- Work supported by the Department of Energy, UCLA and UCOP.

LAPTAG, Encouraging High School students to Consider Physics Related Careers

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The Los Angeles Physics Teachers Alliance Group (LAPTAG) represents high school physics teachers from the entire Los Angeles area. It was formed in 1993 Over the years between twenty and thirty schools have participated. Our Website is at http://coke.physics.ucla.edu/laptag and web service is provided to schools without servers or Internet access. LAPTAG encourages communication between high school and college/university physics teachers by providing regular meetings, tours of laboratories at UCLA and other institutions, and discussion of curricular issues. LAPTAG also provides unique opportunities for student involvement in research projects. Our first project was a distributed seismometer experiment in which ten schools received seismometers. LAPTAG provided a Web based astronomy class in which studied a variable star. During the past three years, we have constructed a plasma device and developed a high school plasma curriculum. These laboratory experiences engage science students and encourage them to enter physics related careers.

*Funded by: University of California Office of the President and the Department of Energy

Construction of a High School Plasma Laboratory.* M. Buck, Chaminade High School, J. Wise, New Roads H.S. , B. Baker, University H.S., J. Altounji, Sylmar H. S., R. Buck, Louisville H.S., C. Spahn, Monroe H.S., W. Gekelman, UCLA, P. Pribyl, UCLA.

Members of LAPTAG have constructed a laboratory plasma device for use by high school students. Currently students are using the device to do experiments to measure the velocity of ion acoustic waves The plasma is contained in a 0.25 m^3 chamber that is initially evacuated by a turbo vacuum pump to $\approx 10^{-7}$ Torr. It is produced by a Helicon source which is comprised of a 250 watt 13.6 MHz RF power supply, a double loop antenna on the outside of a glass section surrounded by solenoidal magnets. The magnetic field in the source can be as much as 100 Gauss. A steady state plasma then streams into an unmagnetized experimental. Data is taken by means of a Langmuir probe connected to a 175 MHz digital oscilloscope. Current upgrades of the device include automating the motion of Langmuir probe with a computer driven stepper motor and the use of digitizers and computers to facilitate data acquisition. The high school teachers and students are directly involved in the machine upgrade. They have already constructed the probe drive and will write LABVIEW based software to control it as well as the data acquisition. Other diagnostics such as energy analyzers and a monochrometer will be installed shortly.

- Work supported by the U.S Department of Energy. Some equipment has been donated by TRW systems, Redondo Beach.

Ion Acoustic Waves, A High School Plasma Experiment. R. Buck, Louisville H.S, J. Wise, New Roads H.S., N. Gibson, Crossroads H.S., , M. Buck, Chaminade, H.S., W. Gekelman, UCLA, E. Wetzel. Louisville H.S., C. Wetzel, Loyola H.S., C. Moynihan, Cal Tech,.

Over the last three the Los Angeles Physics Teachers Alliance Group (LAPTAG) has built a plasma device and designed experiments for high school students to learn about plasma properties and behavior. One of the first experiments performed by small student groups (two to three students at a time) is to create ion acoustic wave tonebursts in an Argon plasma, measure the wavelength and frequency of the wave and thereby calculate the velocity of the wave. A grid antenna immersed in the plasma, which is pulsed by a function generator, creates the waves. Measurements are made using a Langmuir probe and read out on a digital oscilloscope. From this information students calculate values such as the temperature of the plasma, the plasma density and percent ionization of the plasma. In order to do these experiments students must understand what plasma is, how plasma can be created using a helicon source, how to use an oscilloscope and many other aspects of the plasma chamber involved in the experiment. Other experiments are currently being done on the device and still others are being designed. For more information visit the LAPTAG website (http://coke.physics.ucla.edu/laptag).

Characteristics of the LAPTAG high school Plasma , P. Hsu, Compton H.S., B. Baker, University H.S., J. Wise, New Roads H.S., M. Buck Chaminade H.S., R. Buck, Louisvillle H.S., W. Gekelman, UCLA*

In 1999, a group of high school teachers in the Los Angeles Physics Teachers Alliance Group (LAPTAG) successfully constructed a plasma device for high school research. Since then groups of high school students have collected data to characterize the plasma. The plasma has a helicon source which produces an Argon plasma that streams into an unmagnetized chamber. The plasma density is obtained from the ion saturation current to a Langmuir probe, $I = ne\sqrt{\frac{kT_e}{M_I}}A$, where A is the probe area. In our plasma Te>>Ti. In these experiments the plasma density is $n \approx 10^9 - 10^{10}$ cm^{-3}. The electron temperature is measured from the dispersion of ion acoustic waves, discussed in another poster in this session. The plasma potential is measured by sweeping the Langmuir characteristic curve. We will present data on the spatial distribution of the plasma potential and discuss the radial electric field in the device. Measurements of the plasma production as the RF source power and background gas pressure are changed will be presented as well. Using these measurements we have generated a list of possible future experiments the device may be used for.

*Work supported by the U.S. Department of Energy.

Using Plasma Physics to Enhance the High School Physics Curriculum

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Faculty and student members of the Los Angeles Physics Teachers Alliance Group (LAPTAG) have constructed a plasma machine on the ULCA. Dr. Gekelman, the faculty advisor, provides information and materials on plasma physics via the Web and lectures to high school faculty and students. Faculty members then transfer the information to students at their respective schools and schedule time for experiments on the machine. A lab manual and curricular materials suitable for high school students is being developed using a lab based, discovery approach. The manual is available as a pdf document on the LAPTAG website (http://coke.physics.ucla.edu/laptag/plasma_exp.dir/laptag_plasma.htm)

Introducing plasma physics into the high school curriculum provides a 20th century application of classical physics concepts that support and motivate student interest in physics. Students from LAPTAG schools use state-of-the-art computers, software, and equipment to perform developed labs and to design experiments of their own. Collaboration exists between students and faculty from different schools and the university. Learning physics concepts takes place in the context of a "science community" that realistically demonstrates the scientific process to students.

*Funding has been provided by the U.S Department of Energy.