



**INSTRUCTIONAL EQUIPMENT REQUEST**

**Due in Dean/Unit Head's Office on September 19, 2011 (FALL) and March 1, 2011 (SPRING)**

The Definition of Instructional Equipment can be found in the California Community College's Budget and Accounting Manual. A copy of these definitions is on the PBC webpage:  
<http://grapevine/pbc/InstructionalEquipment.php>

<b>Name of Requestor:</b>	Thomas Dodge
<b>Division/Unit</b>	MSEPS
<b>Brief title of request (equipment or materials being requested must be similar, related or part of a system).</b>	Modern Physics Equipment

**Request amount** (unit cost and total cost including tax and shipping. Please include all costs including installation, modification to existing facilities to accommodate new equipment, etc.): This should come from the vendor quote.

Item(s) Cost	\$ 18,771
Tax (0.0875)	\$ 1,642.47
Shipping	\$ 0
Installation	\$ 0
Facilities Modification	\$ 0
Other	\$
	\$
<b>Total Cost</b>	<b>\$ 20,413.47</b>

**Attach copy of quote(s), estimate(s) and requisition(s):**  
 (Must attach quote & requisition; absence of either will delay processing)

**Brief description of specific equipment or materials requested and what they will be used for: (include the # pieces being requested; i.e.: 10 crayola crayons, sky blue, etc. in 250 words or less)**

The following equipment is for students to reproduce some of the most famous physics experiments that led to the creation of modern physics. Most of these experiments not only resulted in the development of quantum mechanics but also won the physicist the Nobel Prize:  
 4 Teltron Thomson Tubes: High vacuum electron tube with an electron gun, built-in plate capacitor, and ruled phosphorescent target screen.  
 4 Teltron Critical Potential Tubes with Helium (2)/ with Neon (2): Electron tube filled with the inert gas Helium (or Neon). Also, an aluminum shield and a collector battery are included.  
 2 Teltron electron diffraction tubes: High vacuum electron tube with a poly crystalline graphite lattice (Debye-Scherrer diffraction) and a visible fluorescent screen.  
 2 Teltron Tube Holders: mount for the Teltron tubes; capable of holding Helmholtz coils; provides voltage protection to the cathode rays.  
 1 High Voltage Power Supply: A power supply capable of providing voltages up to 5000V  
 2 Oscilloscopes: Digital, 2-channel oscilloscope, 60 MHz, 1GSa/s Real-Time

**Is this in your Program Review?** Yes  No

It is the goal of the Physics Department to obtain enough equipment such that eight groups may perform each of the laboratory experiments concurrently. The equipment requested in this proposal will allow for six modern physics experiments to be run at the same time. Currently, the Franck Hertz experiment has only one setup, the electron charge-to-mass ratio experiment has only two setups, and the electron diffraction experiment has enough equipment for three setups. With the growing number of students in the Physics 8D and Physics 2B courses, this equipment is necessary for the experiments to be conducted by these larger groups of students in a manageable way.

Is it a replacement? Yes

Upgrade? Yes

New technology? Yes

Please explain?

The equipment is simply more of what we already have. We currently only have one or two setups for each experiment. It is crucial to obtain this equipment such that students may have a direct hands-on involvement in the laboratory portion of the courses. The current equipment is inadequate for a full class of students.

Following is the evaluation criteria; please see corresponding Instructional Equipment Rubric.

***Instructional and Service Impact***

How will this item have a positive impact on instruction and/or teaching and learning in the classroom? Is this for use by the Instructor or students, or both?

The growing number of students taking the lab courses is a huge concern. Currently, instructors are forced to have different experiments performed by different lab groups on the same day. Sometimes, this means one group does one experiment, two more groups do a second experiment, and three more groups perform a third. Then, the following weeks, groups rotate. This has many drawbacks: the instructor often has not have covered all the material during the lectures necessary for students to be properly prepared for every experiment; in the lab, it is much more difficult and time consuming to instruct each group with their experiment instead of leading the entire class; also, students often get confused grabbing equipment from other experiments or hearing the wrong instructions.

Another method some professors employ is to simply break the students into larger lab groups. This has the obvious disadvantage of leaving some students to simply watch while two or three students dominate the procedures. The labs are meant to be a hands-on learning experience for all the students, so it is the goal of the department to limit these lab group sizes.

Secondly, equipment from these particular experiments is beneficial in lectures as demonstrations (portions of the famous modern physics experiments such as electron diffraction, for example). These demonstrations are mostly useful in PHYS 2B, PHYS 8B, and PHYS 8D courses.

Finally, the oscilloscopes would be used in many other experiments in ENGR 44 (Circuits), PHYS 8B, PHYS 8D, and PHYS 2B.

***Impact on Enrollment***

**Will the equipment impact enrollment, attract or increase the number of students participating in a course or program?**

The main concern is the growing enrollment of the physics 8 and 2 series courses. Instructors are letting some of these courses go beyond their intended limit. The PHYS 8D course which would benefit most from this equipment has grown dramatically over the last few years and appears to be continuing to grow. The Physics Department simply does not have enough of the necessary equipment to accommodate such an increase of student enrollment. Currently, as described previously, students must either form very large lab groups or the instructor must assign different experiments to each group. Both of these options negatively affect student learning.

