Experimental measurement of correlation functions in trapped ions[1] SHUAINING ZHANG, YANGCHAO SHEN, YAO LU, KUAN ZHANG, JING-NING ZHANG, KIHWAN KIM, Center for Quantum Information, IIIS, Tsinghua University, Beijing, P. R. China, J. S. PEDERNALES, LUCAS LAMATA, ENRIQUE SOLANO, Department of Physical Chemistry, University of the Basque Country UPV/EHU, Bilbao, Spain, J. CASANOVA, Institut fr Theoretische Physik, Universitt Ulm, Ulm, Germany — We measure the time-correlation functions of spins and phonons of a system that evolves under a Hamiltonian of Jaynes-Cumming model or Dirac equation with trapped 171Yb+ ions. The algorithm proposed in Ref. [1] requires only one ancilla qubit to obtain the time correlations of the observables in the system. In the experiment, conditional gates depending on the state of the ancilla, spin-dependent force and spin-independent force have been performed. We measure the spin-spin time-correlations in spin system and the spin-phonon time-correlation in bosonic field. According to the linear response theory, the time-correlations can be used to characterize relevant physical magnitude such as magnetic susceptibility. This scheme can be extended to a system including n-time spins and phonons correlations. [1] J. S. Pedernales, et al., Phys. Rev. Lett. 113, 020505 (2014).

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