MLF Experimental Report	提出日 Date of Report 9/ 4 /2014
課題番号 Project No. 2014A0217 実験課題名 Title of experiment Study of the time-reversal symmetry breaking and the penetration-depth in the non-centrosymmetric superconductivity of LaNiC2 実験責任者名 Name of principal investigator KATANO Susumu 所属 Affiliation Saitama University	装置責任者 Name of responsible person HIGEMOTO Wataru 装置名 Name of Instrument/（BL No.） D1 port 実施日 Date of Experiment 6/12/2014 – 6/13/2014

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

LaNiC2. The crystal structure of this system lacks the centrosymmetry. At low temperatures below 3 K, the system exhibits superconductivity, and from its unique structure this superconductivity is considered not to be a simple BCS type, but to be an unconventional one. The samples used were polycrystals made with an argon-arc furnace and qualified well from X-ray diffraction, specific heat, magnetization, and resistivity.

2. 実験方法及び結果（実験がうまくいかなかった場合、その理由を記述してください。）
Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

The zero-field muon spin relaxation rate of LaNiC2 was measured on the D1 machine using a liquid-He flow type cryostat. We expected to use a dilution refrigerator to measure the relaxation rate below down to a 100 mK order in the superconducting state; however, with several reasons we could not use that refrigerator in this experiment. Before the experiment, we expected that with the He flow type cryostat the sample temperature could be cooled down to 2 K at least, which is below the superconducting temperature Tc. In a previous muon experiments on this system the relaxation rate is shown to be changed below Tc, indicating that the system exhibits spontaneous magnetization in the superconducting state. This implies the breaking time-reversal symmetry, which leads that the superconducting state of the system is an unconventional p-wave one. Using our well qualified sample to clarify the characteristics of this superconducting state much more, the relaxation rate was measured from low temperatures to room temperature.

The electron relaxation rate λ obtained in this experiment is shown in the figure below. The relaxation rate increases linearly with decreasing temperature, but below about 20 K that dramatically increases. The rates below 10 K, however, increase a little. The lowest temperature obtained in the experiment was 3 K with some troubles occurred in the cryostat; thus the rate in the superconducting state could not be measured. The experiments indicate that the mechanism of the relaxation may change at around 20 K. However, at present its mechanism cannot be identified yet.

2. 実験方法及び結果（つづき） Experimental method and results (continued)

To determine the spin relaxation mechanism at the higher temperatures we need further experiments. Furthermore, to clarify the superconducting mechanism of this system more extensive experiments on the relaxation rate in the superconducting state using a dilution refrigerator are indispensable.

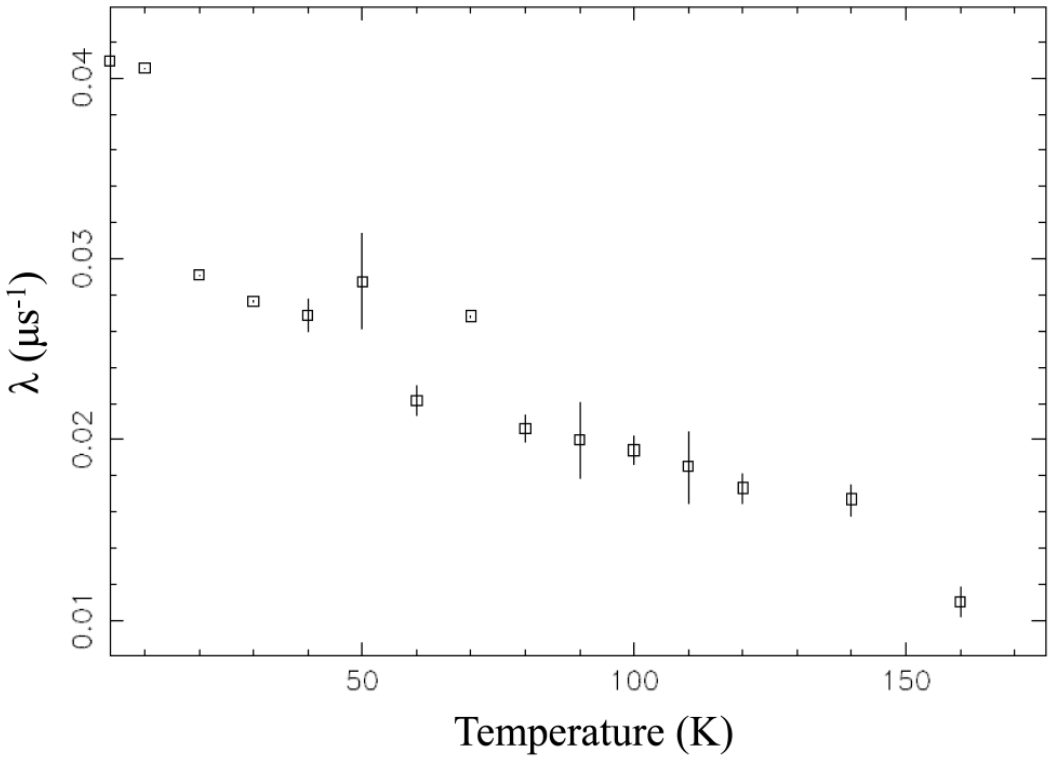

Fig. The electron relaxation rate λ as a function of temperature.