

Marques Franklin
REU summer program 2002
Nevis Labs, New York

Physics Emasondosondo

My participation in the 2002 REU summer program was two fold. The first project involved research concerning developing technology that could be used in low energy neutrino detectors. We studied electron bubble behavior in cryogenically cooled argon. However, we were only able to spend a small fraction of our time in the lab because we were preparing for the second portion of the program. Of the results we obtained, we were unable to draw any major conclusions due too large amounts of noise in our data. The vast majority of our time was spent developing a physics outreach program. Our purpose was to raise the awareness of physics in the classrooms of township schools surrounding the city of Johannesburg South Africa.

The team was made up of several individuals stemming from the United States and South Africa. From the United States side, six members with varying backgrounds gathered at Nevis Labs in New York. The team leader was Dr. Jeremy Dodd, a research physicist from Nevis Labs. Dr. Dodd consulted with Mr. Bill Metzler, a high school math and physics teacher, in order to select the other four members of the team. Of all the applicants, the four chosen were Amanda Weltman, a graduate student at Columbia University studying particle physics, Ian Tolfree, a recent graduate from Columbia University who was preparing for graduate studies in the field of plasma physics at John Hopkins University, William Serber, an undergraduate at Columbia University involved with studies involving cosmology, particle physics, and predominantly astrophysics, and

Marques Franklin (that's me!), an undergraduate from Purdue University in Indianapolis, IN studying mechanical engineering.



Fig.1 The team preparing to set off on the first day

Just as diverse was the team from South Africa. The primary contact was Dr. Simon Connell, a research physicist at the University of Witwatersrand. Mrs. Cynthia Malinga, Director for High School Physical Science in the Gauteng Department of Education, served as a most beneficial resource when it came to information on each of the 16 schools visited. Mr. Tony Voorveldt assisted the program by providing self-made, antique-style physics equipment (Van der Graff generator, Jacob's Ladder, Hand generator, etc.) In addition to providing equipment, Mr. Voorveldt was most helpful by demonstrating insightful uses for his materials. Duduzile Masinga, a local high school teacher and participant in the Quarknet program, provided information about our surroundings.

The schools we visited were selected by the Gauteng Province Department of Education as being in the most need of help in the fields of physics and science. So our goal was to develop a presentation to better familiarize the students with everyday uses of physics. In order to do this, we concentrated on three different methods of study. We chose to do a show where the students would volunteer to help in several demonstrations in front of the student body. The second aspect was a laboratory exercise in order to give the students some hands on experience. Lastly we decided to do an exploratorium where the students cycled around to different stations where they could also get some hands on experience with physics.



Fig.2 An example of the team working in a lab setting

Preparation for the demonstrations began when the team met in early June with our sister team who was to visit Cape Town, South Africa. We met at Southern Illinois University. The first order of events was to decide the type of demonstrations that we wanted to do and to come up with a written explanation of each. The idea was to eventually have the written explanations translated into local languages so that if the

students were not able to follow our presentation due to communication barriers, they would at least have an understandable explanation. An example of a write-up appears in the appendix.

Using some of the equipment at SIUE, we practiced our demonstrations and explanations with a group of local college students. Several of the students had not had any physics so we assumed this would be a good trial. We received constructive criticism from the group of students and from each other.

Upon returning to New York, our plan was to gather various pieces of equipment that we could leave in South Africa. The next few weeks were spent fine tuning our explanations and demonstrations using the new equipment.

The second week of July, we all arrived in Johannesburg and began to sort the materials that we had shipped. After consulting with Dr. Connell, we decided upon a few last minute items that we would need.

On Monday, July 15, Dr. Dodd and Mr. Metzler met with the teachers from the local high schools that we were to visit. This meeting lasted most of the day and was done mainly to inform the schools of necessary preparations in order for our visit to go smoothly. For instance, for some of the demos, it was necessary to know whether or not we would have access to electricity or not.

Our first visit was on July 16 to Emshukantambo Secondary in Pimville, Soweto. The whole day went reasonably well. The students reacted well to all three portions of the program. The only major problem we faced was having enough time to do everything. We eventually came to the conclusion that we brought too many demos to

try to do in a single day. So we narrowed down the list, a copy of which appears in the appendix.



Fig.3 Will demonstrating how to get electricity from a lemon in the exploratorium.

The next few weeks were more of the same thing. Students and teachers reacted well to our presentation. We were asked many interesting questions. I believe that our work truly inspired some and simply developed curiosity in physics with others.

