnon-MFP reconstruction at different temperatures for LSSE experiments.*

References

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