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A μSR investigation of the influence of inter-site impurities on quantum spin liquids.

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Quantum spin liquids (QSLs) represent a state of matter governed by long-range quantum entanglement. These states are stabilized by geometric frustration and remain magnetically disordered even at zero temperature. Of particular interest, are the new exotic fractional excitations with S = ½, so-called spinons. Kagome antiferromagnets are known as one of the most promising systems for the realization of QSLs, and the dynamical spin fluctuations are preserved down to the lowest temperatures. On the other hand, kagome antiferromagnets such as Zn-Brochantite or Zn-Barlowite are polluted by intersite disorder between the copper atoms, with effective spin ½, and the nonmagnetic zinc atoms. Therefore, true observation of QSLs is a formidable task. Nevertheless, sophisticated techniques such as μSR can unambiguously distinguish the slow fluctuations of QSLs from magnetic order or fast paramagnetic fluctuations and thus identify possible QSL candidates. More detailed information is also obtained from muon Knight shift measurements, which directly probe the local magnetic susceptibility, providing information on the gapped nature of the QSL ground states. Moreover, the spinon Kondo effect has been observed in a gapless QSL, in which the magnetic impurities seen by the muons are screened by the surrounding spinons.

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