$BiFeO_3$ for electronics, magnonics, photonics and beyond

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$BiFeO_3$ is a one of the very few room-temperature multiferroic materials [1]. Its rediscovery thirteen years ago [2] was initially motivated by a possible application in electric-field controlled spintronics devices [3]. Other important properties of $BiFeO_3$ are its remarkable spontaneous polarization of 100 $\mu C/cm^2$ in the <111> pseudocubic direction, high Curie temperature of 1100 K and cycloidal spin order in the bulk. In addition $BiFeO_3$ exhibits interesting optical characteristics, such as a band gap in the visible range (2.7 eV [4,5]) and a large birefringence [6].

In this talk, we will first describe how $BiFeO_3$'s structural, ferroelectric, magnetic and optical properties can be tuned by epitaxial strain [7,8], thereby unveiling novel functionalities of interest for applications in various fields. Then, we will show how the remarkable ferroelectric properties of T-like $BiFeO_3$ can be harnessed to produce giant resistance switching in epitaxial field effect transistors based on Mott insulator channels [9] and in memristive ferroelectric tunnel junctions [10] for applications into novel neuromorphic computational architectures.

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