Spin torque nano-oscillators (STNOs) use spin polarized dc currents to drive and sustain magnetization dynamics and convert it into electrical rf signals. They provide unique potential functionalities for rf-communications, energy harvesting or next-generation computing [1]. Therewith, they unify hardware multifunctional key capabilities in the framework of Industry 4.0 and emphasize the potentialities of spintronics, even beyond the paradigm of CMOS. Along with the STNO’s nano-size, radiation-hardness, frequency tunability, low energy consumption and CMOS compatibility, their key characteristics is their strong nonlinearity, which opens up the path to various interesting physical phenomena. However, their nonlinearity also causes the oscillators’ poor spectral coherence, which so far limits their applicability in real practical devices [2-4].

This talk aims at providing a deeper understanding of the STNO’s noise in the framework of nonlinearity. Generalizable to all types of spintronic oscillators, we experimentally and theoretically study the contribution of 1/f flicker noise at low frequency offsets in vortex based STNOs. We discuss the influence of this type of noise on the oscillation’s spectral shape and demonstrate potential means for efficient coherence improvements [4]. Moreover, the talk is also dedicated to the coupling and synchronization of several STNOs, since these capabilities facilitate different applicational schemes in prospective technologies [5]. Indeed, beyond synchronization, novel complex phenomena are experimentally demonstrated and studied, such as the emergence of exceptional points in the coupled system. In summary, the presented results open up new perspectives not only for the fundamental research on STNOs, but also for novel types of future applications.

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