Toward observation of real-time dynamics of a nuclear spin in phosphorus doped *n*-type diamond

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A nitrogen-vacancy (NV) center in diamond is a key resource for quantum information processing, such as quantum computation, quantum cryptography, and quantum memory, due to its characteristics of electron and nuclear spins' manipulation with a long coherence time at room temperature.

In order to evaluate a quantum spin state in quantum information processing, a non-destructive measurement is required. Recently single-shot measurements which satisfy this condition have been experimentally demonstrated [1-2]. The key of these measurements are to observe real-time dynamics of a nuclear spin coupled with an NV center by monitoring photon counts while mapping the correlation between the set of first and second measurements repeating *n* times. These measurements also require the stability of the charge states of NV centers in diamond under laser illumination. However, it is well known that the charge state of the NV centers in *i*-type diamonds is not usually stable under laser illumination. Recently, we have observed the long stability of the charge states of an NV center in phosphorus doped *n*-type diamond under laser illumination [3].

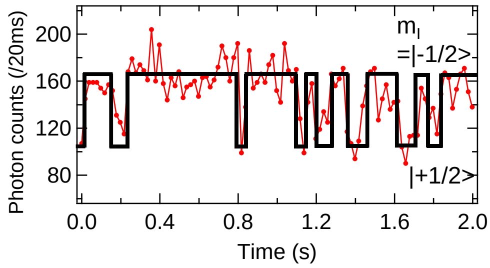

Fig. 1: PL time trace shows real-time dynamics of a ^{13}C nuclear spin.

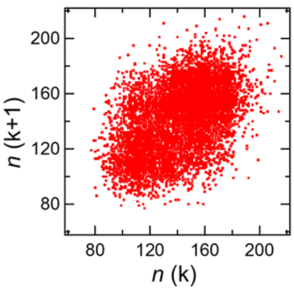

Fig. 2: photon count correlation between a set of first and second measurements.

In this poster, we report on preliminary results for a single-shot measurement of a ^{13}C nuclear spin coupled with an NV center in an *i*-type diamond (Figs. 1 and 2). We also discuss an observation of a single-nuclear-spin dynamics in phosphorus doped *n*-type diamond.

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