Obtaining this equipment will allow students to break into reasonably-sized 4-student groups to perform the required experiments. It will allow instructors to perform one experiment on each of the days the class meets instead of several. This allows both students and instructors to be much better prepared for the labs, and allow all of the students a good opportunity to have a hands-on experience in the lab.

### Access

**How does this item promote the principles of universal design, by providing opportunities for under-represented populations & accommodate students with diverse learning styles?**

Many students learn by doing. This is especially true in physics. Scientific concepts are given substance when the student sees first-hand the concept at work. If lab groups are held to smaller numbers, then the students will have much better opportunity to be an active member in the experiment. It is this learning style that the laboratory portions of the course attempts to give a large amount of focus. More equipment simply allows for more student participation.

The laboratory portion of physics courses allow for some problem-solving students to excel where they may struggle in the classroom. These students often need to see the problems in front of them as a real object they may see and touch. However, the laboratory must have adequate equipment for these labs. Otherwise, these students are put into large groups where only the most confident students will step forward and dominate running the experiment.

### **Outcomes**

**How will this equipment enable or enhance SLOs? What are the consequences related to learning outcomes if request is not funded?**

As stated in the Physics Department SLO, the ability to demonstrate many of the most important physical experiments of the 20th century is a requirement of any student studying physics. At this point, our PHYS 8D classes have reached sizes of 16-20 regularly and still continues to grow. The PHYS 2B classes are consistently at the maximum of 24 students. Yet the Physics Department owns only one or two setups of each of these sets of experimental equipment. In order to fulfill the department's SLO, each student must demonstrate a working knowledge of these historical physics experiments. At this time, it is an impossibility.

The addition of this equipment will bring PHYS 8D and PHYS 2B inventory into a standard which will allow each student more face time with the apparatus thus enhancing the students' opportunity to demonstrate the SLO in question.

A little more detail:

The Thomson tubes will allow students to calculate the electron charge-to -mass ratio similar to the famous JJ Thomson experiment. This won him the Nobel Prize in physics in 1906. The critical potential tubes filled with an inert gas will allow students to investigate the quantum nature of matter by recreating the famous Franck-Hertz experiment. James Franck and Gustav Hertz shared the Nobel Prize in physics for this experiment in 1925. Finally, the electron diffraction tubes allow students to investigate the wave nature of matter. This is one of the foundations of quantum mechanics.

**Total Cost of Ownership (This is an attempt to identify what the ongoing costs of purchasing this equipment will be to the institution)**

- a) What is the lifespan of the equipment? 5 years? 10 years? 20 years?**
- b) Is there sufficient current/planned space available for the storage and use of this equipment? If so, where will it be housed? If not, is there a proposed location and are there any costs associated with installation or modifications to the space?**
- c) Are there operating costs and how will they be covered by the department?**
- d) What will be required to maintain the equipment, such as regular servicing or upkeep? Who will perform maintenance, and what will the estimated costs be?**

a) The Teltron tubes are especially fragile, but we have taken good care of the few we currently possess. Only one tube (of 10) has been damaged in the past 17 years. They are kept securely and safely in storage until needed. It is expected that these new tubes will have similar lifetimes. Only one high voltage power supply has failed to work properly in the past 17 years. Also, all of the current oscilloscopes are in good working condition. Thus, it is expected that the new oscilloscopes and high voltage power supply should have a lifespan of at least 15 years.

b) After the renovation, there should be sufficient space inside the physics storeroom, 1832, to safely store the electron tubes, Helmholtz coils, and holders. The high voltage power supply and the oscilloscopes will reside in the physics lab, room 1831, with the other oscilloscopes and power supplies.

c) There are no operating costs associated with the equipment.

d) No upkeep or regular servicing is required of the equipment. The physics laboratory technician will maintain the equipment and fix minor problems. The Teltron tubes are fragile and if one is broken, it must be replaced; they may not be fixed.

***Visibility/Profile within Community***

**Is this a "flagship" item that will bring recognition/notoriety to the College or raise the stature of the program? Will it attract students and/or enhance the image of the College in the community because of its rare, one-of-a-kind status?**

The equipment is certainly not rare and may not bring any notoriety; however, the equipment will allow students to recreate some of the most famous and ground-breaking experiments in modern physics. These are the most advanced experiments we offer in the Physics Department at Las Positas College. They may even be the most advanced physics experiments the students ever perform in their academic career.



**Commitment to Sustainability**

How does this equipment exceed basic sustainability goals and encourage renewable resources at the College? Is the design/operation of this item in keeping with the College's commitment to sustainable practices?

not applicable

**Health, Safety & Security**

Does this equipment address any health, safety & security concerns? If so, please explain below.

