

Magn. Reson. Discuss., author comment AC6
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Reply on EC1

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-AC6>, 2022

Dear Geoffrey,

Many thanks for considering our manuscript and your comments. We well realize that we will not get famous by proposing the generalized measurement-based visualization. Luckily, that is not our goal. The story is that that we found AMPS exceptionally useful for describing spin evolution in many situations in atomic physics (especially, things like alignment-to-orientation conversion) and for NQR [see D. Budker, D. F. Kimball, S. M. Rochester, J. T. Urban, Alignment-to-orientation conversion and nuclear quadrupole resonance, Chem. Phys. Lett. **378** (3-4), 440-448 (2003), [https://doi.org/10.1016/S0009-2614\(03\)01327-7](https://doi.org/10.1016/S0009-2614(03)01327-7)]. The point is that AMPS immediately reveal the symmetries of the density matrix, helping predict and optimize signals.

Our current manuscript addresses (in our opinion, successfully) the painful deficiency---we did not have an analogue of AMPS for coupled spin systems which are of primary importance, for instance, in ZULF NMR.

You are 100% correct, however, that the usefulness of visual representations is not universal---what helps some people does not necessarily help others, especially, if the latter had already developed their own "crutches." I remember being elated at what I thought was a clear exposition of the mechanism of NQR in powdered samples presented in the paper quoted above that I tried to "sell" to the great Erwin Hahn, whose office at Berkeley was just a few doors down from mine. "Finally, you can see how alignment evolves in each crystallite, even though this has nothing to do with spin precession!" said I. "Not so fast," said Erwin, "Think of alignment as two spin vectors pointing in opposite directions," said Erwin, "the quadrupole splitting pattern is equivalent to these two vectors rotating in opposite directions, which," he raised his arms and started waving them in circles, "immediately shows you how alignment can convert to orientation, resulting in observable signal in NQR!" While Erwin's picture may, indeed, be useful, the additional strength of AMPS over his handwaving is that AMPS have precise one-to-one connection to the density matrix and allows visualizing arbitrary polarization moments, for which Erwin would not have enough hands.

Thank you so much for your strong advice against the AMC terminology; indeed, we have completely eradicated it from the manuscript.

Sincerely,

Dmitry Budker