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Energy landscape scheme for an intuitive understanding of complex domain dynamics in ferroelectric thin films[1] JONG-GUL YOON, University of Suwon, T.H. KIM, W.K. PARK, S.M. YANG, S.Y. JANG, T. MIN, J.-S. CHUNG, Center for Correlated Electron Systems, Institute for Basic Science, S.H. BAEK, C.B. EOM, Department of Materials Science and Engineering, University of Wisconsin-Madison, T.W. NOH, Center for Correlated Electron Systems, Institute for Basic Science — Fundamental understanding of domain dynamics in ferroic materials has been a longstanding issue because of its relevance to many systems and to the design of nanoscale domain-wall devices. Despite many theoretical and experimental studies, a full understanding of domain dynamics yet remains elusive due to complex interactions between domain-walls and disorder. In this work, by observing domain-wall breathing motion in ferroelectric $BiFeO_3$ thin film using stroboscopic piezoresponse force microscopy, we demonstrate domain-shape-preserving deterministic domain-wall motion, confirming microscopic return point memory. We also map a spatial energy landscape that provides new insights into domain dynamics. The evolution of complex domain structure can be understood by the process of occupying the lowest available energy states of polarization in the energy landscape which is determined by defect-induced internal fields.

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Jong-Gul Yoon
University of Suwon

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