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Low temperature spin dynamics in the $S = 2$ kagome magnet $Fe_4Si_2Sn_7O_{16}$: An AC susceptibility, NMR and μSR study

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Fe4Si2Sn7O16 displays an undistorted kagome lattice of Fe2+ (3d6, S = 2) ions. We present results of DC-pulse-field magnetisation up to 50 T, Nuclear Magnetic Resonance (NMR), AC-susceptibility and muon-spin-resonance (μSR) measurements down to 19 mK on powder sample of Fe4Si2Sn7O16. The magnetization measurement at 2 K excludes the presence of strong Ising anisotropies. In the temperature range of 3 K to 8 K, the maximum in the real part of AC-susceptibility shows frequency-dependent shift and indicates the presence of spin-glass-like behavior. An additional frequency-independent magnetic regime is observed below T = 0.7 K. The transverse-field and zero-field μSR results show the onset of static magnetic correlations below 30 K. Further, below T = 1 K, ZF-relaxation rate remains relatively constant which indicates the presence of persistence spin dynamics down to 19 mK. Based on the longitudinal field decoupling μSR studies, we discuss the coexistence of static and dynamic magnetic correlations below 250 mK. From our combined AC-susceptibility and μSR results, we demonstrate that in Fe4Si2Sn7O16 the dynamic magnetic correlations increase below 250 mK and a possible gapless-spin-liquid behavior is achieved.

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