Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Vortex Dynamics in Superconducting Ratchet in Niobium Thin Film Observed by Lorentz Microscopy YOSHIHIKO TOGAWA[1], KEN HARADA[1,2], TETSUYA AKASHI[2,3], HIROTO KASAI[2], TSUYOSHI MATSUDA[1,4], ATSUTAKA MAEDA[1,5], AKIRA TONOMURA[1,2], [1]FRONTIER RESEARCH SYSTEM, THE INSTITUTE OF PHYSICAL AND CHEMICAL RESEARCH (RIKEN) TEAM, [2]ADVANCED RESEARCH LABORATORY, HITACHI, LTD. TEAM, [3]HITACHI INSTRUMENTS SERVICE CO. TEAM, [4]HITACHI SCIENCE SYSTEMS, LTD. TEAM, [5]DEPARTMENT OF BASIC SCIENCE, UNIVERSITY OF TOKYO TEAM — Vortex dynamics in the superconducting ratchet was investigated in a Niobium thin film by direct imaging of Lorentz microscopy. Vortices were field-gradient driven by an ac magnetic field. Microscopic channels for vortex motion with arrow-shaped cages were created by Focused Ion Beam irradiation, where the potential energy distributed in a spatially asymmetric way. With increasing magnetic field, vortices penetrated inside the channel directed toward the thicker part of the sample, while vortices were not willing to intrude the oppositely-oriented channel. On the other hand, with decreasing field, in both channels, large portion of vortices were expelled through the bottle-neck of front cage of the channel toward the outside region. This observation indicated that field-gradient driven vortices were rectified in the asymmetric potential. For further demonstration of vortex motion control, a closed loop of the channel was fabricated and vortex motion was investigated in a two-dimensional circuit.

Yoshihiko Togawa
Frontier Research System,
the Institute of Physical and Chemical Research
(RIKEN)

Date submitted: 30 Nov 2004 Electronic form version 1.4