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Non-equilibrium spin polarization and spin-orbit torque induced by electric field and temperature gradient in a magnetized two-dimensional electron gas with Rashba spin-orbit interaction ANNA DYRDAL, JOZEF BARNAS, Adam Mickiewicz University, ul. Umultowska 85, 61-614 Poznan, Poland, VITALII DUGAEV, Department of Physics and Medical Engineering, Rzeszow University of Technology, al. Powstancow Warszawy 6, 35-959 Rzeszow, Poland — We have considered theoretically temperature dependence of non-equilibrium spin polarization of electrons that appears in a magnetized two-dimensional electron gas with Rashba spin-orbit interaction due to external electric field and/or temperature gradient. To do this we have employed the approach based on the Matsubara Green function formalism. We analyzed in detail variation of the induced spin polarization with position of the Fermi level, temperature, and Rashba coupling constant. Moreover, we analyzed the temperature dependence of the electrically and thermally induced spin polarization in the temperature regime, where the spin relaxation time can be assumed constant (independent of temperature). In contrast to the case of nonmagnetic Rashba gas, all three components of the induced spin polarization are now nonzero. The induced spin-polarization is exchange-coupled to the local equilibrium magnetization and therefore exerts a torque on the magnetization vector. We have considered in detail the temperature behavior of spin-orbit torque induced by electric field and by temperature gradient for specific relative orientation of the magnetization and electric field or temperature gradient, respectively.

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