Andrew Zwicker Profile
By Raphael Rosen
Princeton Plasma Physics Laboratory
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Andrew Zwicker loves physics research, but nothing compares to the "a-ha" moment.

That moment occurs all the time in the PPPL Science Education Program, when students and teachers suddenly grasp the concepts underlying plasma physics. Zwicker has been involved with the Science Education Program since 1997. This year, the education program hosted 73 students, 7 visiting scholars, and 24 teachers. The teachers participated in either the PPPL Plasma Camp or the Academies Creating Teacher Scientists program (ACTS).

Andrew Zwicker also helps manage the High School Research Internship, which lets New Jersey high school students come to PPPL and conduct independent laboratory research. Summer interns receive a stipend and school-year interns receive school credit.

In fact, mentoring a high school student is what drew Zwicker from a typical physics research position to teaching.

Having received his Ph.D. in physics from Johns Hopkins, Zwicker obtained a research position at the Oak Ridge National Lab. Later, when Zwicker was at PPPL, a local high school student received an internship from the Science Education Program – Andrew had not yet taken over – and was asked to write a computer program that would display information from a fusion reactor in real time. She had no experience with computer code, so Zwicker agreed to help her. He soon found that the experience of explaining science to someone else – and watching the new knowledge click inside that person's mind – was addictive.

The heart of the Science Education Program is the Science Education Laboratory, a multi-use space on one of PPPL's lower levels. Originally located in one room in 2001, and then moved to an abandoned machine shop in 2002, the Science Education Laboratory now occupies a new space with 2,000 square feet. It includes a teaching space, with a large white-board and room for lab tables and experiments.

Next door is a suite of rooms where visiting students and teachers can experiment with dusty plasmas. Dusty plasmas sound exotic, but are actually extremely common. They are found throughout the universe; examples include the material trailing a comet and the rings around Saturn. In short, a dusty plasma is a very hot, ionized gas with very small particles suspended in it. The particles are minuscule, ranging from millionths to billionths of a meter across. Dusty plasmas are interesting because the dust particles are charged and interact with each other in a variety of ways.

"Dusty plasmas are amazing because they are relevant to both basic and applied science,"

says Zwicker. "They are great teaching tools. They allow you to see plasma phenomena that you couldn't see any other way."

Also, this is the third year in which PPPL students have conducted dusty plasma experiments on the *Weightless Wonder*, an airplane owned by NASA that can duplicate low-gravity conditions. (For obvious reasons, this plane is also called the "Vomit Comet.")

In addition, the science education lab lets students and teachers experiment with "sputtering," a kind of plasma processing during which plasma ions accelerate towards a target material and knock off some of the target's atoms. Those free-floating atoms can then be deposited "where we choose," says Zwicker. Sputtering is the technique used to make thin, small electronic components, but rather than being done by industry experts, at PPPL it is done by undergraduate students and high school teachers.

PPPL's science education program accepts both teachers and students. The teachers mostly come from local schools, but some are recruited from across the nation. The high school students are all local and enroll in the program primarily in the summer. Those students receive stipends. Other students come during the school year and receive school credit for their work.

According to Zwicker, PPPL's Science Education Program is unique. No other national laboratory has an education program in which experiments are set up specifically for students to perform. Furthermore, the Science Education Program collects data showing how the students' experience in the program affects them. The data indicates that students who enroll in the program are much more like to go to graduate school than those who didn't.

"Dusty plasmas are a fusion of science and education," Zwicker says. The same might be said of Zwicker himself.