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The nanoAdvisor

Educational News & Events in Nanotechnology

In This Issue

This newsletter is published by Nanoscience Instruments, Inc. to support the SPM and nanoscience education community. Comments and suggestions are welcome. Requests for your education program to be reviewed, guest editorials, or other comments can be made to edu@nanoscience.com.

An electronic version of this newsletter is available at nanoscience.com/education.

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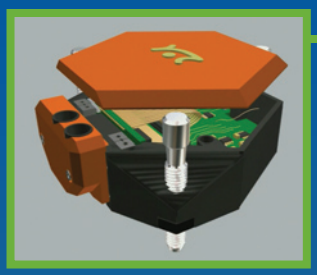
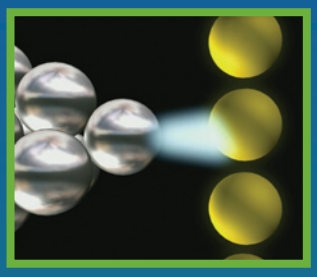
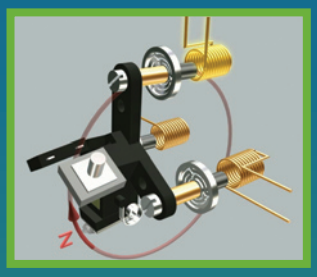
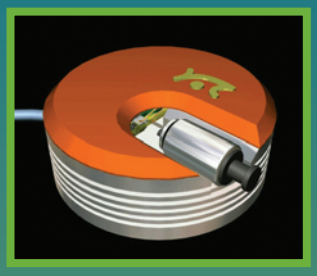
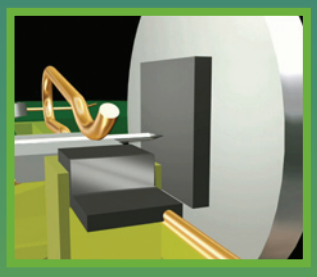
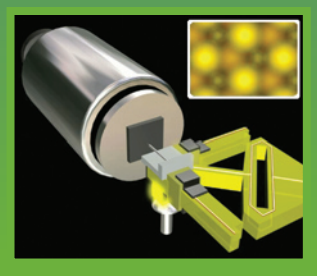












Feature Article

Virtual Lab Animates How SPM Works

University of Virginia Models *The Way Things Work* in 3D

The University of Virginia (UVA) is harnessing virtual reality (VR) to unlock the mysteries of advanced technology. UVA's Virtual Lab® uses 3D animation to disassemble and examine instrumentation that is too small or too complex for traditional tinkering.

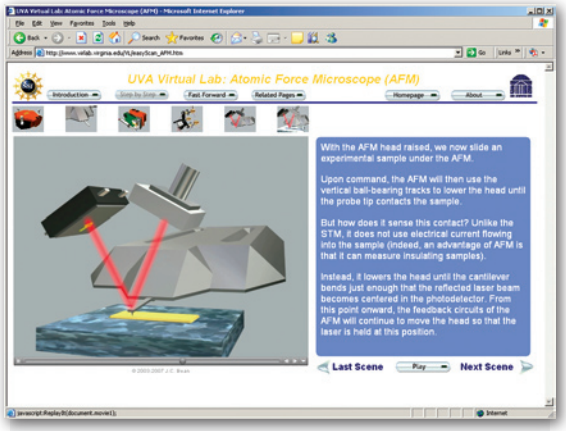
"If there's a patron saint of this web site, it's David Macaulay" (author of *The Way Things Work*), says Dr. John Bean, professor in UVA's Department of Electrical Engineering. Dr. Bean received an NSF Course, Curriculum, and Laboratory Improvement (CCLI) grant in 1999 to develop the site. The site went live in 2003 with over 50 animations (now available as podcasts) on subjects ranging from integrated circuits to scanning electron microscopy.

The Virtual Lab had its beginnings when Dr. Bean sensed that traditional "blackboard media" were not always getting the points across. "I realized there was a communications gap in that I had internalized some of my understanding of microelectronics." That's when he began exploring the possibility of explaining concepts related to semiconductors with 3D animations.

"I wanted to try to harness VR to go between human and atomic scales, to show things that are invisible like fields and forces, and to take apart things that you can no longer take apart in person."

