UNIVERSITY OF LOUISIANA AT LAFAYETTE

STEP Committee

Technology Fee Application

Acquisition of a Polarimeter for Chemistry Laboratories

Title

August A. Gallo & Wu Xu

Name of Submitter

(Faculty or Staff Only)

Department of Chemistry, UL Lafayette

Organization

Title: Acquisition of a Polarimeter for Chemistry Laboratories Date: January16,2017

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Department/College/Org: Dept. of Chemistry/ Sciences/UL Lafayette

ABSTRACT (250 words or less): This proposal requests funds for a polarimeter for student use in the Department of Chemistry. The requested instrument will have a direct impact on the education of both chemistry and non- chemistry majors and it will help in the teaching of optical activity of molecules as it relates to its 3-dimensional structure. Many students have difficulty in understanding stereochemistry and optical rotation and the use of this polarimeter will show the phenomenon of optical activity by color changes and/or brightness. The disciplines of biochemistry, organic, and inorganic chemistry will use this instrument in its teaching laboratories. In addition, classroom demonstrations will use a projection camera to demonstrate optical activity with this polarimeter. Thus students in chemistry, biology, chemical engineering, environmental sciences/ geology, physics and all pre-professional health related areas will either use this instrument when taking chemistry laboratories or see it via a classroom demonstration. All students taking organic labs (Chem. 233 and Chem. 234, totaling 250/year) will be the major users of the instrument. Students enrolled in Chem. 252/452 (inorganic), Chem. 317/319 (biochemistry) and undergraduate research courses (Chem. 362/462) will also use the instrument. Funding of this proposal will have a positive effect on undergraduate student laboratory experience and promote collaboration with other departments including biology, chemical engineering and geosciences/environmental sciences.

PROPOSAL

The proposed project includes the acquisition of a hand held polarimeter and filter to meet the needs of both students and faculty in teaching. Presently, we do not have a polarimeter for student use in teaching laboratories or for demonstration purposes. Thus the purpose of this grant is to acquire one for student usage. The teaching of stereochemistry, chirality and optical activity is a difficult topic for many students because they have to visualize the 3-dimensional structure of a molecule and how its structure affects optical activity and the rotation of plane polarized light. The proposed polarimeter with filters will demonstrate the phenomenon of optical activity dramatically with color changes and intensity of the sample brightness. By allowing a polarimeter to be routinely available, students can start to appreciate and better understand the physical and mathematical principles of asymmetry and optical activity of chiral molecules. The project director will continue to lead the department in integrating student usage of instrumentation into the educational and research missions of the chemistry program. Students in chemistry along with the disciplines of biology, engineering, geology/geosciences, health related pre-professional disciplines including veterinary science, environmental science, and polymer-manufacturing will use this instrument in the chemistry lecture and/or collaborative teaching laboratories. The number of students directly affected will total over 300/year. New experiments in organic, biochemistry and inorganic chemistry which use the polarimeter will be incorporated into all chemistry laboratories, thereby giving students direct access to the instrument. In the organic I lab (Chem 233), students will isolate limonene for citrus and determine its optical activity with the polarimeter. In the organic II lab (Chem 234), the reduction of benzil to form hydrobenzoin will be undertaken and then the specific stereoisomeric form (R, S, meso or racemic) determined by its optical activity using the polarimeter. A polarimeter will be used in the biochemistry teaching lab (Chem 319). Correct protein folding is an essential process inside cells. Incorrect protein folding will cause diseases, such as Alzheimer disease possibly due to the misfold of beta amyloid, Parkinson disease possibly due to misfold of α-synuclein, and Huntington disease possible due to travel of misfolded Huntington between cells. Proteins are biosynthesized through a polymerization reaction using 20 amino acids as monomers. Nearly all amino acids are L-form in structure although D-form amino acids can be found in nature. L-form amino acids can fold into only right-handed, not left-handed, helices. Students in Biochemistry Lecture (Chem 317) and Biochemistry Lab (Chem 319) often ask why L-form amino acids can fold into only right-handed helices, and why amino acids in proteins are L-forms. A polarimeter will allow students to study stereochemical properties of amino acid, and of a small polypeptide with 5-10 amino acids. The inorganic discip[line of chemistry (chem 252/452) will synthesize chiral metal ligands and use the polarimeter to determine its optical activity.

