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Spontaneous polarization in classical spin transport far from equilibrium TOBIAS REICHENBACH, THOMAS FRANOSCH, ERWIN FREY, Arnold Sommerfeld Center for Theoretical Physics (ASC) and Center for NanoScience (CeNS), LMU Munich, Germany — Spintronic devices like the Datta-Das spin-field effect transistor aim to exploit the spin of electrons for information processing. Based on an exclusion process, we present a classical model for the spin transport in such systems [1]. Particles move unidirectionally on a one-dimensional lattice under the constraint of Pauli's exclusion principle. Analyzing the emerging non-equilibrium steady state, we find that it can be tuned by controlling the particle fluxes at the boundaries. In particular, a spontaneous polarization may occur at a certain spatial position and, upon changing the fluxes at the boundaries, be driven in or out of the system. We derive the shape of the density profiles as well as resulting phase diagrams analytically by a mean-field approximation and a continuum limit.

[1] T. Reichenbach, T. Franosch, E. Frey, Phys. Rev. Lett. 97, 050603 (2006)

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