Electrically Detected Conduction Electron Spin Resonance in Bulk Germanium and Germanium Quantum Wells

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Germanium has been under the spotlight of researchers for several decades and it has been studied both from the theoretical and experimental point of view. Its characteristic conduction band, with four minima at the edges of the Brillouin zone, is a playground for material scientists.

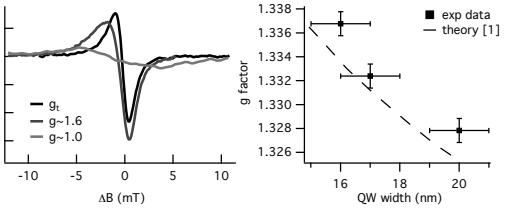

Fig. 1 (left) lineshapes at different g in bulk Ge; (right) g factor of conduction electrons in Ge QWs as a function of the QW width at T = 2 K.

Here we present the magnetic resonance of conduction electrons in bulk Ge crystal and in Ge quantum wells (QWs). The carriers were generated in the bulk by illumination, while they were introduced in the QWs by modulation doping.

In the bulk, we observed ESR lines with axial symmetry and principal g values g_p=1.920 and g_t=0.839, as expected for electrons in conduction band-like states. In the QWs there is a dependency on the thickness of the well, in agreement with the model proposed by Baron et al. [1]. Relaxation times have been estimated by the saturation curves and linewidth, providing exceptionally long values with respect to the bulk.

The ability of tailoring the g factor in a semiconductor is appealing because it opens new pathways, allowing spintronic functionalities on a silicon-compatible technology.

References.

1. F. Baron *et al.*, Phys. Rev. B 2003, 68, 195306.