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Negative magnetocapacitance and associated Schottky barrier height changes in lightly doped GaAs SEFAATTIN TONGAY, ARTHUR HEBARD, University of Florida, Department of Physics, HEBARD LABORATORY TEAM — We investigate the magnetic field response of Schottky barriers formed on GaAs with Si dopant densities of ∼3E16 cm^{-3} and ∼9E16 cm^{-3}. Negative magnetocapacitance of up to 21% at 20K and increasing Schottky barrier height as determined by various impedance measurement techniques are observed. We attribute these effects to a magnetic-field induced increase in the ionization energies of electrons bound to Si impurity atoms, causing shallow impurity electrons to hop to (ionization process) and from (capture process) the conduction band on longer time scales. The effective field at which these effects are seen is a factor of 10^5 smaller than it would be in vacuum because of the smaller effective mass and larger dielectric constant of the GaAs host. The dependence of interband hopping on magnetic field decreases the dipole response in the depletion region and gives a corresponding decrease in the measured capacitance. Magnetic field dependent Schottky barrier heights are inferred from linear $1/C^2$ versus bias voltage plots. We note that these magnetic field dependent effects are occurring in the absence of magnetic impurities and thus need to be understood before characterizing the magnetic response of diluted magnetic semiconductors.

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