PHYSICS DEPARTMENT
COLLEGE BASED FEES
FINAL REPORT
2003-2004

SUMMER RESEARCH **$22,319.00**

During the summer of 2003, 15 different students conducted research with 9 different faculty members. They worked on the following projects.
T. Bensky: Attenuation of the visible spectrum as a function of depth in Avila Bay, and Rubidium resonance with a stabilized diode laser.
R. Echols: Improving the power conversion efficiency of low costs polymer solar cells. Developing a numeric model of the quasi-biennial oscillation (QBO), and computer simulation of polymer solar cells for optimal design.
R. Frankel: Fourier transform of the free induction decay in pulsed nmr.
A. Garcia: Studying factors controlling alluvial fan morphology in Jakes Valley, White Pine country, east-central Nevada.
M. Moelter: Particle trajectories inferred by surface currents in Monterey Bay.
P. Schwartz; Connecting DNA to polystyrene mocrospheres, and Atomic force microscopy and nanolithography.
J. Sharpe: Understanding the effect of noise on state transitions in the physical system, and Understanding spontaneous complex pattern formation in dynamical systems.
R. Zammit: Design and fabrication of circuit boards for curve tracing.

A few faculty continued supporting students into the academic year: Moline, Schwartz and Zammit. In addition, T. Coughlin is helping students build an adaptive telescope, and R. Field has student working on an astrophysical system analysis project.

SENIOR PROJECTS **$960.52**

Sarah Cowan built a telescope for her senior project.

STUDENT TRAVEL **$3,816.74**

Dr. Peter Schwartz took 5 students to a Nanotechnology conference at UC Santa Barbara. Twelve students attended the APS meeting at Lawrence Berkeley Lab. Two students attended the MRS conference in San Francisco. One student visited Bowling Green University to look at their physics graduate program.

PHYSICS UPPER DIVISION COURSES **$21,388.00**

The following physics courses were paid for by CBF: 301 Thermal Physics, 302 Analytic Mechanics I, 317 Special Theory of Relativity, 408 Electromagnetic Fields and Waves, 412 Solid State Physics, 470 General Relativity.

FACULTY TRAVEL **$11,241.16**

Twenty-one different faculty members went on 24 different trips for professional development. The travel was as follows: Meetings of the American Association of Physics Teachers in Miami and Madison, Wisc; The American Physical Society meetings

in Berkeley and San Diego; The American Geophysical Union in San Francisco; The Nanotechnology Conference at UCSB; the MRS Conference in San Francisco; a meeting on Gravity at Cal Tech,; Optics research at INOA in Florence Italy.

FACULTY STARTUP **$22,497.33**

T. Bensky: The money was used to supplement an external grant to build a fiber-optic based apparatus to monitor sunlight penetration into the ocean at the Cal Poly pier at Avila, CA. The following items were purchased: mounting hardware such as copper framework, water proof ropes, stainless steel pulleys, and iron harnessing rods; a MEMs based pitch roll sensor used to track the orientation of the apparatus in the water; a Pockels cell which is slated to be used for Ruthie Hambley's senior project from Fall 2004-Winter 2005, and which will eventually be integrated into the Phys 323 (Optics) laboratory on "Polarization."

R. Echols: His allocation was used to lower his teaching load by three units during the academic year. As a consequence, Dr. Echols had more time to engage students in his ongoing research projects involving polymer photovoltaics, atmospheric dynamics, cosmology, and particle physics. Please see Dr. Echols' web page for more details on student involvement and information about some of these research projects.

A. Garcia: The funds were used to fund research. Monies were spent in July supporting fieldwork in Jakes Valley, east-central Nevada, including salary for a student assistant. Remaining funds were used to pay for radiocarbon dating of Mollusk shells collected during the field campaign.

C. Hoellwarth: The purpose of his research is to characterize materials using x-ray diffraction and resistivity measurements. He is currently studying high temperature superconductors and TiC. He purchased a computer in order to control the resistivity measurements, a microscope to assist him in placing leads on small resistivity samples, and C60, one of the precursors to making the TiC.

M. Moelter: He purchased a temperature controller for his closed-cycle refrigerator (down to 10K), and a computer for automated data acquisition/control of oscilloscope, multimeter, and the refrigerator.

P. Schwartz: The money was largely used to fund his AFM lithography research – salaries for three students, and related hardware. It is a collaboration with De Yoreo at Lawrence Livermore National Laboratories (LLNL). They were able to upgrade Atomic Force Microscopes (AFM), which allowed Jamie Romnes to initiate investigations of Dip-Pen Nanolithography – whereby molecular patterns are generated with an AFM on a gold surface with nanometer precision. They are able to supplement these experiments with images taken by Scanning Electron Microscope (ESEM) facility in Materials Engineering (MATE). Dr. Schwartz is working with Linda Vanasupa of MATE to provide this ESEM as a user facility for all Cal Poly faculty. He presented these results at a well-attended talk at the Materials Research Society meeting this past April.

EQUIPMENT/LABS **$34,791.79**

Optics related materials were purchased. Optical breadboards are used in Physics 323 Optics, Physics 315 Laser Physics, and Physics 417 Advanced Optics. Funds were also used to purchase mounts for optical components such as posts, bases and post-holders. These items give the same optics design equipment to our students that is used everywhere in industry. When these classes are not offered, these items are in almost constant use by students for their senior projects, to hold and mount elements for optics experiments. Lenses were purchased to upgrade the lab equipment in Physics 323 Optics, Physics 315 Laser Physics, and Physics 417 Advanced Optics. Two new high-resolution light spectrometers tell us what wavelengths are in a light source and are in near-constant use. They are used primarily for Physics 340, 341, and 342 (Quantum Lab), Physics 323, 315, and 417, Physical Science 101 and Physics 132. Additionally they were utilized in an astronomy class, and by Bensky, Echols, Hoellwarth, Moelter and Sharpe for senior projects. A laser temperature controller was purchased to control diode laser temperature and current for quantum lab. Christian Heredia used these for his senior project, and Mary Lee Weeks will do the same beginning in Winter 2005. Photo detectors, rotation stages lenses, and fiber emitter detectors were purchased in order to introduce a Fiber Optics lab into physics 323. The lab will allow for determination of the numerical aperture of a fiber optic cable. The equipment purchased comprises a class set of fiber optic strands and fiber light detectors. The lab will first run Fall 2004.

Dr. Garcia is using the drafting table for student and faculty geology research.

Replacement multi-channel analyzer/pulse height analyzers were purchased to be used in Physics 340, 341, and 342 for all experiments that measure lifetimes, energy spectra, and Mossbauer spectra.