

MAR11-2010-004045

Abstract for an Invited Paper  
for the MAR11 Meeting of  
the American Physical Society

### **Challenges and opportunities for probe-based information technology<sup>1</sup>**

JEREMY LEVY, U. Pittsburgh

Scanning probe microscopes have become standard tools for characterization of materials and devices at the nanoscale. But what about “OEM” versions for information technology? The standard answer is that probe-based lithography or storage is not practical because it cannot scale—their cost and complexity will never allow useful devices to be made with probes. Such was not always the conventional wisdom in the industrial community. The Millipede Project,<sup>2</sup> pioneered by Gerd Binnig at IBM and pursued at other companies such as Hitachi and Seagate, sought to scale the number of probes to ~1000. In fact, they were successful, but not enough to be competitive with FLASH memory. Since then, order of magnitude improvements have been made both in scaling up to the number of probes past ten million,<sup>3</sup> and in scaling down the minimum bit size below two nanometers.<sup>4</sup> Combining these two approaches may well justify the statement: “There’s plenty of room for probes at the bottom.”

<sup>1</sup>This work was supported by NSF DMR-0704022 and DARPA Seedling (W911NF-09-10258).

<sup>2</sup><http://www.zurich.ibm.com/st/storage/concept.html>

<sup>3</sup>F. Huo et al, Science **321**, 1658 (2008).

<sup>4</sup>C. Cen et al, Science, **323**, 1026 (2009).