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Spin-population inversion in magnetic point contacts under non-equilibrium conditions[1] TORSTEN PIETSCH, STEFAN EGLE, ELKE SCHEER, None — The creation of a novel type of spin-based electronics is one of the most intensively researched topics in current solid-state physics. The unifying characteristics in this advancing field is that the spin degree of freedom of the electron rather than its charge is exploited to achieve a specific device functionality. Recently, theoretical predictions suggest that spin-inversion in metallic point contacts under strong non-equilibrium conditions may enable the design of novel types of radiation sources. These radiation sources are highly tunable and of giant intensity compared to cutting-edge semiconductor devices, due to the much larger electron density in metals. Moreover, the accessible frequency range covers both, microwave (GHz) and THz radiation. Especially the later one is of great interest, since up to date there is no miniaturized, high intensity THz source available. Therefore, the experimental demonstration of this lasing effect in metallic systems is an important breakthrough in solid state physics. Presently the concept of spin-flip lasing in magnetic point contacts rests on theoretical predictions and first proof of principle studies. Herein we present detailed investigations on the magneto-transport properties of magnetic herterostructures and -point contacts. In particular, we study the complex interplay between magnetization, current density and the influence of high frequency (GHz and THz) fields on the magneto-transport properties of magnetic point contacts. The results illustrate that a successful spin-population inversion can be detected via transport spectroscopy.

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