



Anatoly Frenkel: The Poetry of Nanoscience



New York, NY, Nov 10, 2003 -- In his essay, "An Absurd Reasoning," Camus expressed his dismay that science could not depict the universe at its most fundamental level. "[Y]ou tell me of this invisible planetary system in which electrons gravitate around a nucleus," he wrote. "You explain this world to me with an image. I realize then that you have been reduced to poetry: I shall never know [the truth of nature]."

It's too bad that Camus didn't live to witness the experiments of Anatoly Frenkel, PhD, Associate Professor of Physics at Stern College for Women, who is using a technique called x-ray absorption spectroscopy to paint portraits of tiny clusters of atoms in stunning detail. Dr. Frenkel is a specialist in nanoscience, the study of materials in miniature, billionths of a meter wide, dimensions at which many substances exhibit unique shapes and properties. His work holds promise both for probing the fundamental nature of matter and for developing real-world applications, such as fuel cells for automobiles or data storage for electronics.

People outside this esoteric corner of physics are starting to take notice. In September, the Department of Energy awarded Dr. Frenkel and his colleagues a three-year, \$900,000 grant to explore the role of nanoparticles as catalysts in chemical reactions.

Not long ago, he could only dream of having access to such a wealth of resources.

From Russia, with love (of physics)

Dr. Frenkel was born and raised in Leningrad (now St. Petersburg) in 1964. Both his father and grandfather were engineers, but they encouraged young Anatoly to study physics. "Engineering had not been a reputable job since the October 1917 revolution," he explains in heavily accented but splendid English. "And physics was considered to be the most challenging science intellectually. They wanted to give me the best education possible."

Anatoly excelled in science, graduating at the top of his high school class. The Frenkels, it seemed, would have their physicist. For Jews like Anatoly, however, there were invisible barriers to advancement in the Soviet Union. To make his way in science, he would eventually have to emigrate.

In the meantime, he earned a diploma in physics (a degree equivalent to our master's) from St. Petersburg University and then worked as an engineer for a local R&D company. He also continued to research in physics research, publishing several papers in leading journals. By the end of the eighties, his credentials were good enough to earn him a spot in the doctoral program in physics at Tel Aviv University.

To Anatoly (and soon, to the whole world), the Soviet Union was history. "I went back only once to visit my parents," he says. "In Israel, I started a new life." Soon, he would help develop a new field.

During this period, he was invited to study with Professor Edward Stern at the University of Washington, Seattle, the founder of x-ray absorption spectroscopy. By the time he earned his doctorate, in 1995, Dr. Frenkel was well on his way to a career in nanoscience.

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After graduation, he settled in the United States, pursuing a string of opportunities in this new field, including a stint at the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory, the country's premier facility for studying matter with infrared, ultraviolet, and x-ray light.

In 1997, his parents and sister were able to join him in the U.S. Once again, the Frenkel family was whole.

To Yeshiva

By 2001, Dr. Frenkel landed at Yeshiva, relishing the chance to conduct pure research and to teach, which he had done in various capacities since studying physics back in the Soviet Union.

Today, he splits his time between Yeshiva and Brookhaven (with which he is still affiliated), often using the latter as an extension of his Stern classroom, not only as teaching tool but also as a form of career counseling. "I realized early that research was the most logical career for me," explains Dr. Frenkel, who bears a resemblance to the actor Tom Berenger. But some students, he says, enter graduate school without learning whether it suits them, wasting precious time and money.

In "Experiments in Modern Physics," a course he designed with his Yeshiva colleagues, students spend a full week at Brookhaven performing experiments that bring concepts like the photoelectric effect and nuclear decay to life. Several other students have conducted research at Brookhaven under Dr. Frenkel, including SCW honors student Shira Frankel, whose work on nanoparticles structure determination resulted in their joint article in *Physica Scripta*. Shira's other work, on using synchrotron x-rays to study chemical kinetics of nickel oxide reduction, was published in the Brookhaven laboratory's annual report.

Camus didn't live to see the universe at its most basic level, but perhaps Dr. Frenkel and his students will.