Contribution ID: **45** Type: **Poster**

Storage and retrieval of microwave pulses with molecular spin ensembles

Electronic spin degrees of freedom provided by spin ensembles have been efficiently exploited into circuit quantum electrodynamics architectures based on microwave devices and resonators at low temperature. Molecular spins have recently emerged as a new class of quantum systems whose electronic and nuclear spin states and their related quantum features can be tailored synthetically. Different strategies for encoding quantum information with molecular ensembles or single molecules have been developed and experimentally proved. Moreover, the coherent coupling with microwave photons have been recently successfully achieved with transition metal-based oxovanadium(IV) complexes [1,2] as well as with organic radicals [3,2] embedded into planar resonant geometries, paving the way for the integration of molecular spin ensembles into microwave quantum architectures. However, along this line, optimal experimental conditions and protocols (i.e. pulse sequences) to efficiently address the molecular spins still need to be found. In this work we test single crystals and solid dispersions of diluted oxovanadium tetraphenyl porphyrin (VO(TPP)) as prototypical molecular spin ensembles for the storage and retrieval of microwave pulses when embedded into planar superconducting microwave resonators at low temperature (2K) [4]. We first measure the (Hahn-echo) memory time and the Rabi Oscillations of the samples. We then test two Dynamical Decoupling sequences: the Carr-Purcell-Meiboom-Gill and the Uhrig Dynamical Decoupling. Both the sequences are found to enhance the memory time of the crystal samples up to three times after the application of a low number (3,4) of π pulses, reaching up to 3 μs. We then successfully store and retrieve into the ensembles trains of up to 5 small pulses and we show that individual control on such excitations can be achieved. Our proof-of-principle results demonstrate the memory capabilities of molecular spin ensembles when embedded into quantum circuits [4].

[1] C. Bonizzoni, A. Ghirri, M. Atzori, L. Sorace, R. Sessoli and M. Affronte, Sci. Rep. 7, 13096 (2017)

[2] C. Bonizzoni, A. Ghirri and M. Affronte, Adv. Phys. X 3, 1435305 (2018)

[3] A. Ghirri, C. Bonizzoni, F. Troiani, N. Buccheri, F. Beverina, A. Cassinese and M. Affronte, Phys. Rev. A 93, 063855 (2016)

[4] C. Bonizzoni, A. Ghirri, F. Santanni, M. Atzori, L. Sorace, R. Sessoli and M. Affronte, NPJ Quantum Inf. 6, 68 (2020)

Presenter: Dr BONIZZONI, Claudio (Istituto Nanoscienze CNR - Sezione S3 di Modena)

Session Classification: Beers and Posters