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Dimensional control of cobalt spin state in oxide superlattices DA WOON JEONG, CFI-CES, IBS, Seoul National University, W.S. CHOI, S. OKAMOTO, Oak Ridge National Laboratory, C.H. SOHN, H.J. PARK, CFI-CES, IBS, Seoul National University, J.-Y. KIM, Pohang Accelerator Laboratory, H.N. LEE, Oak Ridge National Laboratory, K.W. KIM, Chungbuk National University, S.J. MOON, Hanyang University, T.W. NOH, CFI-CES, IBS, Seoul National University — Perovskite cobalt oxide is a very intriguing system with various spin states owing to the delicate balance between crystal field splitting and Hund exchange energy. In this talk, we show that its spin state can be altered through dimensional control, enabled by digital synthesis of perovskite cobalt oxide superlattices. We employed a few unit cells of $LaCoO_3$ as an active magnetic layer, separated by $LaAlO_3$ spacer layer. High quality $[(LaCoO_3)n(LaAlO_3)n]8$ (n = 2, 6, and 10) superlattices were fabricated using pulsed laser epitaxy. Spectroscopic tools including x-ray absorption spectroscopy and optical spectroscopy revealed clear evolution of the electronic structure and resultant spin state by changing dimensionality. Specifically, the spin state changed from a high to a low spin state with a larger optical band gap, as the dimension reduced from 3D to 2D. Dynamic mean field calculation supported the critical role of dimensionality on the spin state and electronic structure of $LaCoO_3$.

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