

Magn. Reson. Discuss., referee comment RC3
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Comment on mr-2021-55

Anonymous Referee #2

Referee comment on "Spin noise gradient echoes" by Victor V. Rodin et al., Magn. Reson. Discuss., <https://doi.org/10.5194/mr-2021-55-RC3>, 2021

In this manuscript the authors discuss the generation and observation of spin noise echoes through the use of pulsed gradients and in the absence of RF excitation. The topic is interesting, the presentation is clear, and the results are very much appropriate for the journal so I recommend this manuscript for publication provided the authors address the comments below.

1-I think the authors could elaborate a bit more in the main text on the mechanism of spin-noise echo formation. In particular, I wonder if a description that takes into account the spin noise spectral density (or, equivalently, the spin noise correlation function) isn't appropriate. Along the same lines, it would be good if the authors could include a correlation curve (as determined from the spin noise time traces in the absence of gradients) and show how this compares to values derived from the gradient protocol (where decoherence and diffusion can be determined separately).

2-The impact of radiation damping on spin noise detection is mentioned a couple times but the main ingredients are described very superficially. With the understanding that the subject has been previously discussed elsewhere, it would be a good idea to devote a paragraph or two to better highlight the central ideas, even if briefly.

3-In the concluding section, the authors highlight some of the areas where the present technique could find use, including the case where the system T1 is long. While this is true on general grounds, I wonder how long should the T1 be to make this technique competitive. I think a ballpark numerical assessment is in order here. I recommend the same for other directions the authors identify as promising.

4-I had a hard time interpreting some of the figures. In particular, I found several occasions where all axis labels and units are missing and numerical labels are too small to be seen (if at all present). I strongly suggest the authors should more carefully review all figures to ensure they convey all necessary information.

