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Reply on RC1

Jingyan Xu et al.

Author comment on "Visualization of dynamics in coupled multi-spin systems" by Jingyan Xu et al., Magn. Reson. Discuss., https://doi.org/10.5194/mr-2022-9-AC1, 2022

We thank the referee for assesing our approach as superior to the previously described methods. One particlar case where the presented approach may produce an enhanced level of intuition is the presented near-zero-field NMR experiment (Figure 6). Additional discussion is added to the revised version of the manuscript.

Initial magnetization of two coupled spins (with gyromagnetic ratios g1 and g2) in high magnetic field is (g1*I1z + g2*I2z). This state can be presented as a sum of symmetric and antisymmetric components: 0.5*(g1+g2)*(I1z+I2z) and 0.5*(g1-g2)*(I1z-I2z). Remarkably, both of these components can be detected by a magnetometer in ZULF NMR experiments. The first symmetric component corresponds to the orientation of a collective magnetic moment (I1z+I2z) and its visualization is related to an AMP surface presented by the Fig.6C (however, the surface represents probability and not exactly the measured property). This component typically corresponds to static magnetization at zero field. The experiment shown in Fig. 6C makes this component precessing with Larmor frequency 0.5*(g1+g2)*Bx upon application of the magnetic field Bx. The second component of decomposition represents a zero-quantum coherence (I1z-I2z) which is directly detectable by the magnetometer. Intersection of the plotted AMC surface with any axis is a direct representation of a measured signal by a magnetometer along that axis.