RESEARCH EXPERIENCES FOR UNDERGRADUATES IN PHYSICS
– FOCUS ON MINORITIES –
(Special Minority Undergraduate Physics Research Program – REUP-FOM)
Activities, Summer, 2000, 2001, 2002

1 Summary

The 10 week summer REU-FOM program begins approximately June 1. In this funding cycle, we experimented with moving from a program at Pitt run by one director (the P.I., Julia Thompson), to two linked programs.

One of the programs is the original one at Pitt, but with the detailed responsibility for the program's functioning shifting to two co-PI's each summer, chosen from a pool of 4 participating co-PI's in addition to Thompson. This pattern of shared responsibility among the P.I. and the co-pi's worked very well, as did the Pitt program generally (see, for example, the letter of support from Prof. Kathleen McCloud of Xavier for our renewal proposal). The shared co-director responsibility means that the program can be led by research active faculty, which is an important aspect of our program. Thompson and 3 of the 4 co-pi's have submitted a renewal proposal to continue the Pitt site, in approximately the same style: challenging all students to examine ideas critically and to achieve to their limits, but within a supportive environment to encourage them that the limits are attainable; emphasizing participation from under-represented groups in physics; and, because of this emphasis on under-representation, accepting students as early as the summer after their freshman year, a point known to be quite vulnerable to the "leaky pipeline" effect.

The second aspect tried was establishment of a sister program at Southern Illinois University Edwardsville (SIUE), led by Thompson. Although there were excellent participating faculty and interesting past and prospective projects, we will not continue the sister program beyond 2002. Resources at SIUE are stressed by the state's recent educational budget cuts, and are judged to be too thin to allocate to a program drawing a large fraction of participants from a national pool, not from the geographic area served by SIUE. In addition there were difficulties in transferring funds from Pitt through SIUE to the students in a timely fashion. These difficulties, combined with the personal circumstances of the student participants (e.g., one underwent unexpected surgery, and all were highly distracted due to their specific personal circumstances) posed severe challenges for the program. None of the challenges were unsurmountable, but we were unable to overcome them in a sufficiently stable way to propose a continuation of the SIUE site at this time. Details of the SIUE site pertinent to this report are included throughout, and can be found on the directory: http://www.phyast.pitt.edu/ jth/reupsill.

This report is a cumulative report for summers 2000, 2001, and 2002 and includes general discussions of activities common to both years and both sites, as well as details specific to a given year or a given site. Unless specifically marked as specific to a given year or given site, descriptions should be taken as common.

A brief summary of participants in different years follows. Note that the number of student participants is somewhat higher than the 10 budgeted in part due to support for

additional students from the Pitt administration, and in part because some students, due to personal circumstances, are not full time in the program. Previously unexpended funds and an RET supplement also allowed us to include more participants. We report on all participants, since there would have been no program without the NSF supported site.

1. **In 2000**, the program ran from May 29 through August 5. The program included **18 undergraduate participants, 15 in Pittsburgh and 3 at Edwardsville, Illinois/St. Louis, Missouri. Three teachers were also included, one at Pittsburgh and 2 working primarily in Southern Illinois**. Three graduate teaching assistants (Elizabeth Leeds, Bill Love, and Gordon Weinberg) and two faculty advisors (Prof. Julia Thompson, physics, P.I., and Prof. Oladipo Onipede, Mechanical Engineering, co-P.I.) shared responsibility for directing the program.

2. **In 2001**, the program ran from June 1 through August 10. This year, **the first with an established site at SIUE, the program included 14 students, (10 at Pitt and 4 at SIUE) and 4 teachers, all working primarily in Southern Illinois**, including two from South Africa. Information on individual participants can be found in the section on participants. Three graduate teaching assistants (Bill Love, Gordon Weinberg, and Michele Belfort) and three faculty advisors (Prof. Julia Thompson, physics, P.I., Prof. Oladipo Onipede, Mechanical Engineering, co-P.I., and Prof. James Mueller, physics, co-P.I.) shared responsibility for directing the program. Thompson was the overall director and local director at our SIUE site. Mueller and Onipede were the local directors at the Pittsburgh site. As noted above, one goal in this funding cycle is to expose our group of co-P.I.'s to the director's duties, to increase the robustness of the program.

