Requests for Collaboration

Name: Masaaki Nakayama, Dr. Sci.
Current position: Professor
E-mail address: nakayama@a-phys.eng.osaka-cu.ac.jp

Research Interests

- Optical properties and functions of semiconductor quantum wells, superlattices, and nano-scale thin films
- Fabrication and exciton-polariton properties of semiconductor microcavities
- Generation of terahertz (THz) electromagnetic waves from semiconductor surfaces

Creative Achievements in The Application of New and Existing Science and Technology

(1) In the physics of semiconductor microcavities, I revealed the specific dispersion relation of nonequilibrium exciton-polariton condensates in a CuBr microcavity, which was originally prepared, using angle-resolved photoluminescence (PL) spectroscopy [1]. The dispersion relation is fully different from that of the well-known equilibrium condensates, the so-called Bogoliubov mode; namely, it is defined as a diffusive Goldstone mode. Note that nonequilibrium exciton-polariton condensates can be applied to new type polariton lasing.
(2) In the formation process of electron-hole droplets (EHDs), which correspond to a liquid phase of electron-hole plasma (EHP), I revealed in a GaAs/AlAs type-II superlattice that the EHDs are dynamically transformed from the EHP gas using time-resolved PL spectroscopy [3].
(3) From the viewpoint of control of terahertz (THz) electromagnetic waves, I achieved the following two subjects using time-domain THz spectroscopy. (i) Control of THz frequency of the coupled mode of coherent longitudinal optical (LO) phonons and photogenerated plasmon in undoped GaAs/n-type GaAs epitaxial structures. (ii) Voltage-controllable THz intensity of coherent LO phonons in a p-i-n diode structure of GaAs [5].

Research Theme That I Want to Collaborate

- Exciton-polariton condensation in semiconductor microcavities
- Excitonic properties of nano-structured semiconductors
- Control of THz electromagnetic waves emitted from semiconductors

A List of 5 Key Publications

[1] Observation of diffusive and dispersive profiles of the nonequilibrium polariton-condensate dispersion relation in a CuBr microcavity: M. Nakayama and M. Ueda, ***Phys. Rev. B*** **95**, 125315-1–125315-7 (2017).
[2] Initial process of photoluminescence dynamics of self-trapped excitons in a β-Ga_2O_3 single crystal: S. Yamaoka, Y. Furukawa, and M. Nakayama, ***Phys. Rev. B*** **95**, 094304-1–094304-5 (2017).
[3] Dynamical formation process of electron-hole droplets in a GaAs/AlAs type-II superlattice: Y. Furukawa and M. Nakayama, ***J. Phys. Soc. Jpn.*** **85**, 034701-1–034701-6 (2016).
[4] Systematic investigation of effects of exciton–acoustic-phonon scattering on photoluminescence rise times of free excitons in GaAs/$Al_{0.3}Ga_{0.7}As$ single quantum wells: M. Nakayama, T. Ohno and Y. Furukawa, ***J. Appl. Phys.*** **117**, 134306-1–134306-6 (2015).
[5] Voltage-controllable terahertz radiation from coherent longitudinal optical phonons in a p-i-n diode structure of GaAs: M. Nakayama, S. Asai, H. Takeuchi, O. Ichikawa, and M. Hata, ***Appl. Phys. Lett.*** **103**, 141109-1–141109-4 (2013)