Dr. Bean had learned firsthand the value of taking technology apart or building it from scratch. An avid tinkerer, as a kid he used a Heathkit to build things like short-wave radios, and these experiences provided a wealth of discovery and learning that strongly influenced his educational and career paths.

Prof. John C. Bean
Univ. of Virginia, Dept. of Electrical Engineering



Over 50 educational VR animations can be viewed (or podcast) at the UVA Virtual Lab©: *virlab.virginia.edu*

"These home electronics kits were all over the place in the '60s and '70s, but as everything went into ICs [integrated circuits], they fell off the market because there was basically no assembly you could do. There was once a tremendous opportunity for rolling up your sleeves and doing technology that this generation hasn't had."

The Virtual Lab, then, is about re-capturing the Heathkit experience. Discovering how things work on your own is empowering, he believes, bringing a mixture of fascination and (constructive) frustration: "Wow, that's clever" and "Hey, I could've thought of that myself."

Traffic to the already popular site escalated sharply in late 2006 when he added two animations of Scanning Probe Microscopy (SPM). Bean had created animations of a Nanosurf Scanning Tunneling Microscope (STM) and Atomic Force Microscope (AFM) that had been acquired for a new nanoscience course at UVA (see accompanying article in this issue).

"I thought it would be left field," Bean says. But when he posted the SPM animations as podcasts, a surge of interest – nearly 200,000 hits in just two weeks – ensued. Fittingly, a large portion of that traffic came via DIY (do-it-yourself) blogs, the haunts of modern-day hobbyists and tinkerers.

Hands-on Introduction to Nanoscience

University of Virginia: Preparing for the Unknown Nano-future

The Hands-on Introduction to Nanoscience course at the University of Virginia (UVA) prepares students for the future of nanotechnology with a grounding in the laws of quantum mechanics and experiential investigations using a new generation of miniaturized instrumentation.

Funded by a 2005 NSF Nanotechnology Undergraduate Education (NUE) grant, the course, which began Spring semester 2007, distinguishes itself, in part, with the long view it takes on the nanotechnology revolution. "We don't know what form nanotechnology is going to take – it's too early," says Dr. John Bean, one of the two instructors.

"Maybe all the structures we're playing with right now will become obsolete and be supplanted by other things, but we do know, to the extent you can know, that the rules that govern whatever will replace these will be quantum mechanics. We're basically saying to the students, 'We don't know where it's going, but we can predict the scientific foundations, so we can give you relevant experiences that will prepare you for what comes.'"

A second distinguishing feature of the course is its strong focus on hands-on experience with advanced instrumentation, including six Nanosurf Scanning Probe Microscope (SPM) systems: 3 Scanning Tunneling Microscopes (STMs) and 3 Atomic Force Microscopes (AFMs). Co-instructor Prof. Keith Williams' grad school and post-doc experience with SPMs was key in including them in the NUE grant proposal. "He knew that you can get them working with undergraduates," says Dr. Bean, "that you can put them in a suitcase and take them to a lecture and get them to work."

Dr. Bean spoke further on the value of SPMs as educational tools. "If you want to say 'I saw an atom,' there are only a few ways of doing it. I can do a lot of things that indirectly infer atomic positions, and up until 1990, that's all we could do. For the younger student, who doesn't have the experience to go through the math or really believe you when you give the indirect data, SPM has an immediacy – it's virtually a camera."

"While we're using quantum mechanics to describe things," he continued, "in practical terms we believe we're going to rely much more on self assembly processes, and that's something SPM can show us."

An important phase of the course is making sure students understand how the instrumentation works. "I do not want to concede, as you often do in undergrad courses, that some things are just going to be largely mysterious black boxes," Dr. Bean says. "There will be no black boxes in this class!" To this end, he has re-created both the AFM and STM in virtual reality and posted the presentations on the UVA Virtual Lab site (see accompanying article in this issue).

Students in UVA's Hands-on Introduction to Nanoscience course using Nanosurf STMs and AFMs. First they learn about how the instruments work, with the Virtual Lab website. "There will be no black boxes in this class!" says Prof. John Bean.

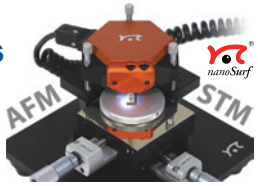
"There's that Arthur C. Clarke quote that goes, 'Any sufficiently advanced technology is indistinguishable from magic.' We've gotten to that point, and I want to get back from that point: I want to show them it's not magic." Dr. Bean believes that taking things apart can be very empowering for students, himself included. In the case of the STM, for example, the fundamental principles are based on high school level physics, so students can actually understand how it works with knowledge they already have.

