

Supplementary Information

Coherent manipulation of spin qubits based on polyoxometalates: the case of the single ion magnet



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Experimental details

Pulsed-EPR: Model Bruker ELEXYS E580. Operating in the range 4 -300 K with X and Q band sources it is equipped with crystal mounting options. Magnetic Fields 0-2 T; 9.3 GHz cavity and resonator.

The pulsed X-Band is equipped with a TWT amplifier. It is able to perform between 0.7 ns to 15 μ s pulses width.

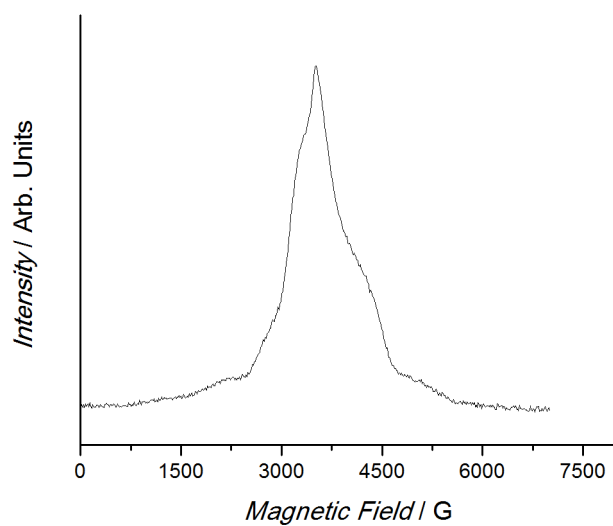
Rabi oscillations were acquired by long microwaves field pulses of length t and subsequently recorded by spin echo, the t pulse and the $\pi/2$ - π Hahn spin-echo sequence were recorded varying the attenuation power and subsequently B_1 . The B_0 was 0.354 T.

Mathematical details

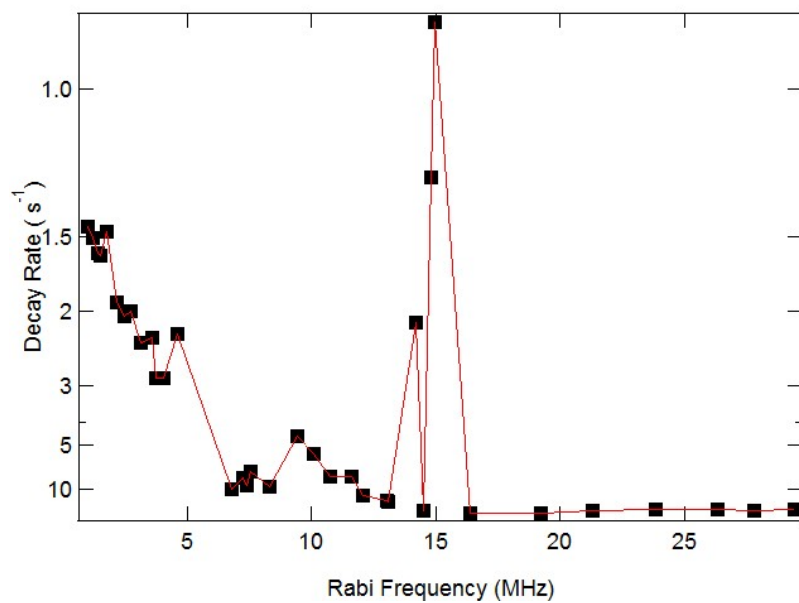
$$M_z(t) = M^0 \cdot e^{-\frac{t}{\tau_R}} \cdot \sin\left(2\pi \cdot \frac{t-t_0}{\Omega_R}\right) + a + b \cdot t \quad (1)$$

$$\Omega_R^{M_{S+1} \leftrightarrow M_S} = g\mu_B B_1 \sqrt{S(S+1) - M_S(M_S+1)} \quad (2)$$

SI 1. X-Band echo-detected EPR as a function of magnetic field for $[\text{GdW}_{30}\text{P}_5\text{O}_{110}]^{14-}$ measured at 4.5 K. Pulses of 12ns for $\pi/2$ and 24 ns for π .



SI 2. Decay rate of Rabi oscillations vs Rabi frequency. Below 15 MHz there is a zig-zag corresponding to duplicated points, determined at short and long times.



SI 3. Analysis of experiment at working field of 349.6 mT, with the results of the individual fits for each of the first 80 oscillations. Top: Distribution of the frequency $\Omega_R/2\cdot\pi$ for all oscillations. Bottom: Evolution of the intensity for all oscillations.