Several of experiments that this equipment will be used for require high voltages and/or high currents. These are potentially dangerous experiments that must be performed with utmost care for safety. The current practices of having either large lab groups perform the same experiment concurrently or having several different experiments operating at the same time has some safety drawbacks. While no student or instructor has been injured during these experiments, it would be most beneficial if the entire class was working on the same experiment and in small groups. It is often the case that the students that are least involved are the most dangerous to the equipment or to others in the room. Their lack of participation leads to carelessness and accidents. When the instructor has different experiments occurring at the same time, special precaution must be made to communicate the proper instructions to the students. The instructor (and the lab assistant) must talk with each group and prevent anyone from starting prematurely. This is inherently difficult and student injury, as well as damage to the equipment, has luckily been minimal.

**Signatures (required)**

(If requesting computer-related equipment/software, LPC IT Department Review is **required**.)

Requested by Thomas Dede Dean/ Unit Head Neal Ely IT Department Signature \_\_\_\_\_ Vice President Prince Noble  
LPC VP Business/President \_\_\_\_\_ LPC Business Office Use (Account Number) \_\_\_\_\_

# LAS POSITAS COLLEGE Equipment, Apparatus and Service Requisition

#R

#P

Track #

FOR OFFICE USE ONLY

TAX ID#

SUGGESTED VENDOR: **3B Scientific (1-888-326-6335)**

NAME OF STAFF MEMBER: **T Dodge** DATE WRITTEN: **19-Mar-12** DATE REQUIRED: **Physics** DIVISION/ DEPARTMENT: **Physics** For inventory purposes include Room # **1831, 1832** RETURN COPY OF REQUISITION TO: **L Camino, T Dodge**

DESCRIPTION	(PRODUCT, TYPE, SIZE, COLOR, STOCK NUMBER)	UNIT	QTY	UNIT PRICE	Air
Teltron Tube Holder S		ea	3	\$ 554.00	\$ 1,662.00
Teltron Helmholtz coils S		pair	3	\$ 399.00	\$ 1,197.00
Teltron Thomson Tube S		ea	4	\$ 999.00	\$ 3,996.00
Teltron Critical Potential Tube S w/ He-filling	[U18560]	ea	2	\$ 999.00	\$ 1,998.00
Teltron Critical Potential Tube S w/ Ne-filling	[U18565]	ea	2	\$ 999.00	\$ 1,998.00
Teltron Electron Diffraction Tube S	[U18571]	ea	2	\$ 1,199.00	\$ 2,398.00
Teltron Control Unit for Critical Potential Tubes (115V, 50/60 Hz)	[U186501-115]	ea	5	\$ 534.00	\$ 2,670.00
Teltron Plug In Power Supply (115V, 50/60 Hz)	[U18700-115]	ea	5	\$ 75.00	\$ 375.00
High Voltage Power Supply 5kV (115V, 50/60Hz)	[U33010-115]	ea	1	\$ 549.00	\$ 549.00
color Digital Storage Oscilloscope, 2CH 60MHZ	[U43565]	ea	2	\$ 964.00	\$ 1,928.00
<b>INSTRUCTIONAL EQUIPMENT - SPRING 2012</b>					
<b>Comments:</b>					
				Subtotal	\$ 18,771.00
				Tax	\$ 0.0875
				Shipping (if available):	
				<b>BT#</b>	

Original invoices and receipts must be attached for payment. Include current taxes unless incorporated in price.

ACCOUNT # \_\_\_\_\_ FUND \_\_\_\_\_ ORG \_\_\_\_\_ ACCT \_\_\_\_\_ PROGRAM \_\_\_\_\_

Business Office

APPROVALS  
 Dean Healy Ely 3/20/12 Date  
 VP / President Juanita Ponce

TOTAL COST \$ **20,413.46**

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Product	Description/Item No.	Qty	Unit price	Sub-total
	<a href="#">Teltron Tube Holder S</a> U185001	 <input type="text" value="3"/> 	\$ 554.00	\$ 1,662.00
	<a href="#">Teltron Helmholtz Coils S</a> U185051	 <input type="text" value="3"/> 	\$ 399.00	\$ 1,197.00
	<a href="#">Teltron Thomson Tube S</a> U18555	 <input type="text" value="4"/> 	\$ 999.00	\$ 3,996.00





Teltron Critical Potential Tube S with He-Filling  
U18560

\$ 999.00 \$ 1,998.00



Teltron Critical Potential Tube S with Ne-Filling  
U18565

\$ 999.00 \$ 1,998.00



Teltron Electron Diffraction Tube S  
U18571

\$ 1,199.00 \$ 2,398.00



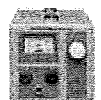
Teltron Control Unit for Critical Potential Tubes (115 V, 50/60 Hz)  
U186501-115

\$ 534.00 \$ 2,670.00



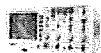
Teltron Plug In Power Supply (115 V, 50/60 Hz)  
U18700-115

\$ 75.00 \$ 375.00



High Voltage Power Supply 5 kV (115 V, 50/60 Hz)  
U33010-115

\$ 549.00 \$ 549.00



Color Digital Storage Oscilloscope, 2CH 60MHz  
U43565

\$ 964.00 \$ 1,928.00

Sub-total

\$ 18,771.00

Shipping Charges

\$ 0.00

**Total**

**\$ 18,771.00**

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