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Presentation Title

Magnetic field dependence of quadrupole interaction in a strained (110) GaAs quantum well

Abstract

In order to investigate spin-related physics in semiconductor nanostructures, it has become important to manipulate and detect nuclear spins. In particular, optical [1-4] and electrical [5,6] manipulation and detection of nuclear magnetic resonance (NMR) have been extensively studied in GaAs-based nanostructures. In those experiments, quadrupole interaction plays a crucial role in the presence of an electric field gradient (EFG), which is induced by a strain, because all the constituent nuclei of GaAs have quadrupole moment. The quadrupole interaction is dependent on the EFG and the direction of the static magnetic field. Therefore, it is necessary to examine and understand its angular dependence to establish a comprehensive picture of the nuclear spin dynamics. In this work, we investigated the effects of the quadrupole interaction on the NMR spectra in a strained GaAs (110) quantum well (QW).

We employed the optical time-resolved Faraday rotation technique to detect the nuclear spins [1,2,4]. We evaluated the EFG and the strain by analyzing the dependence of the quadrupole interaction on the static magnetic field. Moreover, it was shown that the quadrupole interaction influences nuclear spin coherence time.

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