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Magnetocapacitance of Semiconductors with Nonmagnetic and Magnetic Impurities JEREMY NESBITT, ARTHUR HEBARD, University of Florida — Positive magnetoresistance in semiconductors has been studied by previous investigators and found to have an exponential dependence on magnetic field in the regime of hopping conduction and a power law dependence at higher temperatures, due to band carriers. To our knowledge, little experimental study has been performed on the magnetocapacitance of semiconductors outside of the low temperature regime, where phenomena such as the quantum Hall effect have been studied. Here we report on the magnetocapacitance of lightly doped ($\rho > 1$ Ω-cm) n- and p-type silicon, using both Schottky and oxide barriers to form capacitor structures. The frequency-dependent negative magnetocapacitance can be as large as 30% at 50K and decreases to a few percent at room temperature. We attribute this effect to a field-induced localization of shallow donor impurity wavefunctions in directions transverse to the applied magnetic field. The effect can only be observed if the measurement frequency ($\sim$1MHz) is comparable to or greater than the field-dependent transition rate between impurity sites. We will also contrast the differences in the magnetocapacitance effect for diluted magnetic semiconductors such as GaCrN and GaMnAs.

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