3. **In 2002**, the program ran from May 31 through August 9 at the Pittsburgh site and May 27 through August 1 at the SIUE site. This year, the program included /bf12 students, (6 at Pitt and 6 at SIUE). Information on individual participants can be found in the section on participants. Two graduate teaching assistants (Gordon Weinberg at Pitt and Natasha Collymore at SIUE) and three faculty advisors (Prof. Julia Thompson, physics, P.I., Prof. James Mueller, physics, co-P.I., and Prof. Oladipo Onipede, Mechanical Engineering, co-P.I., shared responsibility for directing the program. Thompson was the overall director and local director at our SIUE site. Mueller and Onipede were the local directors at the Pittsburgh site.

Students full time in the program spend a minimum of 20 hours, and typically more like 30-40 hours, in research. The focus of the program content is physics (including astrophysics, elementary particle and intermediate energy physics, condensed matter physics, materials science, surface science, molecular beams, education, and some engineering (biomedical, mechanical) applications.

Academic work is informal and explicitly individualized to support the students' research efforts, which, for most of the students, is the main goal of the summer.

The student participants give oral presentations and summarize their research in final written papers. To focus the students' attention on their research and help them in planning, mid-summer presentations are also given, and a draft of the final paper is requested at the time of the mid-term presentations. At the mid-term, posters similar to the posters in an APS poster session are also prepared, are displayed at the mid-term banquet, are updated as the summer progresses and left in place during the year.

An important part of the mid-summer presentations is the participation of our "visiting committee", interested advisors of participating students, who, together with an invited speaker, generally ask questions of the students and critique the mid-term presentations and point out places where the program should be improved. Visiting advisors discuss their own students' progress, both separately with the students, and in conferences with the program director and the student's T.A. or on-site research advisor.

The program structure is flexible. In the early weeks of the programs all students concentrate more on the academic (workshop) component of the program. The emphasis shifts toward research work after the mid-program presentations which focus the students' attention on their research progress. The movement toward research is monitored through our Monday morning group meeting and through the individual weekly conferences of each student with the director.

Ethics discussions and workshops are described below.

The use of video-conferencing to connect the two sites was tried, once for the special lunch speaker at the Pitt mid-term session (Ms. Mamie Wadkins Clemons, sister of the late Warren Henry), and once near the end of the summer, for a wrap-up session, and informal presentation of each group's work to the other. These two sessions served to work out technical bugs and show us how to use the links effectively. A third session requested from the Pitt side to allow them to meet the South African high school physics teachers visiting the SIUE site, failed because of the limited time available and scheduling problems.

Philosophical Questions. The program continues to struggle with several tensions:

1. between challenging the student toward critical thinking (in the end, our primary goal) while at the same time supporting the student in that quest, encouraging them to achieve what they are able at this stage in their development, without making them feel inadequate or inferior for not having achieved more. We try to make this goal explicit and feature it prominently on our web site (http://www.phyast.pitt.edu/ reupfom) both because of its importance and because making it explicit helps in the rough spots which unavoidably arise when students are pushed beyond their past achievements and their own expectations.

2. between achieving in research and having the informal and other peer interactions which may help to carry these students through their college years and beyond to achievements, in research or otherwise, in the rest of their lives.

3. between mentoring, tutoring and research.

4. between achieving those last desirable research results and having the results from the summer well documented in a final paper. Generally the directors monitor early drafts throughout the summer, and start asking for final proofreading drafts about a week before the final presentations.

2 Academic Activities

1. The first step is the **evaluation of the student's preparedness**. Before arriving, the student is invited to fill out a self-evaluation form in consultation with a faculty advisor. An entry quiz with questions of varied difficulty is given in the first few days of the program. As a measure of growth, a similar quiz is given at the end. At the end, in addition to the simpler evaluative questions used initially, questions probing areas of study during the summer are also included. The scores therefore cannot be strictly compared, but comparison of the two sets of quizzes demonstrates growth over the course of the summer. Details of the quizzes and individual scores are available upon request.

2. To monitor the student's progress, and to be alert to problems, the director has a **weekly conference**, typically Friday or Monday, with each student and the T.A. with special responsibility for that student. Students bring their log-books, and a brief written summary of the week's activities, problems, and progress to the conference.