The teaching of stereochemistry, chirality and optical activity begins at the sophomore level in chemistry when students in analytical, inorganic and organic chemistry are introduced to the subject. The requested instrument will be heavily used by students in organic chemistry, biochemistry, inorganic chemistry and polymer chemistry. Students in chemistry along with the disciplines mentioned above will also be affected by this project. There has been a concerted effort to update the chemistry curriculum and instrument holdings of the chemistry department over the past 10-15 years to meet the demands of new instrument technologies and modern day theory of chemistry courses. The project director has been at the forefront of new equipment acquisitions and instituting usage of the instruments in chemistry laboratories.

This project will continue to enhance the department's resources and extend the use of instrumental techniques in chemistry even down to the freshmen level. Funding for this project will provide all students taking chemistry laboratories the experience of using a polarimeter, understanding its mode of operation, and the relationship of the structure of a molecule and its optical activity. Students will also learn how to calculate the specific rotation of a chiral sample based on the observed rotation. Thus the integration of optical activity and the requested polarimeter into chemistry will further strengthen the curriculum, both at the laboratory and

pedagogical lecture levels. It will also help undergraduate research projects undertaken by chemistry students and non-chemistry majors.

PRINCIPAL INVESTIGATOR and IMPLEMENTATION

The following four objectives will be accomplished during the implementation of this project :(1) acquisition of the requested instrument, (2) integration of the instrument into the chemistry curriculum, (3) training of Dr. Gallo and Dr. Xu (Co-PI) and other faculty, and (4) evaluation of the results of this proposal. Dr. August Gallo will be the major person responsible for the implementation of this project and he will assist all faculty members in integrating the polarimeter into each of the labs mentioned previously. He is an organic chemist with extensive experience in organic synthesis, organo-sulfur chemistry, and spectroscopy. He presently is the curator of the NMR spectrometer, GC-MS instrumentation and the old IR spectrophotometer. He has over 25 years experience in spectroscopic analysis and maintaining such instrumentation. He has attended summer workshops at the University of Rhode Island and Mississippi State University on spectroscopy and teaching.

The requested polarimeter will be housed in Montgomery Hall, room 235, our instrument room. Dr. Gallo and Dr. Xu (Co-PI) will be responsible for ordering the instrument, installation of the spectrometer and training of all faculty members in its use. They will coordinate the incorporation of the instrument into the organic laboratories for student usage and all other laboratories. The department of chemistry will be responsible for any service charges after the initial warranty period expires. A typical polarimeter has a projected lifetime of 10+ years with routine maintenance such as replacement of filters and optics.

Since the requested polarimeter comes complete with a Lab Kit including filters, sample holder and measurement capability (e.g. an indicator protractor), no other accessories are required. A price quote is included in this grant.

PREVIOUS STEP PROJECTS FUNDED

2001: Instrument upgrade for teaching laboratories in chemistry- Dr. Gallo

2013: SMART classroom, Montgomery Hall, room 103- Dr. Gallo and Dr. Junk

2014: SMART classroom, Montgomery Hall, room 230- Dr. Gallo, Dr. Xu and Mr. Wellman

2015: Acquisition of a FT-IR spectrophotometer for Chemistry – Dr. Gallo and Dr. Yan

Budget Proposal

1.	**Equipment**	**$515**
2.	**Software**	**$0**
3.	**Supplies**	**$0**
4.	**Maintenance**	**$0**
5.	**Personnel**	**$0**
6.	**Other**	**$25**
TOTAL:		**$540**

PRICE QUOTE

Date: 1/13/2017
Invoice # 1242
Expiration Date: 2/10/2017

HK LLC
www.Polarimeter4Demo.com
1799 Skyline Dr.
Orem, UT 84097
P: 801-691-8861
Polarimeter4Demo@gmail.com
(Please submit your PO via email)

To
Prof. August A. Gallo
Dept. of Chemistry
University of
Louisiana at Lafayette

Salesperson	Job	Shipping Method	Shipping Terms	Delivery Date	Payment Terms	Due Date
Andrew Frazier		USPS Priority	1 Week from Order		Due on receipt	

Qty	Item #	Description	Unit Price	Discount	Line Total
1	HK-101C	Polarimeter 4 Classroom Demo With Lab Kit	515.00		515.00

- Each package comes with all necessary parts and accessories and a bottle of chiral compound.
- No additional purchase of accessory is needed.

Shipping	24.95
Subtotal	539.95
Sales Tax	0
Total	539.95

Quotation prepared by: Andrew Frazier

This is a quotation on the goods named, subject to the conditions noted below: (Describe any conditions pertaining to these prices and any additional terms of the agreement. You may want to include contingencies that will affect the quotation.)

To accept this quotation, sign here and return: _____

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Thank you for your business!