Two-photon spectroscopy is one of the useful methods for precise measurements [1-3]. Two-photon spectroscopy is classified as one colour identical and two colour different wavelengths. In rubidium (Rb) atoms, the one colour spectroscopy of $5S - 5D$ transition has good advantages of neglect for undesired effects from intermediate $5P$ state such as occurring decoherence and heating trapped atoms. We study two-photon spectroscopy of ultracold $^{87}\text{Rb}$ atoms. We have reported the results of observing the spectrum of ultracold Rb atoms in a low magnetic field with several gausses [4].

Figure 1(a) is the energy level diagram for $^{87}\text{Rb}$. The atoms are excited from the $5S_{1/2}$ ground state to the $5D_{5/2}$ excited state via off-resonant $5P_{3/2}$ state by using one-colour (778 nm) laser. We observe transition spectra by using the number of remained atoms in an optical trap with the absorption imaging method. Figure 1(b) shows a configuration of optical paths in this experiment, including trapping beams, an excitation beam with $\sigma^-$ polarisation, and a probe beam. The frequency of the excitation laser is locked to a relaxation emission via $6S - 5P$ (420 nm) transition, after $5S_{1/2} - 5D_{5/2}$ ($F,m_F$) at a room temperature cell with an applied magnetic field. The frequency is swept in the range of 100 MHz by an acousto-optic modulator (AOM). We prepare $10^6$ atoms with 10 $\mu$K in initial condition by using a crossed far-off-resonance optical trap (crossed-FORT) with the 1064 nm beams and the power of 3 W.

We have investigated Zeeman spectra in low magnetic fields. In this research, we focus on the difference of the spectra depending on the excitation laser intensity and the irradiation time. We will report on the Zeeman spectra of Rb in a magnetic field with up to about 10 gausses and the difference of the spectra.

References