   The length of the meetings varies, from about 20 minutes to, on occasion, close to an hour. Generally three times during the summer the research advisor attends the meetings: initially, when the plan for the summer's work is set; at the time of the midterms, when a draft of the student's paper is considered, progress is assessed, midterm course corrections are made, and the plan for the remainder of the summer is set; and at the end, to summarize the student's progress, and status of the project. In addition to research, personal and social issues relating to the students general well being are also discussed, generally at the initiation of the student.

   During the first meeting we also asked for **research advisors' input** into what workshop topics would be most beneficial to the students' research. At the student's or the directors' request, a research advisor may attend future meetings; however, normally the liaison with the research groups will be handled informally, through contacts between the program directors and the research faculty, or contacts of the program T.A.'s with students and research advisors.

   The details of the meetings vary by site and year within the broad description above. For example, beginning in 2001, as part of the general gradual development of the paper, at Pitt students are requested to prepare a formal bibliography and (brief) summary of the literature. This consists of a short (no more than two page) summary of the background material their advisor had asked the student to read in preparation for their research project. At SIUE, the literature is discussed with the students, but no formal bibliography is requested.

3. The **weekly informal group discussion session** allows research or academic questions, or more general questions, to be raised and discussed. A general meeting of all the undergraduate students, teaching assistants and the two faculty advisors was held every Monday morning from 9 am to 10:00 am. at Pitt, and Tuesdays or Fridays at SIUE, depending on other activities. Meeting as a group the students can voice their concerns with the program and other issues outside of their particular research topic, ranging from plans to counter a difficult dormitory situation to suggestions for topic for Thursday lunch seminars. These meetings were also a venue where students could be reminded of activities for the week, including trips, tutoring sessions, academic workshops, etc.

   In recognition of the importance of effective vocabulary use, the program has begun some **informal vocabulary work**. At the beginning of weekly meeting, each student had to write a new word, along with its definition, on the board. The goal here was to help the students increase their vocabulary and assist in preparing them for the GRE's. A short piece of literature was sometimes distributed to the Pitt students, and gives inspiration for the new vocabulary words. At SIUE we used the New York Tuesday Science Times. The definitions selected by the students at Pitt, and those selected by the students at Edwardsville were shared between the two groups via e-mail. The following week, a brief "nonsense" story using the words is made up, with each student contributing in turn, using two words.

4. Workshops in Physics and Mathematics. Introductory workshops in physics and mathematics were held regularly to strengthen the academic background of the underclassmen/women in the program. The "advanced" workshops have included topics in Linear algebra, differential equations, particle physics, electromagnetism and finite element analysis were conducted, typically one or two periods devoted to each topic. These later workshops were targeted towards specific students needs and interest. The workshops were conducted by the teaching assistants who were graduate students in physics and mathematics. At Pitt, an optional machine shop class (meeting once per week, for 4 three-hour sessions) gives interested students a hands on exposure to machine tools. Students use the machines and at the end make a nut and bolt from chunks of steel. This workshop is valuable for students working in laboratories or experiments where they may have to build or assemble special devices or supports for their research.

   Students are encouraged to go to an average of 4-6 hours of workshop activities per week. Preparation time and extra discussions may raise the total time to 20-25 hrs/week, for some students, at some times of the summer. The weekly individual conferences monitor the division between academic and research work.

5. Variations at SIUE: in 2001, since all students worked with Prof. Thompson, instead of a general Monday meeting, the group met briefly each morning, with Thompson and senior researcher David Kraus, to keep abreast of current research and other plans. Vocabulary work and other informal academic work was done with Thompson on Fridays or Saturdays (since the group's work week was shifted

to Tuesday-Saturday instead of Monday - Friday). In 2002, the students worked with a more diverse group of faculty, and the structure was more like the meeting structure at Pitt discussed above.

3 Group lunches / Broadening Physics Awareness

At each site, occasions are found to broaden our physics awareness and understanding. In addition to the speakers, there are "physics puzzlers," drawn from problems the students have thought about, or from books such as **The Flying Circus of Physics**. While the activities are informal, the flavor can be got from an example attributed to Feynman as having been posed to a child of a friend: take two cans of canned food, toss them in the air... from the motion in the air, decide whether the contents are liquid (with some solid pieces, as e.g., peas) or solid. (The answer has to do with the gyration or "wobbling" of the motion about the center of mass trajectory).

Typically, once weekly, students meet for an informal brown bag lunch with a speaker, either a graduate student or faculty member in some research area of interest.

