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Single-ion and exchange anisotropy in high-symmetry tetramer single molecule magnets[1] DMITRI EFREMOV, Technische Universitaet Dresden, RICHARD KLEMM, Kansas State University — We study the effects of single-ion and both symmetric and antisymmetric exchange anisotropy in equal-spin s_1 tetramer single molecule magnets exhibiting the molecular group symmetries $g = C_{4h}$, D_{4h}, C_{4v}, S_4, D_{2d}, and T_d. The near-neighbor and next-nearest-neighbor isotropic exchange interactions are J and J', respectively. From the vector basis used to diagonalize the general quadratic spin-spin interaction Hamiltonian $\mathcal{H}$ for each site and site pairs, we impose the symmetries characteristic of each g upon $\mathcal{H}$. Using our exact, compact forms for the four-spin single-ion matrix elements, we calculate the eigenstate energies to first order in the anisotropy interactions. Type I tetramers with $J' - J > 0$ act as two dimers with maximal pair quantum numbers $s_{13} = s_{24} = 2s_1$ at low temperature T. Type II tetramers with $J' - J < 0$ are frustrated, with minimal low-T pair quantum numbers. For both Type-I and Type-II antiferromagnetic tetramers, we calculate the first-order level-crossing inductions analytically. Accurate Hartree expressions for the thermodynamics, electron paramagnetic resonance (EPR) and inelastic neutron scattering cross-section are given. An EPR procedure to extract the effective microscopic parameters is provided.

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