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Engineering the magnonic and spintronic response of $BiFeO_3$ films by epitaxial strain MAXIMILIEN CAZAYOUS, P. ROVILAIN, Laboratoire Materiaux et Phenomenes Quantiques, Univ. Paris Diderot (France), J. JURASZEK, Groupe de Physique des Materiaux, Univ. Rouen (France), A.K. ZVEZDIN, Prokhorov General Physics Institute, Russian Academy of Sciences, Moscow (Russia), L. BELLAICHE, Physics Department, University of Arkansas, Fayetteville (Usa), B. DKHIL, Laboratoire SPMS, Ecole Centrale Paris, Chatenay-Malabry (France), A. BARTHELEMY, M. BIBES, Unite Mixte de Physique CNRS/Thales, Palaiseau et Universite Paris-Sud, Orsay (France) — Multiferroics display cross-coupling effects between ferroelectricity and magnetism. $BiFeO_3$ has many properties such as a cycloidal magnetic order in the bulk and conductive domain walls, most related to its ferroelectric order. However its antiferromagnetic properties have not been investigated deeply in thin films. Here we show how the strain engineering can be applied to modify its static and dynamic magnetic properties. We have used Mossbauer and Raman spectroscopies combined with Landau-Ginzburg theory and effective Hamiltonian calculations. We show that the cycloidal spin modulation that exists at low compressive strain is driven towards collinear antiferromagnetism at both tensile and compressive high strain. Morover, we find that the spin excitations are entirely modified with the suppression of the magnon modes as strain increases and that the strain modifies the average spin angle from in-plane to out-of-plane. Our results illustrate the power of strain engineering for designing functional materials on demand.

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