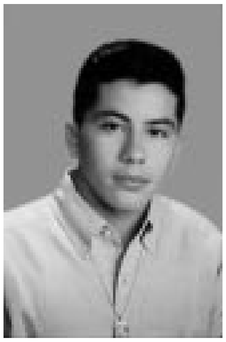
People ask me "why do you like physics so much?" I tell them, "because it's fun." Then I begin



to give them examples of everyday activities that involve physics. Being a gymnast, I can easily do a cross in the still rings because I am short, light, and have compact arms, therefore reducing the torque that my body weight exerts on my pectoral muscles. Secondly, the application of physics to gymnastics was essential for me to perform giants on the high bar, front summersaults, and more. But, the real joy of physics for me is to write about nature's most intimate secrets so that others can use this knowledge to better their lives. One small example is how I used Newton's equations and vector analysis to show my father how we could replace the clutch in his truck using minimum effort. We saved energy, time and money. Ultimately, I plan both to teach and do research.

STEP IN THE RIGHT DIRECTION:

Science and Technology Education Program Lawrence Livermore National Laboratory

BY MIGUEL A. GARCIA
UC Davis Graduate

Mid-January is traditionally the time for undergraduates to apply for summer programs. Seniors may well consider an intermediate step between undergraduate and graduate school. As a senior, I found that a structured research internship perfectly filled the bill.

Last year, UC Davis Professor Rodney Cole from the Minority Undergraduate Research Participation in the Physical and Mathematical Sciences (MURPPS) Program organized a trip to the Lawrence Livermore National Laboratory (LLNL). Here, Dr. Don Correll and Barry Goldman presented the various programs within STEP—the Science and Technology Education Program. This is how I learned about the Undergraduate Research Semester (URS) sponsored by the Department of Energy Defense Programs.

I completed a B.S. in physics in June 1999 and began working in July as a research intern with support from LLNL's diversity program.

The URS (see Spring 1999 *CAMP Quarterly*) has allowed me to conduct leading-edge research. More importantly, this type of interaction with scientists, which is not always

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NOVEL DIODE-PUMPED SOLID STATE HIGH AVERAGE POWER LASER DESIGN*

ABSTRACT: A proprietary laser design uses diode pump-light introduced at the edges of the device. Using ray trace models, we optimized the optical geometry and dimensions of the device to produce the highest efficiency and power output.

INTRODUCTION: A lens-duct concentrates the light of a diode laser array and conditions it to enter the edge of the composite solid. The diode pump light efficiently absorbed using the proprietary design.

METHODOLOGY: Trace Pro-Modeling. We measured the divergence of the diode array and used it in the code for our calculations. The geometry was optimized for efficient absorption. The source distribution was mapped.

DISCUSSION: Our results predicted a very efficient laser of high output power. Experiments are presently ongoing with the first generation prototype. There is a trade off to be made between pumping efficiency and pumping homogeneity. Ongoing experiments address this issue.

* UCRL ID-137915

available, complements my undergraduate education.

Research at LLNL was the primary focus. Under the supervision of my technical mentor, Luis Zapata, Ph.D., I used ray-trace models to investigate the optical geometry and optimized dimensions of a novel laser design that uses diode-pump light introduced at the edges. Our goal was to balance the laser design's efficiency and pump uniformity. Our design yielded an optimized source distribution for a 6-mm-aperture lasing crystal. Experimental results were in agreement with the predictions of the computer model.

At Lawrence Livermore Lab, students from most scientific fields learn important skills and training unique to the Laboratory. I strongly agree with Dr. Howard Powell, program leader of the Laser Science and Technology Program, who says, "there is no substitute for technical excellence." Certainly, a strong academic background helps students "see connections" in the world of science—connections that can transform personal goals.

I have found that my many long nights toiling through physics problems in school earned me the technical knowledge required to operate the various lab instruments used in my experiments. For example, the theories and equations that I learned in my optics class have been an integral part of my laser design. In addition, I must fully grasp the methods and equations used by the software code that I run to model the laser system.

I made research a major part of my undergraduate career and presented the results at various national and international conferences. This experience helped me realize how much I like research, particularly physics.

My ultimate goal upon entering graduate school is to obtain a Ph.D., which will allow me eventually to head a research group in industry or in academia. Up to this point in my academic career, I have yet to explore all areas of physics. So far, quantum optics and condensed-matter physics seem to be interesting fields with many opportunities.

I would like to encourage all my fellow students to participate in research programs and academic events. Engage yourself in a field that really excites you, because your work can last beyond your lifetime. The abundance of research opportunities gives students ample opportunity to explore their potential as professional scientists.

MIGUEL A. GARCIA

PUBLICATIONS

R. Cole, M. Garcia, S. Tooker, *"Web-Based Tutorials for Physics Education, Computer Applications in Engineering Education,"* Wiley, expected publication Spring 2000.

R. Cid, M. Garcia, *"Teaching Science and Engineering to Latino Students,"* Journal of Woman and Minorities in Science and Engineering, expected publication Spring 2000.

Cole, R.W., Tooker, S.C., Garcia, M.A., *"Web Based Lessons, Changing the Face of Electromagnetics Education,"* Progress in Electromagnetic Research 98, Nantes, France, Proceedings, 1998.

F.E. Fernandez, M. Garcia, A. Martinez, V. Pantojas, M. Pumarol, *"Structure and Properties of III-N Semiconductor Thin Films Grown at Low Temperatures by N-Radical-Assisted Pulsed Laser Deposition,"* MRS Symposium Proceedings, Nitride Semiconductors, vol. 482, 1997.

TECHNICAL TALKS

1999

"Novel Diode-Pumped Solid State High Average Power Laser Design," URS Symposium, Livermore, CA.

"Using JAVA to Teach Elementary Electromagnetism via Internet," CAMP Conference; Los Angeles, CA.

1998

"Optical and Crystal Characterization of AlN Thin Films grown by N-Radical-Assisted Pulsed Laser Deposition," National Conference on Undergraduate Research, Rochester, NY.

"Characterization of Aluminum Nitride Thin Films Grown at Low Temperatures by N-Radical Assisted Pulsed Laser Deposition," National Technical Career Conference, Orlando, FL.

"Using JAVA to Teach Elementary Electromagnetism via Internet," Undergraduate Research Conference, UC Davis.

1997

"Solitons in One-Dimension: Linearity vs Nonlinearity," Austin, TX, National Conference on Undergraduate Research; National Technical Career Conference, Philadelphia, PA.

"Ellipsometric Analysis of AlN Thin Films Grown by Pulsed Laser Deposition," Mexican-American Engineers Society, San Diego, CA.

"Surfing the World Wide Web for Physics," Undergraduate Research Conference, UC Davis.

1996

"Solitons in One-Dimension: Linearity vs Nonlinearity," Undergraduate Research Conference, UC Davis; National Conference, Louis Stokes Alliance for Minority Participation (LSAMP), Tallahasse, FL.

1995

"Solitons in One-Dimension: Linearity vs Nonlinearity," MURPPS, UC Davis Summer Institute.

For Information on MURPPS, see [http://maxwell.ucdavis.edu/~murpps/]