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Optical Orientation and Spin Relaxation of electrons and holes in Strained Germanium Quantum Wells[1] FABIO PEZZOLI, Università degli Studi di Milano-Bicocca, FEDERICO BOTTEGONI, FRANCO CICCACCI, STEFANO CECCHI, Politecnico di Milano, EMANUELE GRILLI, MARIO GUZZI, GIOVANNI ISELLA, Università degli Studi di Milano-Bicocca, DHARA TRIVEDI, PENGKE LI, YANG SONG, HANAN DERY, University of Rochester — We demonstrate optical orientation in strained Ge/SiGe quantum wells and study their spin properties. The energy proximity between the center of the Brillouin zone to its edge allows us to achieve high spin-polarization efficiency and to resolve the spin dynamics of holes and electrons. The circular polarization degree of the direct-gap photoluminescence is 37% and 86% for transitions with heavy and light holes states, respectively. Considering the ultrafast transition of electrons to L valleys, the extracted spin lifetime of holes at the top of the valence band is found to be 0.5 ps. This lifetime is governed by transitions between heavy and light hole states. The indirect-gap photoluminescence via the no-phonon line and its LA phonon replica allows us to study spin properties of electrons at the bottom of the conduction band. Taking into account the recombination lifetime of electrons (radiative and non-radiative channels), we find that their spin lifetime exceeds 5 ns below 150 K. Theoretical analysis of the electrons spin relaxation indicates that phonon-induced intervalley scattering by the X point phonon modes dictates the spin lifetime.

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