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電荷敏感型赤外光子検出器による 2 色検出

Two-color Detection in a Charge Sensitive Infrared Phototransistor (CSIP)

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Charge sensitive infrared phototransistors (CSIPs) are ultra-highly sensitive detectors in a wavelength range of 12μm ~ 45 μm, fabricated in double quantum well (QW) GaAs/AlGaAs heterostructures [1]. Their unprecedented sensitivity has lead to the first realization of passive terahertz near-field microscopy [2]. Promising applications are expected also in astrophysics [3].

Sensitive multicolor detection of electromagnetic waves is strongly demanded in many applications, but has been hardly accessible with conventional detectors. Here we demonstrate sensitive ***two-color detection*** by developing a novel structure in CSIPs. The device consists of triple GaAs/AlGaAs QWs (Fig. 1(a)), where photo-excitation takes place in upper two QWs (7nm-wide UQW1 and 9nm-wide UQW2) via inter-sub-band transitions. The excited UQWs 1 and 2 are thereby ionized, and are sensed by the lower QW (LQW) via its conductance change. Two distinct photo-response lines at 9.1μm and 14.7μm (32.9 THz and 20.4 THz), marked by the arrows in Fig. 1(b), are consistent with the photon energies theoretically expected for respective UQWs. The broader spectrum around 14.7 μm, resulting from the overlap of several side peaks, is theoretically explained by the multiple intersubband transitions in UQW2.

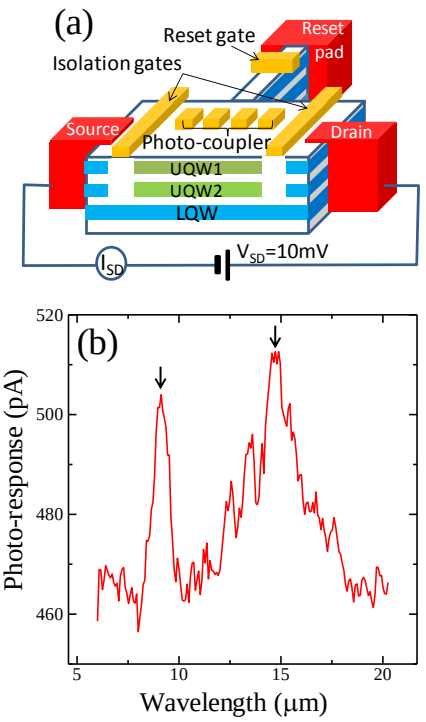

Fig. 1 (a) Schematic view of CSIP for two-color detection. (b) Spectral response of CSIP at 4.2K.

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