I do not know what will become of this program in the future. The program was well set up in order to continue. What I mean by that is, we left all of the equipment in South Africa. This way, if someone wants to pick up where we left off, it would be fairly easy to do. There were several students from Witswatersrand that accompanied us on a daily basis. This was to make sure that we did not just leave the equipment for someone to figure out. In addition, we left force tables and DC circuits lab kits at each of the school to give them some materials to work with in a laboratory setting.

If asked to do the program again next summer, I would do so without hesitation. I just hope that I did well enough to be asked to return.

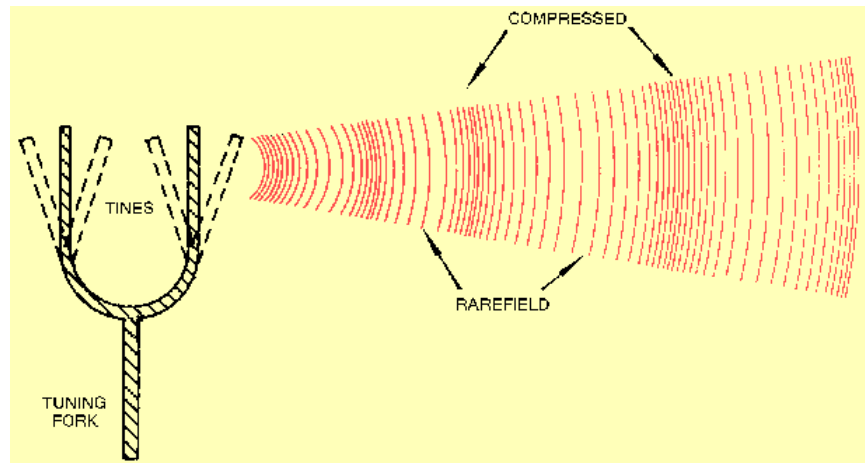
Appendix

A1. A demonstration write-up that I wrote.

What's that sound?

What sound you might ask. Any sound. I'm asking you if you can hear everything around you. Can you hear the person next to you talking? Can you hear the birds singing? Can you hear the music coming out of your radio?

Why of course you can! But why...I mean, why can we hear different sounds? Well, it all has to do with waves and vibrations. I'm sure you know what waves are by now. But what are vibrations. Basically, when something is moving back and forth, it is said to be vibrating. How fast something is vibrating is known as its frequency. Different frequencies are responsible for the different sounds we hear.



Let's look at a tuning fork as an example. If you hit tuning fork it starts to vibrate. How fast it vibrates depends on its physical characteristics (mass, length, etc...). These vibrations are transferred to the air and the air starts to vibrate also.

For instance, when you stand close to a speaker that is playing loudly, you can feel the vibrations from the speaker even though you are not touching the speaker. The air is vibrating in the form of a longitudinal wave and when these waves hit your ear and you hear sound.

A2. The checklist we used for all the demos and the exploratorium

Angular Momentum

- Spinning Platform
- Weights

Spinning Bicycle Wheel

- Wheel with Rope
- Hanging Rope

Coupled Pendulum

- Pendulums (2)
- Stand
- Spring

Tuning Forks

- Tuning Forks (2)
- Mallets (2)
- Clay

Copper Tube and Swinging Blades

- Tube
- Small Magnets
- Horseshoe Magnets
- Ring Stand
- Blades (2)
- Screw

Jumping Ring

- Solenoid
- Rings (3)
- Light Bulb Solenoid

Sour Power and Solar Power

- Electrodes (3)
- L.E.D
- Lemon
- Knife

AC/DC

- L.E.D. cord
- Transformer Box
- Extension Cord

Parabolic Mirrors

- Parabolic Mirrors (2)
- Laser Pointer (green)
- Laser Pointer (red)
- Fog Machine
- Laser Holder Apparatus

Magdeburg Hemispheres

- Hemispheres (2)
- Pump
- Petroleum Jelly
- Extension Cord

Generator

- Genecons (3)
- Light Bulbs
- 1 Farad Capacitor
- Tony's Hand Generator
- Compasses

Van Der Graff Generator

- Van Der Graaf
- Streamer
- Grounding Globe
- Popcorn Apparatus
- Beanie
- Fluorescent Tube

Jacob's Ladder

- Jacob's Ladder

Liquid Nitrogen

- 35L LN2
- Dispensing Dewar
- Gloves
- Balloons
- Tongs
- Banana
- Wood
- Nail
- Rubber Balls

Magnets

- Iron Filing Plate
- Lode Stone
- Horseshoe Magnet
- Battery Motor

UV Light

- SW/LW Lamp
- Voltage Converter
- Fluorescent Rocks
- OMO
- Plastic Plate

Cross Polarizers

- Square P. Filters
- Rectangle P. Filters
- Polarizing Lenses