Speakers in the Pitt Summer 2000 lunch series:

1. Prof. E. Engels, (twice) physics and accelerators in elementary particle physics.
2. Arnold Tharrington, (African American graduate student in physics), computer exploration of phase transitions and ergodicity in equilibrium states of carbon materials.
3. Dr. Chandrelekha Singh, senior physics lecturer, and researcher in physics education, Superconductivity.
4. Stephanie Hoogendoorn, math graduate student, dynamic systems.
5. Prof. Andy Connolly, astrophysics, studies of Hubble deep field galaxies and their Doppler shifts.
6. Prof. David Snoke, Introduction to Optoelectronics
7. Prof. Bernard Cohen, physics, health risks and low dose radiation, possible inverse correlation of risk and (low) radiation doses.
8. Visit by Dr. T. Rettig, NSF REU monitor. Discussion with students.
9. Prof. Vittorio Paolone (co-spokesperson of the experiment to discover the tau neutrino, which announced its results in the previous week)
10. Prof. H.M. Gach, Introduction to Magnetic Resonance Imaging; and Tim Stever, Zoll Medical Corporation, Experiences in Design and Testing of Equipment in Industry, with emphasis on importance of analog electronics experience.

2001, Pitt A list of summer 2002 Pitt speakers can be found on the web site: http://www.phyast.pitt.edu/~reupfom. In addition to having Tharrington and Engels back, there were:

1. Neutrinos: Dr. Jeff McDonald, general experimental situation and emergence of the neutrino as a probe of physical theories, and Prof. Vittorio Paolone, on the SNO results, newly announced in the summer, showing oscillation of electron neutrinos from the sun into muon neutrinos as the most likely explanation of the long-standing "solar neutrino deficit";

2. Prof. Peter Koehler, strategies for getting into graduate school;

3. Elizabeth Leeds, former math graduate student and REU participant and TA, now working for NeuralWare, software company specializing in neural net technology;

4. Carla Adams, past REU participant and Pitt alumna, now graduate student in astronomy at the University of New Mexico, on her work on Hubble deep field galaxy studies; and

5. Prof. Jeremy Levy, director, Pitt Center for Quantum Computing.

2001, SIUE Activities at SIUE, instead of one hour meetings each Thursday, included fewer total meetings, but some more extended afternoon field trips to St. Louis. Discussions included:

1. Lunchtime discussion about the SNO neutrino experimental results, at the time they broke, and in preparation for Paolone's talk on this subject at the midterm presentations;

2. Field trip to the nanotechnology scanning microscope laboratory (Center for Molecular Electronics) at the University of Missouri at St.Louis, where Director Phil Fraundorf met with students, told us about the different kinds of microscopes and allowed students to handle the microscopes themselves;

3. Field trip one to Washington University: discussion of general relativity and dark matter with Prof. Clifford Will, and quasi-crystals with Profs. Pat Gibbons and Ken Kelton

4. Field trip two to Washington University: lunch with faculty and graduate students, with our students explaining their work. After lunch the students visited the groups of Professors: Conradi, magnetic imaging; Miller, ultrasound; Buckley, ice cream from liquid nitrogen and electronics for space exploration; Hohenberg, spectroscopy on gases and materials found in space and in Antarctica;

5. Talks at SIUE by Profs. Art Braundmeier (metals development, including a heat shield material used for astronauts), Jerry Pogatshnik (hydrogen bomb development) and Fred Zurheide (cosmic rays).

2002, Pitt A list of summer 2002 Pitt speakers can be found on the web site: http://www.phyast.pitt.edu/∼reupfom. Speakers in 2002 at Pitt were:

1. Prof. James Mueller, (intermediate physics experimentalist) "Introduction to Modern Physics".

2. Dora Bodlaki, graduate student with Prof. Eric Borguet, surface chemistry and physics.

3. Andrew Petersen, former REU member, now Pitt graduate student: "Using Molecular Dynamics to Calculate Protein-DNA Binding".

4. Bill Love, former REU TA and current Pitt physics graduate student, "The Massive Star Beta Carinae".

2002, SIUE At SIUE our lunches were a combination of informal discussions based around the New York Times Science Tuesday section, discussions of student and faculty research, external visitors and trips.

1. Prof. Julia Thompson (elementary particle experimentalist) discussion of scattering and basic ideas of elementary particle physics.

