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**Quasiparticle spin relaxation with superconducting-velocity–tunable state in GaAs (100) quantum wells in proximity to $s$-wave superconductor** TAO YU, M. W. WU, Univ of Sci Tech of China — We investigate the quasiparticle spin relaxation with superconducting-velocity–tunable state in GaAs (100) quantum wells in proximity to $s$-wave superconductor. In the quasiparticle state, rich features such as the suppressed Cooper pairings, large quasiparticle density and non-monotonically tunable momentum current can be realized by varying the superconducting velocity. In the degenerate regime, the quasiparticle Fermi surface is composed by two arcs, referred to as Fermi arcs, which are contributed by the electron- and hole-like branches. The D'yakonov-Perel' spin relaxation is explored with intriguing physics revealed when the Fermi arc emerges. Specifically, when the order parameter tends to zero, the branch-mixing scattering is forbidden. The open structure of the Fermi arc leads to the nonzero angular-average of the effective magnetic field due to the spin-orbit coupling, acting as an effective Zeeman field. This Zeeman field leads to the spin oscillations even in the strong scattering regime. Moreover, in the strong scattering regime, the open structure of the Fermi arc leads to the insensitiveness of the spin relaxation to the momentum scattering, in contrast to the conventional motional narrowing situation.

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