Measurements of *g* factors in GaSb/InAs core/shell nanowire hole quantum dots

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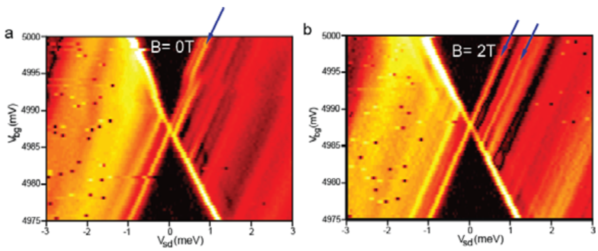
Hole spins confined within quantum dots have emerged as promising candidates for spin-based quantum information processing.[1, 2] The strong spin-orbit interaction in bulk two-dimensional hole systems lead to a significant reduction in spin relaxation times. In addition, recent studies have reported[3] that the spin relaxation times of holes confined into quantum wells are also longer than in bulk. Another attractive property of GaSb is that it has the highest hole mobility among the III-V semiconductors.

In this work, hole quantum dots were realized using GaSb/InAs core/shell nanowires. The nanowires were grown from gold aerosol nanoparticles which were deposited on a GaAs (111) B substrates.[4] The nanowires were transferred from the growth substrates to highly doped Si substrates with a 100-nm-thick SiO_2 capping layer. Ti/Au contacts with a varying contact separation were defined to the GaSb nanowire segments of selected nanowires. The fabricated devices were characterized by low temperature (50 mK) transport measurements, where periodic conductance oscillations due to Coulomb blockade were observed in the measurements, with a charging energy of 5 meV. Detailed experiments at perpendicular magnetic field show Zeeman splitting in the GaSb hole quantum dots. The measurements show that quantum levels of the GaSb quantum dots have g factors with absolute value up to ~4. An energy gap of 150 μeV has also been deduced from an avoided level crossing between ground state and first excited state in such a GaSb nanowire quantum dot.

Figure1: Logarithmic differential conductance as a function of source-drain bias and gate voltages at different magnetic field of 0 and 2 T.



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