Quantum Magnetic Deflagration in Mn$_2$-acetate

Reem Jasser, Eugene Chudnovsky, Dmitri Garanin, Lehman College.

Molecular Structure of Mn$_2$-acetate

SMM: Basic Characteristics

- They are organic materials which contain a large number of identical magnetic molecules.
- They contain magnetic defects, composed of one or many magnetic atoms, coupled together in a magnetic network.
- The net effect of each molecule is determined by the exchange interaction between the magnetic moments of the spins.

Spin Hamiltonian for Mn$_2$-acetate

\[ \hat{H} = -D S_x^2 - A S_z^2 - g \mu_B H S_z + V_g \]

Landau - Zener effect

\[ W = E_E - E_\theta = W \]

Transition probability

\[ P = 1 - \exp \left( \frac{\Delta \theta}{2h} \right) \]

Avalanches

In the last two decades, the magnetization of Mn$_2$-acetate has been found to be very high, and the results show that it can be used as a useful tool in the field of spintronics. The process of avalanche in the propagation of a spin transition through a reversible chemical cycle is shown below:

\[ \Delta E = 2 g \mu_B H \]

And as an example of a spin propagating in the case of a magnetic field that is not uniform, the spin reversal of the magnetic field can be observed by solving the equation of motion for a time.

The Landau-Zener effect of spin transition through a large spin cycle is shown in the following diagram: