

Spin-torque nano-oscillators for wireless communication

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Spin-polarized current can excite magnetization precession by spin-transfer torque in magnetic nanostructures, leading to spin-torque nano-oscillators (STNOs). The STNOs raise prospects for the application in RF transceivers, but should overcome critical challenges such as weak output power, broad spectral line width, and necessity of external magnetic fields. The STNOs have been realized with nano-magnetic elements such as, for instance, nano-pillars and nano-contacts having single magnetic domain or vortex structure. Here we employ a novel magnetic entity in STNOs, which can provide unique properties resolving major challenges. It is shown that, in a properly-tailored magnetic nano structure, the perpendicular spin current gives rise to microwave oscillation with a strong spectral intensity and narrow linewidth; and, more importantly, the microwave oscillation is observed even without applying external magnetic fields. This nano-tailoring of magnetic elements opens a new venue to engineer the properties of STNOs, and thereby sheds light on their real applications.