Building a Spin Hall Nano-Oscillator Ising Machine

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Mutually synchronized spin hall nano-oscillators (SHNOs) [1,2] have emerged as one of the most promising types of spintronic devices for neuromorphic computing as individual SHNOs in large arrays can be voltage [3] and memristor [4] controlled. Very recently, the first experimental steps towards SHNO-based Ising Machines were also taken [5], and their potential was evaluated theoretically [6]. In my talk, I will describe the key elements of an SHNO-based Ising Machine, such as much larger mutually synchronized SHNO arrays, individual electrical and optical [7] control of the inter-SHNO coupling strengths, different annealing schemes, and magnetic tunnel junction read-out of the solutions. I will also discuss how to realize the required non-planar topology in a seemingly planar two-dimensional geometry.

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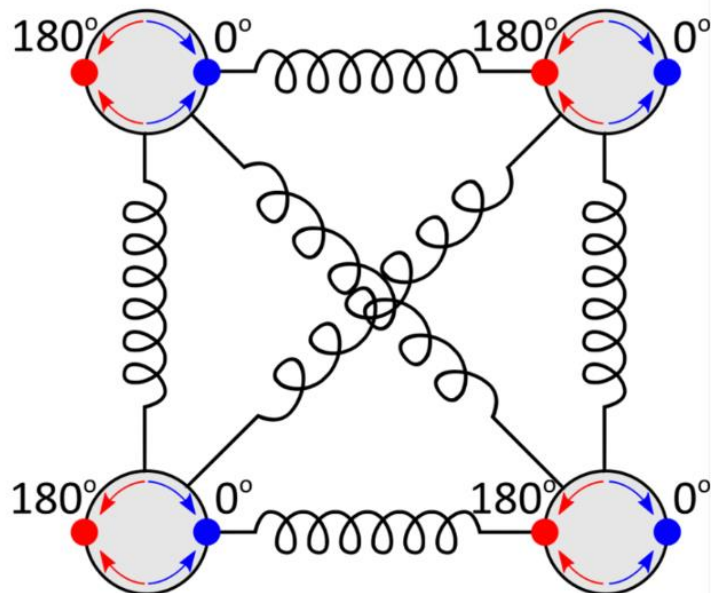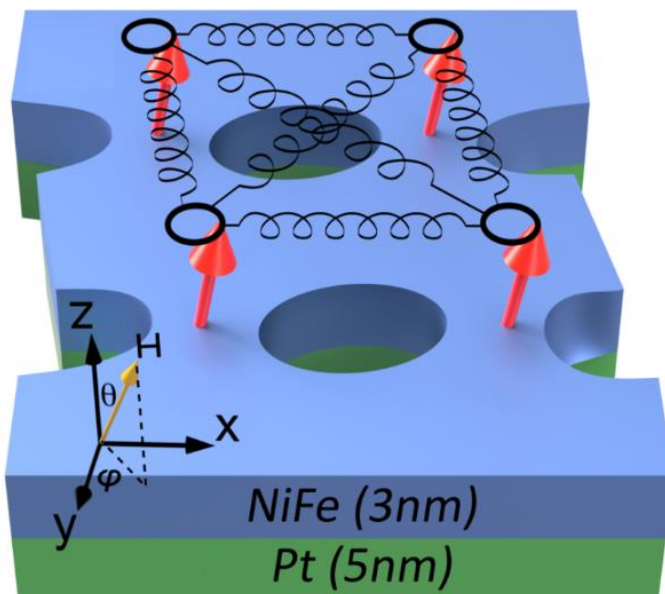[2] M. Zahedinejad et al., Nature Nanotechnology 15, 47 (2020).
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[4] M. Zahedinejad et al., Nature Materials 21, 81 (2022).
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[7] S. Muralidhar et al., Applied Physics Letters 120, 262401 (2022).

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