

# Microwave response of electrons in a quantum ring

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In quantum ring structures, interference effect of conducting electrons has been studied extensively by means of DC measurements. Nevertheless, few works have been done to investigate irradiation effect of microwave on the conduction through a quantum ring. It is expected that microwave breaks the coherence of electrons. We investigated the irradiation effect of microwave in DC measurements. The quantum ring structures with various inner and outer radius were fabricated by e-beam lithography and chemical etching technique on GaAs/AlGaAs heterostructures. Inset of Fig. 1 shows one of the ring structures. The DC measurements were carried out at 1.8 K, using standard 4 terminal methods. The wavelength of applied microwave was between 35 and 140 GHz. Figure 1 shows a magnetic field dependence of the voltage drop through a ring with and without microwave irradiation. The radius of the ring structure is 360 nm. The microwave irradiated both ring and a part of 2 dimensional (2D) lead adjacent to the ring. In the measurements, Aharonov-Bohm oscillation was clearly observed in the magnetic field between 0 and 0.1 T. Irradiation of microwave changes the phase factor of the oscillation, which is caused by heating of 2D lead. Furthermore, we observed a large peak at 0.25 T under the irradiation of microwave, at which the cyclotron radius corresponds to the ring radius. The peak position does not depend on the frequency of the microwave but the size of the ring. The peak amplitude depends on power of the applied microwave. The appearance of the peak is an evidence localized electrons in a ring absorb photons of microwave. This opens us a new and simple detection of microwave using a quantum ring.

