Intermodal Coupling in Two-Mode Nanostrings

A. A. Barakat[1], A. T. Le[1], E. M. Weig[1]

[1]*Chair of Nano and Quantum Sensors, Technical University of Munich, 85748 Garching.*

Two-level systems are known in various fields of science to exhibit interesting dynamical phenom- ena using different ways of interaction. In nanostrings, the fundamental in-plane and out-of-plane modes exhibit analogous phenomena under linear, nonlinear and parametric coupling. Despite its simplicity, a linear intermodal coupling shows interesting phenomena such as avoided cross- ings. In addition, this coupling provides a baseline for other analogous phenomena celebrated in quantum two-level systems [1]. In this work, through a dielectric actuation of nanostrings [2] and using micro-cavity-assisted detection scheme, the linear and nonlinear dynamics of the string can be controlled under forced and parametric excitation. Under excitation, a characterization of the nanostrings is carried out providing an overall picture of the system's dynamics. Moreover, several dynamical phenomena based on the intermodal interaction could be also found which shows how such a simple system can be rich in dynamics.

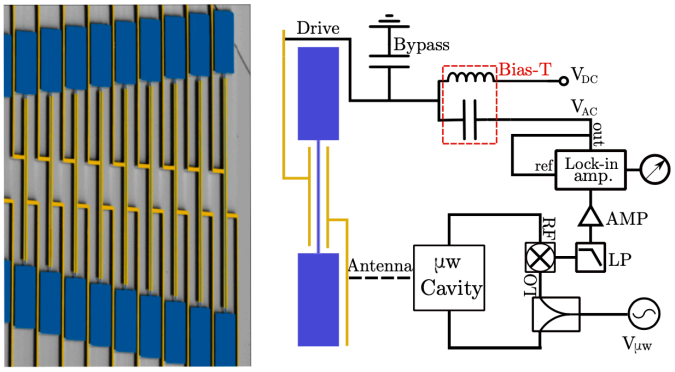

Fig. 1: *(left) SEM image of an array of nanostrings with varied lengths, (right) the measurement setup used for detecting nanostrings' vibrations.*

References:

[1] T. Faust, et al, *Nature Physics* **9**, 485 (2013).
[2] Q. Unterreithmeier, E. Weig, J. Kotthaus, *Nature* **458**, 1001 (2009).