MAGNETIC RESONANCE
Discussions

Magn. Reson. Discuss., referee comment RC1
https://doi.org/10.5194/mr-2021-55-RC1, 2021

Comment on mr-2021-55

Anonymous Referee #1

Referee comment on "Spin noise gradient echoes" by Victor V. Rodin et al., Magn. Reson. Discuss., https://doi.org/10.5194/mr-2021-55-RC1, 2021

The manuscript “Spin-Noise Gradient Echoes” is the continuation of authors research in the area of spin noise and its applications. Authors are presenting interesting new application of spin noise into the study of spin diffusion showing that diffusion coefficients can be estimated without applying of radio frequency pulses. The beauty of creation the spin noise shows lack of necessity of brute force in the form of pulses because coherence is created spontaneously by statistic of spin fluctuations. Therefore, in their experiment necessary coherence for studying spin diffusion is coming not from pulses but from natural spontaneous fluctuations of spin noise system.

In the course of the manuscript I can see several problems that I would like to address. On Figure 1(b) there is lack of axis label and also lack of corresponding units. Existing number are very small and hard to read. Looking at the same Figure 1 (a) one can see that duration of gradients are not the same. $\delta 2$ is longer than $\delta 1$. However, in the figure caption says they are the same $\delta 1 = \delta 2 = 2$ ms. This shows lack of consistency. This also suggests that acquisition time t is 2ms long which seems to be improbable. This requires clarification.

On the same Figure the delay $\Delta = 0.015$ ms. Which seems to be very short. How the ring down of the gradient coil behaves during this 15 microsecond delay? And what are the consequences of this interference? Clarification is needed.

I could not find a definition in the caption or text for the meaning of the delay $\varepsilon = 0.007$ ms.

The Figure 1S.- is showing the numerical simulation of spin noise according to parameters: ð□□® ð□□□ = −ð□□□ð□□□; ð□□® ð□□□ = ð□□□ð□□□; ð□□¸ = ð□□□; ð□□□ ð□□□ = ð□□□; ð□□□ = ð□□□; ð□□» ð□□□ = ð□□□ð□□□. One would like to ask what means T2=10? Is this microseconds, miliseconds, seconds? T2 always has dimension and without such is meaningless. The same question applies to the rest of the listed parameters. Why can not put real physical numbers into simulation? Lack of real number in simulation indicates that we are talking not about physical reality but something that exists in abstraction or virtual reality. On the other hand spin noise is a physical reality and needs to be treated with real numbers. This issue requires clarification. Also assumption "spin noise can be envisaged as a series of spontaneous excitation events of a random phase " is raising question " is this reflecting physical reality or spin noise abstraction? To reconcile this, the work of T. R. Field and A.D. Bain, Appl. Magn. Reson. 38, 167 (2010) and T.R. Field and A.D. Bain, Physic. Rev. E 87(2), 022110-1 (2013) about properties of spin noise and its origin needs to be discussed and cited.

Figure 2.- lack of labels and units on both axis.

Figure 3. -It could beneficial for reader if captions contains values of $\delta 1$, $\delta 2$, Δ and ε for every spectrum recorded according to this scheme.

Figure 4. -lack of x axis label and units. Numbers are small and hard to read.

Equation 3. -Symbol "γ" is not defined.

Figure 5. -Y axis label in wrong place.

Figure 2S a and b. -the denominator's subscript for y axis label is not readable.

Authors bring several times the magnitude of radiation damping as important parameter. However, they did not present the actual number. I think the value of radiation damping and spin-spin relaxation time will give better view of the physical reality. I would like to suggest to consider measurement of radiation damping and give this to reader.

In equations S1,S3,S4 transverse magnetization is represented by symbol "m0". In NMR tradition which goes back to Bloch, the magnetization used to be expressed by capitol :"M, Mx, My, Mz" I would suggest considering to keep up with common tradition.

The manuscript has the potential for important contribution to the application and understanding of spin noise echo. However, I can see significant number of problems that needs to be addressed before can be published. I recommend for publication after major revision is made.