2. Prof. Art Braundmeier (again, wide ranging topics including reflectivity measurements of sun visor for NASA astronauts, and characteristics which gave it its good reflectivity.

3. Visit to UMSL surface science lab.

4. Dr. Jeremy Dodd, member of ATLAS collaboration, building experiment at LHC, CERN, Geneva, Switzerland. (Search for Higgs Boson, and Why)

5. Prof. William Willis, spokesperson of the U.S. contingent of ATLAS, speaking on "e-bubbles", electrons surrounded by vapor, moving through cold liquids. This technique may be of particular interest to groups studying neutrino physics.

6. Prof. Kathleen McCloud, Xavier University, "Rough Surfaces Formed by Sedimentary Particles"

7. Some students visited Washington University with Prof. David Kaplan.

8. Several spirited discussions concerning items in the New York Times Science Tuesday

9. Some student talks, discussing the problems in the entry quiz.

10. Discussions with Frazer Siteti and Ambrose Yaga, two high school physics teachers from Capetown, South Africa, visiting in conjunction with Thompson's outreach work there: http://www.phyast.pitt.edu/ jth/safrica.

Joint Pitt/SIUE Summer 2002 There were two sessions joint between the Pitt and SIUE groups (via video link):

1. Ms. Mamie Wadkins Clemons, sister of the late Warren Henry. Ms. Clemons was the guest lunch speaker at the Pitt mid-terms

2. Session near the end of the summer at which the students discussed their work. One SIUE student took the occasion to make a practice run for his final presentation.

4 Midterm Presentations

These half-way presentations set up the structure for the final presentation. Home institution advisors are invited. The students prepare a poster presentation as well as a 10-min (plus 5 min questions) oral presentation of their work. At Pitt, in the evening there is a banquet to which other summer students in the city are invited, and our students present their posters to others at the banquet. A distinguished visitor joins in listening to the presentations and interacting with the students, and gives a speech at the banquet. On Saturday, we have student conferences with, where possible, the advisors from the home institutions attending. At SIUE, due to the diverse nature of our students and tight time schedule of our visitors, the social part of the midterms revolved around a lunch at the time of the presentations.

Visitors in 2000: Off-campus home institution faculty visiting in 2000 were: Prof. Kunal Ghosh, Jackson State University; Prof. Kim, Univ. of South Florida; and Prof. Andrew Leavitt, State University of West Georgia. Our distinguished guest was Prof. Harrison Prosper, of Florida State University at Tallahassee. A Caribbean American, Prof. Prosper has worked in a wide range of fundamental physics studies, including searching for time violation via a neutron electric dipole moment, and being part of the group which established the existence of the top quark. He spoke on our emerging view of the universe and some conections to elementary particle physics.

Visitors and Special activities in 2001 On Friday, July 6, students presented their half-way presentations of their work. Students from Edwardsville traveled to Pittsburgh to join in this event. At lunch we heard about the neutrino exciting new SNO neutrino results which seem to confirm earlier indications that the "solar neutrino deficit" arises because electron neutrinos emitted from the sun oscillate into muon neutrinos, which were not detected by early experiments. Then, after the student presentations, in the evening there is a banquet to which other undergraduate researchers in the area are invited. The after dinner speech was given by two visiting high school teachers (Michelle November and Lunghisa Mavundla) from Capetown, South Africa, detailing the difficulties of teaching science in there. During the Saturday lunch, the students rehearsed their presentations for the ethics forum (which was scheduled for the following Monday), and everyone joined in the discussion of the issues. Sunday, we

relaxed a little and went on a rafting trip. This was organized and paid for mainly by the students, with a small subsidy from the program.

Faculty visitors were: Professors Kunal Ghosh, Carnegie Mellon University; Kathy McCloud and Stephen Rodrigue, Xavier University at New Orleans; and Sylvanus Nwosu, University of Pittsburgh.

Visitors and Special activities in 2002 At Pitt, the midterm speaker was Dr. Fred Humphries, chemistry PhD from the Univ. of Pittsburgh, past president of Florida A & M, and currently president of the National Association for Equal Opportunity in Higher Education. He spoke on achieving one's dreams. As mentioned above, Ms. Clemons, Warren Henry's sister, gave a motivational talk at our mid term luncheon.

