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(POS-19) Evaluating high-velocity particle motion with dynamic magnetic resonance scattering

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Structure functions are employed in many optical scattering experiments for the determination of size distributions in small particles. Recently a similar method for magnetic resonance (MR) has been proposed, Dynamic Magnetic Resonance Scattering (DMRS) [1], which constructs structure functions from MR signal time series data. DMRS is useful in the characterization of sample dynamics, where it can be used to measure velocity of moving particles (coherent motion) or the diffusion coefficient of particles in a medium (random behaviour). DMRS has a number of potential advantages from an MR perspective: it examines particles below the minimum spatial resolution of instruments, and it largely cancels static signal contributions that occur in many samples. The method can be employed using a constant magnetic gradient, and the data can be acquired via basic MR sequences. Additionally, DMRS should be well-suited to studies of opaque media where optical methods, such as light scattering, fail. The original paper, though robust in characterising applicability, does not explore extreme cases for coherent motion such as high particle velocity. In this work, we explore the case of dispersed media (sprays) with velocities several orders of magnitude higher than the original paper, and we discuss fundamental restrictions of the method in terms of instrument parameters. The simulated structure function behaviour of expected velocities agrees with experimental data for velocities ˜100 times faster than the original publication. Estimates of other variables of interest are discussed, as well as considerations for applicability to low-field and unilateral NMR instruments.

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[1] Herold, Volker, Thomas Kampf, and Peter Michael Jakob. "Dynamic magnetic resonance scattering." *Communications Physics* 2.1 (2019): 1-10.

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