By design, the course enrollment is initially quite small, consisting mostly of juniors and seniors who are being enlisted as co-developers of the course. "This semester we are trying to develop exciting, but ultimately pretty straightforward and high success rate lab experiments with these SPMs." After that, they will scale up the enrollment, shifting the emphasis to underclassmen.

As part of the NSF grant, all materials developed for the course will be posted on the web (virlab.virginia.edu/Nanoscience_class/Nanoscience_class.htm). The course page will be evolving a lot over the next year, so Dr. Bean encourages people to check for updates.

Tools for Teaching Nanoscience

Easy to Use Scanning Probe Microscopes



nanoscience.com

Atomic Force Microscopy (AFM) and Scanning Tunneling Microscopy (STM) are today's standard technologies for studying objects at the nanometer scale. The Nanosurf® easyScan 2 AFM and STM systems are easy to use, portable and affordable, making this powerful technology accessible to the classroom. With more than one thousand in use, educators around the world utilize them to teach chemistry, physics and engineering. The easyScan AFMs and STMs provide students with a unique hands-on experience in nanoscience to put your course on the cutting edge of science education. Prepare your students for the 21st century by introducing nanoscale imaging. Email info@nanoscience.com for pricing and configuration suggestions.

VISTAprobes™

NEW! Reliable, Low-cost AFM Probes

We are excited to introduce VistaProbes, a new line of quality AFM probes that are compatible with easyScan 2 AFMs. Although VistaProbes are the lowest-priced Nanosurf-compatible probes on the market, they feature high-end specifications and consistent quality for reliable AFM measurements – guaranteed. Visit vistaprobes.com for specifications and pricing.

SAVE 20%
Limited Time Only

NSF Funding

Course, Curriculum, and Laboratory Improvement

Proposals for the next round of NSF Course, Curriculum, and Laboratory Improvement (CCLI) grants are **due May 8, 2007**.

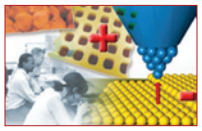
A total of $34,000,000 in funding is anticipated for an estimated 92-125 new and ongoing awards.

Visit nanoscience.com/CCLI for further information.

Seminars, Workshops & Exhibitions

Teaching Nanoscience with SPM

Teach 3 Nano



March 28, 2007
Chicago, IL
2:00 - 8:00 PM

Early Registration Deadline: March 11th

The 3rd Int'l Seminar on Teaching Nanoscience with Scanning Probe Microscopy will be held in the U.S. for the first time in conjunction with the Spring 2007 ACS Meeting in Chicago, IL.

The seminar is a unique opportunity for those involved in teaching nanoscience to learn about other nanoscience educational programs and to share experiences. Everyone will also have the chance to ***win a complete Nanosurf easyScan 2 STM system!***

Call for Submissions All participants are encouraged to submit contributions ***by March 11th***. Proposals relating to teaching nanoscience will be accepted in lieu of the registration fee.

Registration A small fee will apply to all non-contributing participants. The fee ($100.00 thru March 11th, then $150.00) includes food, drinks & entry into the easyScan 2 STM drawing.

To register, submit an abstract, or download a detailed seminar brochure, please visit teachnano.com.

Summer Workshop on SPM

Nanoscience On the Tip

University of Washington's NUE UNIQUE (**U**sing **N**anoscience **I**nstrumentation for **Q**uality **U**ndergraduate **E**ducation) is offering a one-week intensive hands-on workshop using a large variety of scanning probe microscopes applied to fundamental problems in biology, chemistry, physics and engineering. The workshop is open to students nationwide.

Workshop dates: June 25-29, 2007

Registration deadline: April 30, 2007

For details and online registration, visit: nanoscience.com/UNIQUE

Too Small To See at Disney World

Too Small To See, a 5,000-square-foot interactive nanotechnology exhibition for all ages, opened at Innoventions at Epcot® in November 2006 and will be there through May 2007. Developed by Cornell University with NSF support, Too Small to See will travel around the United States hosted by science museums and other venues. Visit www.toosmalltosee.org for details.