Detection of the Magnetic Signal of Mn_{12} Single-Molecule Magnets Using Nano-SQUIDs

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Abstract:
Single-molecule magnets (SMMs) exhibit quantum tunneling of magnetization and slow spin relaxation, making them attractive for quantum. In this study, we utilize ultra-sensitive nano-SQUIDs to detect the magnetic signal of Langmuir–Blodgett (LB) films of Mn_{12} single-molecule magnets. The precise molecular deposition achieved through the LB technique ensures controlled conditions for high-resolution magnetic measurements.

Our results demonstrate the ability of nano-SQUIDs to detect the discrete magnetization steps of Mn_{12} molecules, providing a signature of quantum tunneling events. The flux signal generated by individual and collective molecular spin states is analyzed, offering insights into their stability, relaxation dynamics, and potential decoherence mechanisms. These findings establish nano-SQUIDs as a powerful tool for investigating SMMs at the nanoscale, contributing to advancements in quantum magnetism and molecular spintronics.

Keywords: Single-Molecule Magnets, Mn_{12}-Acetate, Nano-SQUIDs, Magnetic Signal Detection, Langmuir–Blodgett Films, Quantum Magnetism.