At SIUE the mid-term speaker was Prof. William Willis (see above under SIUE talks). We also had a visitor for the final presentations, Ms. Kathy McCloud.

5 Mentoring Activities

Through the mentoring component, which takes an average of 5 hours per week, our student participants earn room and board for the summer.

In summer 2000 , the Pitt students tutored in one of the following programs: IMPACT, a program in the Engineering School for rising freshmen; Upward Bound, a program within the College of Arts and Sciences for rising freshmen; or One Small Step, a local private program for selected African American males in an at-risk section of the city. The IMPACT and Upward Bound tutoring was done evenings on campus, with each student spending one evening. We can claim a modest impact on the Upward Bound program: through our weekly conferences, we learned that one instructor in the Upward Bound program appeared to have been placed out of his depth; discussions with the Upward Bound directors led to a reassignment of the instructor in question and a more appropriate instructor being assigned to the physics group.

This was our first year to participate with One Small Step. This group works with students from early elementary school through high school graduation in a comprehensive effort to improve high school graduation rates and competency among at-risk young black males. In addition to vocabulary and reading, the program also wants to foster scientific and mathematical competence. Students traveled once, or sometimes more, by city bus to the program site.

In summer 2001, at Pitt, students again tutored with One Small Step. The experience was less successful this summer, since students were asked to tutor in languages rather than in math and science. Probably next summer the group will return to on-campus tutoring with Upward Bound.

In 2001 at SIUE , students developed presentations based around their research, and also worked with the 150 E. St. Louis Upward Bound students in a hands on activity based on levers. Next summer it is anticipated that the group will tutor the

Upward Bound group in residence at SIUE. This group will be studying introductory physics, just before taking it as high school seniors in the succeeding year.

In 2002 at Pitt students worked with the Pittsburgh Public Schools, traveling to a school where summer school was in session, and tutoring there.

In 2002 at SIUE students presented hands on activities and the mini-Exploratorium (see http://www.phyast.pitt.edu/ jth/safrica). The activities were tried twice, as the ideas evolved: once early in June, and again July 19, for the local Upward Bound group based in East St. Louis. About 60 students attended. Pictures can be seen on http://www.phyast.pitt.edu/ jth/safrica/pictures/2002prep (all the ones with siue in the title). They also hosted two South African teachers from Capetown.

6 Ethics

In 2000, there was no formal session on ethics in research, but there were informal group and individual discussions on topics such as record keeping, verification of data, reporting of errors, plagiarism, and appropriate professional social relations.

In general, in discussions with students, we point out that ethics considerations can have very real consequences even for students at their level, emphasizing attribution of sources in group work, and touching on issues specific to successful integration of minorities and women into cohesive research groups.

In 2001, we participated in an ethics forum, organized by the REU program at Duquesne University. All the REU programs at Pitt and Duquesne participated in this forum. The directors of the programs had assembled a set of 20 hypothetical situations involving issues of possible scientific misconduct, sexual/racial harassment, etc. Our students, both here and in Edwardsville, were divided into three groups, with a TA leading each group. Each group picked one of the situations and researched the ethical issues involved, tried to present possible solutions and prepared a case study of the situation. These groups met several times during the first half of the program with communication with the students at Edwardsville occurring via email.

The ethics forum began with a presentation on the basic issues of ethical decision making. This this was followed by breakout sessions in which the various groups presented their case studies. The students continued their discussions over lunch, with one student from each breakout session presenting summaries of the case studies and trying to extract common threads in the ethical decision making process.

Students at the SIUE site participated in discussions of the issues with teams of Pitt students, though they did not attend the actual forum.

In 2002, again the Pitt students participated in the Duquesne student ethics forum, with a similar format as in 2001, and again the SIUE students participated remotely through discussion of the topics. Students at SIUE also actively discussed the Bell labs data faking scandal which broke in the summer.

7 Social Activities

Some one time activities typically include:

1. Traditional introductory picnic at Dr. Thompson's home, or the home of one of the co-directors. In 2001 the SIUE students joined the Pitt students for the introductory picnic. In 2002 the SIUE picnic was held in the apartment of the TA Natasha Collymore.

2. Some mid term activities: at Pitt, visit to Science Center in 2000, day-trip rafting excursion in 2001, excursion on the Three Rivers in 2002. In 2001 the SIUE students joined the Pitt students for the midterm activities. In 2002, due to personal constraints of students, and scheduling difficulties, no evening activities were planned, but only a lunch in conjunction with the presentations.

