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Statistical Behavior of Formation Process of Magnetic Vortex State in Permalloy Nanodisks[1] MI-YOUNG IM, PETER FISCHER, cxro/lbnl, YAMADA KEISUKE, Kyoto Univ., SHINYA KASAI, nims — Magnetic vortices in magnetic nanodots, which are characterized by an in-plane (chirality) and an out-plane (polarity) magnetizations, have been intensively attracted because of their high potential for technological application to data storage scheme and their scientific interest for an understanding of fundamental physics in magnetic nanostructures. Complete understanding of the formation process of vortex state in magnetic vortex systems is very important issue in both technical and scientific points of view. In our work, we have statistically investigated the formation process of vortex state in permalloy ($Ni_{80}Fe_{20}$) nanodisks through the direct observation of vortex structure utilizing a magnetic transmission soft X-ray microscopy (MTXM) with a high spatial resolution down to 20 nm. We found a particular selectivity between the circulation sense of chirality and orientation sense of polarity for each other in the formation process of vortex state. Dzyaloshinskii-Moriya interaction inevitably generated in magnetic nanodisks is mainly responsible for the experimentally witnessed selectivity between chirality and polarity.

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