

**Alex Demkov, Department of Physics, The University of Texas at Austin,  
demkov@physics.utexas.edu**

<http://www.ph.utexas.edu/~aadg/>

<http://www.ph.utexas.edu/aliceinwonderland/>



Demkov's current research is focused on the physics of oxide heterostructures. He works on the quantum theory of real materials, and molecular beam epitaxy. His work originally focused upon first-principles computations, and he developed novel methods to study the functions of semiconductor structures using some of the world's most powerful computers. However, due to the complexity of the problems he wished to investigate, he made a transition unusual these days for physicists, and developed an experimental laboratory as well so as to synthesize and probe the materials he was

examining with theoretical tools. For example, he recently grew barium-titanate films on silicon and showed that the resulting structure has ferroelectric properties. This discovery was featured by Brookhaven Lab as one of 10 scientific breakthroughs in 2013, and may lead to new low-power field-effect transistors.

Since 2005, Alex Demkov has organized Alice in Wonderland, a summer physics experience for girls. It arose from his concern about the small number of women pursuing physics, and his resolution to pursue solutions at the high school level. Each summer 5-10 high school students (almost all women) receive a \$1000 stipend and work in a research laboratory at UT Austin for at least a month. In addition, students participate in a short course during June, and receive lectures from faculty and graduate students. Inspired by a student request in 2005, Demkov single-handedly created the program, obtained stipend funding, created the website, solicited and reviewed applications, organized assignments to research labs in the summer, organized the summer course, and organized celebratory events.

Are effects of the summer experience long-lasting? The first class to participate in Alice in Wonderland had just three students, and they are now approaching the age to apply to graduate school. One is preparing to work as an MBA. She writes *While I did not ultimately enter into the physics or engineering sectors, I did find that the Alice in Wonderland program provided a great platform for high school students to explore the physics fields. The analytical skills I developed during the program helped me everyday at my internship.* The second says that she hopes to obtain my masters in either Aerospace Engineering or Materials Engineering. *This summer I am taking a break from NASA and Engineering to teach 7th grade science.* The third says *My experience with Alice in Wonderland sparked an interest in device physics that led me to take the semiconductor physics course at Penn where I met Professor Piazza, and started me on the path I am currently taking. I am glad to hear that the program is still around.*

Alice in Wonderland is a remarkable contribution from a physicist; the low participation of women is evident to everyone in the physics community, but few have devoted themselves personally to changing the situation as has Demkov.

Alex Demkov is a professor of Physics at The University of Texas at Austin. He received his Ph.D. in theoretical physics in 1995 from Arizona State University (ASU). In 1995-1997, he was a postdoctoral researcher at ASU. In 1997-2005, he was a principal staff scientist in Motorola's R&D organization providing theoretical support for the development of low- and high- $k$  dielectric materials. In 2005, he joined the faculty of the Physics Department at the University of Texas at Austin. Prof. Demkov has published over 100 research papers and has been awarded seven U.S. patents. A book on Integration of Functional Oxides with Semiconductors is being released in Spring 2014. He has contributed to several other books and edited one, entitled "*Materials Fundamentals of Gate Dielectrics*," and has also co-authored the 2005 edition of the International Technology Roadmap for Semiconductors (ITRS). In 2002-2004, he served as Associate Editor of the Journal of Vacuum Science and Technology B. He also served as Guest Editor for several issues of *physica status solidi (b)*. He has organized numerous sessions and served on program committees of many national and international conferences. In 2009-2012 he served on the Executive Committee of the Forum of Industrial and Applied Physics of the American Physical Society (APS), and is currently serving on the APS Publication Oversight Committee. Demkov received the NSF CAREER award, 2011 IBM Faculty Award, and is a Fellow of the American Physical Society.