Abstract Submitted
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Theoretical study the physical contribution to the signal to noise ratio (SNR) and sensitivity of Extraordinary Magnetoresistance (EMR) quantum well structures[1] Y. SHAO, S. A. SOLIN, Washington University in St. Louis, A. GIRGIS , L. R. RAM-MOHAN, Worcester Polytechnic Institute, KEON-HO YOO, Kyung Hee University, Korea — The application of EMR sensor performance requires ultra-thin films with very high mobility μ, and high electron concentration n, because the sensitivity of the EMR device is proportional to the μ^2 and the SNR depends on the ${n_{3D}}^{1/2}\mu^2$ ($1/f$ noise) or ${n_{3D}}^{1/2}\mu^{5/2}$ (thermal noise). We have modeled the electron concentration and mobility in a two dimensional electron gas (2DEG) layer located in a delta-doped InSb/AlInSb heterostructure. The non-parabolic band structure due to the nature of the small energy band gap of InSb is explicitly accounted for. The subband energy levels, electron wave functions and band-edge profiles were obtained using the $\boldsymbol{k}\cdot\boldsymbol{p}$ method. The electron transport properties were calculated by including contributions of scattering from ionized impurities, the background neutral impurities, the deformation potential acoustic phonons, and the polar optical phonons. We have calculated the dependencies of μ^2, ${n_{3D}}^{1/2}\mu^2$ and ${n_{3D}}^{1/2}\mu^{5/2}$ on temperature, spacer layer thickness, doping density, and the quantum well thickness. This work will impact EMR sensor design.

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