Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Controlled displacement of nanoscale structures using an electron wind force[1] C.G. TAO, W.G. CULLEN, E.D. WILLIAMS, University of Maryland, College Park — Electromigration is widely used to drive mass transfer in the fabrication of nanogaps, and will be a crucial issue for the structural stability, reliability and performance of nanoscale electronic devices. Using a combination of scanning tunneling microscopy and scanning electron microscopy, we directly observe the biased motion of monatomic islands driven by the electron wind force on patterned single-crystal Ag(111) thin films. The island motion can be steered by changing the direction of the applied electric current. For monatomic adatom islands, the biased motion is opposite to the current direction and along the wind force direction, while vacancy islands move in the opposite direction. The measured dependence of the drift velocity on the island size, yields the product of the diffusion constant and the magnitude of the wind force, giving the diffusion constant $D = 1.56 \times 10^6/z*$ (nm^2/s) for an effective charge of $z*$ =360 [1]. The wind force acts even more strongly on C_{60}-decorated structures, as observed by directionally-oriented bending of step edges. The wind force needed to cause the observed structure distortions is $F = 0.13$ meV/nm, about 3 times the corresponding wind force acting on the bare steps. [1] A. Bondarchuk, et al. PRL 99, 206801 (2007).

[1]Work supported by the UMD NSF-MRSEC grant DMR 05-20471.

C.G. Tao
University of Maryland, College Park

Date submitted: 01 Dec 2007 Electronic form version 1.4