Fate of Uniform Ferromagnetism under Spin Current: Domain Nucleation

JUNYA SHIBATA\textsuperscript{1}, RIKEN FRS, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan, GEN TATARA\textsuperscript{2}, Graduate School of Science, Osaka University, Toyonaka, Osaka 560-0043, Japan, HIROSHI KOHNO, Graduate School of Engineering Science, Osaka University, Toyonaka, Osaka 560-8531, Japan, YOSHICHIKA OTANI\textsuperscript{3}, Institute for Solid State Physics, University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8581, Japan — A key mechanism of the current-induced magnetization dynamics is the spin torque from a spin polarized current (spin current), which is exerted on spatial gradient of magnetization. Recently, it has been pointed out that a large spin current applied to a uniform ferromagnet leads to a spin-wave instability. In this work, we show that such instability is absent in a state containing a domain wall by evaluating the spin-wave dispersion around it. This may indicate that nucleation of magnetic domains occurs above a certain critical spin current. This scenario is supported by an explicit energy comparison between the uniformly magnetized state and the domain-wall state under spin current.

\textsuperscript{1}CREST, JST, 4-1-8, Honcho, Kawaguchi, Saitama, 332-0012, Japan
\textsuperscript{2}PRESTO, JST, 4-1-8 Honcho Kawaguchi, Saitama, Japan
\textsuperscript{3}RIKEN FRS, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan/CREST, JST, 4-1-8, Honcho, Kawaguchi, Saitama, 332-0012, Japan

Junya Shibata
RIKEN FRS, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan

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