# Spin-Driven Silicon Devices Utilizing Enhanced Valley Splitting

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Spin-driven devices might serve as a basis for upcoming logic gates. Silicon, the main element of microelectronics, is composed of nuclei with predominantly zero spin, thus spin decoherence due to hyperfine interaction is negligible. Silicon has also a weak spin-orbit interaction making spin-relaxation mechanisms fairly inefficient.

However, the conduction band of silicon consists of six degenerate valleys. Their quantum numbers may interfere with the spin degree of freedom. In thin silicon films of Si/SiGe heterostructures the six fold degeneracy is partly lifted due to biaxial strain and subband quantization. The value of energy splitting between the two unprimed subband ladders is small due to a slight misalignment of the Si/SiGe interface from the (001) direction, which suppresses the valley splitting. Recent conductivity measurements on point contacts demonstrate a splitting between the remaining valleys larger than the spin splitting.

We show that a large valley splitting in a point contact is caused by an additional lateral confinement. Our analysis is based on the Hensel-Hasegawa-Nakayama **k·p** model including strain, which is accurate up to energies of 0.5eV. The results demonstrate the feasibility of silicon devices operating with spin.