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Quantum spin liquid state of Pd(dmit)$_2$ salts

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Quantum spin liquid proposed by P. W. Anderson in 1973 [1] exhibits the absence of magnetic or valence bond solid order among entangled quantum spins even at zero temperature. Although this third fundamental state for magnetism is a long-sought state of matter that has attracted much theoretical attention, the ground state and low-energy excitations of the S=1/2 antiferromagnetic triangular lattice are still far from full understanding and furthermore there are few candidates of real materials [2]. We found that an anion radical salt β'-EtMe$_3$Sb[Pd(dmit)$_2$]$_2$ (dmit=1,3-dithiol-2-thione-4,5-dithiolate) with a quasi triangular lattice of [Pd(dmit)$_2$]$_2^-$ dimers is a promising candidate for the quantum spin liquid [3]. Measurements of various properties including magnetic suscept! ibility, μSR, magnetic torque, ^{13}C-NMR, specific heat, electrical/thermal transport, vibrational spectra, dielectric constant, and low-temperature crystal structure, have been performed. First-principles DFT calculations followed by tight-binding fitting were also carried out. The spin liquid in the β'-type Pd(dmit)$_2$ salts exists as a "phase" and is situated between an antiferromagnetic phase and a charge ordering phase. Ground states are classified by the anisotropy of the triangular lattice that can be finely tuned by mixed cations with a minimum of disorder effect on the magnetic layer.

[1] P. W. Anderson, Mater. Res. Bull. **8** (1973) 153.
[2] L. Balents, Nature, **464** (2010) 199.
[3] K. Kanoda and R. Kato, Annu. Rev. Condens. Matter Phys. **2** (2011) 167.