Study about frequency response of an AlGaAs/GaAs heterostructured cantilever with optical actuation

Takayuki Watanabe  
Department of Physics, Tokoku University

Background

- We have demonstrated that mechanical resonator can be actuated by optical irradiation through optical resonance of AlGaAs/GaAs heterostructures.
- The origin of force induced by the optical irradiation is assumed to be generated through piezoelectric property of GaAs.

However, the origin of the force is not well verified.

Purpose and method

Purpose

Clarifying features of the force induced in the mechanical resonator which is excited by optical irradiation.

Method

Observing mechanical displacement induced by optical irradiation which the amplitude is modulated at fixed frequency.

Mechanical displacement actuated by AM optical irradiation

Wavelength dependence

Laser power dependence

Delay time estimation by phase

Wavelength dependence of phase at 2 mechanical modes

Wavelength dependence of delay time at 2 mechanical modes

Wavelength dependence of delay time and effective amplitude

Absorption coefficient calculated from mechanical displacement

Summary

- The delay time of the force generated by optical irradiation is calculated from forced actuation. It clarified that the delay time strongly depends on optical irradiation condition.
- The absorption coefficient is calculated by treating delay time dependence and laser power nonlinearity of the amplitude.
- The feature of the force generated by optical irradiation is partially clarified.