We have made changes to the article in response to the referees' and community comments, as follows:

Referee #1

We have corrected the equation numbering.
We have replaced the term "zero-quantum" around line 75 by a more general statement (see highlighted version).

Referee #2
This referee, and some of the community commentators, raised semantic issues over our use of the term "polarization" in some contexts. Our view is that this term is more flexible than stated by the commentators and that its usage may be extended to cover our cases, for the sake of simplicity and economy of nomenclature. We have commented extensively on this throughout the revised manuscript (around lines 105 and 169).

- Could the author add more information on the condition in the eq. (23). Where exactly does it come from (i.e., why a sum of lambda from 1 to 2I)?
  - This has now been done (~ line 180)
- In Figure 4, -1/3 is listed as a lower bound but one can clearly see that the intersect with the x-axis (representing a contribution of the rank 0 polarization moment) is lower than |-0.3| (while it should cross at |-0.33|). Is it a representation error?
  - No, the referee has misunderstood the axes. We have clarified the scales used (caption to Figure 4).

- A similar analysis of the absence of information in the nuclear spin system was recently performed and could be mentioned with respect to the eq. (35): https://doi.org/10.1038/s41467-019-10787-9
  - We do not see the relevance of the article and have not made changes.
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- Page 17. "being inside the red region" – what exactly is the red region?
  - The references to red have been corrected to dark grey (lines 320-325).

- In Figure 7, “hyperpolarized states” are mentioned. This is clearly NMR jargon. States can be overpopulated or depleted but not hyperpolarized.
  - The states refereed to here belong to the spin ensemble, not to individual spin systems. The referee seems not to appreciate that the ensemble may have a state, described the density operator, and that the ensemble state may indeed be hyperpolarized. A comment has been added to the caption of figure 7, to clarify this.
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- I am not sure I fully understand Figure 8. Why does not polarization come to the equilibrium polarization eventually, even in the case of the Lindbladian equation? From the graph, it looks like it cannot ever come there..
  - The caption to figure 8 has been modified to make it clearer that both trajectories do lead to the same equilibrium state.