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Single photon to single electron conversion using a quantum dot HARUKI KIYAMA, TAKAFUMI FUJITA, Department of Applied Physics & QPEC, the University of Tokyo, TETSUYA ASAYAMA, Advanced Materials Laboratories, Sony Corporation, AKIRA OIWA, SEIGO TARUCHA, Department of Applied Physics & QPEC, the University of Tokyo — Photons, and electron spins are leading candidates for implementing qubits useful in information transmission, and computing, respectively. Therefore, quantum media conversion (QMD) between them is a key technology for a comprehensive quantum network. In this work, as a first step toward QMD, we demonstrate single photon to single electron (charge) conversion using a GaAs based lateral QD equipped with a quantum point contact (QPC) as a charge sensor. A distinctive step, which is quite similar to those observed for single electron tunneling onto the QD from the leads, is observed in the single-shot time evolution of the QPC current immediately after the incidence of single photons. From detailed measurements of the light intensity dependence and the QD-lead tunnel rate dependence we confirm that the observed steps are due to single electron generation in the QD just after single photon irradiation. The minimum time resolution of this single photon to single electron conversion is 50 μs. This is short enough to demonstrate the angular momentum transfer between photon polarization and electron spin in the QD as the next step.

Haruki Kiyama
Department of Applied Physics & QPEC, the University of Tokyo

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