3. A few other morale-building activities.

   At Pitt: picnic in the country in 2000, trips to the Pitt Observatory, a trip to some amusement park, outing to 4th of July festivities and fireworks.

   At SIUE: picnics and visits to the St. Louis Municipal Opera and Science Center, in both 2001 and 2002. Some students visited the Cahokia Burial Grounds, In 2001, train trip from Pittsburgh via Chicago to southern Illinois, a square dance, and some students made a trip to a local Six Flags Amusement Park. In 2002 trip to Fireworks in St. Louis, bicycling around the area, and picnic at Prof. Thompson's home.

   Activities which require special program input and support typically occur at the rate of one per summer; those which are approximately cost-free and easily organized by students occur more frequently, according to student inclination).

A more complete list of activities can be found on the web sites:

- http://www.phyast.pitt.edu/∼reupfom and
- http://www.phyast.pitt.edu/∼jth/reupsill

8 T.A. Activities

Typically one T.A. for each 6-7 students follows the students in their academic and research activities, facilitating the Math and Physics workshops, helping to identify and address special academic or research needs of individual students, and acting as liaison between the academic and research components of the program. Because of our emphasis on the T.A.'s as support on the students' research, rather than canned lectures, and the aspects of helping them to learn what they need for their research, this is an effort-intensive job. In 2000, the three (full time) T.A.'s were Elizabeth Leeds, Bill Love, and Gordon Weinberg. In 2001, there were two T.A. equivalents, one full time (Bill Love) and two half time (Michelle Belfort and Gordon Weinberg).

In 2002, Gordon Weinberg was the program TA at Pitt, and Natasha Collymore at SIUE.

Details of individual T.A.'s work with individual students are available upon request.

9 Research Faculty and Projects

The research activities are described in more detail under the summary by participants, and are also summarized on our web site: http://www.phyast.pitt.edu/≈reupfom. In many cases electronic versions are posted on our web site.

10 Evaluations

Evaluations done are of two types, each year, for each site. The first type is student feedback, both in the weekly conferences and generally during the summer, and also by means of a special questionnaire at the end of the summer. The second is through our visiting committee. The two types generally are quite consistent.

The Pitt site, as to be expected from a mature site, had positive comments both from students and the visiting committee. (In 2002, the visiting committee was comprised of Prof. Kathy McCloud of Xavier and Prof. Lee Ponting from Bennett. Both gave positive feedback, summarized in Prof. McCloud's letter of support for our renewal proposal.) Details of the student evaluations area available upon request.

For the SIUE site, **although students agreed that they had benefited technically from the program, and a student with experience at other programs commended this program and particularly his SIUE mentor**, both student feedback and our external visitor, Prof. Kathy McCloud of Xavier University, pointed generally to the same problems, which we had been fighting already throughout the summer:

1. Delay in payment (by about 3 weeks, both for the midterm and final checks) of stipend and expense allowance, due to various bureaucratic snafus, in part to extra paperwork to transfer money from Pitt to students at SIUE, and in part to too many responsibilities handed to our valiant administrative assistant at SIUE. The delay caused some real difficulties for students whose budgets were very tight.

2. Too large a fraction of students who were only half time in the program or living off site or taking classes in addition to their program participation, and were therefore uninterested in group activities as well as feeling the intense research work and other program activities to be burdensome. In part to address the abbreviated working schedules of the part time students, some of whom had substatial domestic problems outside our program, our weekly group meeting became a lunch meeting, which cut into the time students would have had to socialize informally among themselves.

3. In some cases students perceived questioning from research staff as aggressive rather than sympathetic but deep probing.

4. As mentioned in the introduction, the recent Illinois budget cuts pushed the SIUE administration to optimize scarce resources for the benefit of SIUE/Illinois students, rather than for a group drawn nationally.

There are obvious ways to address the first three, and in some form or other they are problems faced and addressed at the Pitt site. But the additional funding difficulties gave less incentive to overcome the other problems at SIUE. Further details of the evaluation can be obtained from Prof. Thompson or Prof. McCloud (kmccloud@xula.edu) upon request.

11 Summary

The Pitt site seems quite robust and the process of bringing younger co-directors into active praticipation seems to be well started.

We will not continue the SIUE site at this time.