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COVER PAGE FOR TRADITIONAL AND UNDERGRADUATE ENHANCEMENT PROPOSALS
BOARD OF REGENTS SUPPORT FUND, FY 2007-08

1. This Proposal Involves: _X_ One Institution
   ____ More Than One Institution

2. Enhancement Subprogram: (check one)
   _X_ TRADITIONAL ENH Program (Includes all multidisciplinary proposals)
   ____ UNDERGRADUATE ENH Program

3. This Proposal Is: (check one) _X_ Primarily an Equipment Request ___ Not Primarily an Equipment Request

4. Name(s) of Submitting Institution(s) of Higher Education (Include Branch/Campus/Other Components) **Louisiana Tech University**

5. Address of Institution of Higher Education (Include Dept/Unit, Street Address/P.O. Box Number, City, State, Zip Code) **Department of Chemistry, P.O Box 10348, T.S., Louisiana Tech University, Ruston, LA 71272**

6. Title of Proposed Project **Incorporation of Nano-scale Surface Characterization Techniques into LA Tech Chemistry/Physics Integrated Labs**

7. First-Year Support Fund Money Requested **$85,238**

8. Second-Year Support Fund Money Requested (if applicable) $ 0.00

9. Proposed Duration (Circle # of Yrs.) (1) 2

10. Category In Which Proposal Is Being Submitted (check one only)
   __ BUSINESS __ MATHEMATICS
   _X_ CHEMISTRY X PHYSICS/ASTRONOMY
   _X_ EDUCATION X Special Multidisciplinary (See Section III.B.2.c of the RFP.) **NOTE: If you check this category, you must also check at least one other eligible discipline.)**

11. Using the Taxonomy in Appendix A of the RFP, Identify All Specific Subcategories of the General Category That Apply to This Proposal and Provide Taxonomy Numbers:

Subcategory(ies):	Taxonomy Number(s):
Analytical Chemistry	0302
Inorganic Chemistry	0303
Solid State Physics	0807
Atomic/Molecular Physics	0803

12. This Proposal Is a: _X_ New Request ____ Request for Continuation of a Previously-Funded Support Fund Project (check one) Provide previous contract number:

By signing and submitting this proposal, the signators are certifying that: (1) the proposed project has not already been funded/is not currently being funded/has not been promised funding; (2) this proposal has been reviewed and approved by an Institutional Screening Committee; and (3) the institution and the proposed project are in compliance with all applicable Federal and State laws and regulations, including, but not limited to, the required certifications set forth in: (a) Grants for Research and Education in Science and Engineering, NSF Grant Proposals Guide (GPG), NSF 03-2, effective 10/1/02, and (b) 45CFR 620, Subpart F (Requirements for a Drug-Free Workplace).

	Name/Title/email (type or print) Institution (if different from Item #5 above)	Dept./Telephone No.	Degree/Year	Signature
PI/PD	Upali Siriwardane, Professor	Chemistry/(318) 257-4941	Ph.D/1985	Upali Siriwardane
Co-PI/PD	Haifeng(Frank) Ji, Associate Professor	Chemistry/ (318) 257-5125	Ph.D/1996	Haifeng Ji
Co-PI/PD	H. Lee Sawyer, Jr, Associte Professor	Physics/(318)257-4053	Ph.D/2002	[signature]
Co-PI/PD	William C. Deese, Professor	Chemistry/(318) 257-4878	Ph.D/1981	William C. Deese

Campus Head or Authorized Institutional Representative	Dean	Authorized Fiscal Agent
Name/Title/email: (type or print) Daniel D. Reneau, President	Name/Title/email: (type or print) Stan Napper, Dean of COES	Name/Title/email: (type or print) Joseph R. Thomas, Jr., VP Financial Services
Signature: Daniel D. Reneau	Signature: Stan Napper	Signature: [signature]
Date: 10-22-07 Telephone Number: (318) 257-3785	Date: Telephone Number: (318) 257-4647	Date: 10/23/07 Telephone Number: (318) 257-4325

(Form 1-ENH, Rev. 2007)

PROJECT SUMMARY

Name of Institution (Include Branch/Campus and School or Division) Louisiana Tech University

Address (Include Department) **Department of Chemistry, P.O Box 10348, T.S., Louisiana Tech University, Ruston, LA 71272**

Principal Investigator(s) **Upali Siriwardane, Haifeng Ji, H. Lee Sawyer, Jr., and William C. Deese**

Title of Project **Incorporation of Nano-scale Surface Characterization Techniques into LA Tech Chemistry/Physics Integrated Labs**

Abstract (DO NOT EXCEED 250 WORDS)*

A strategy has been developed to raise the quality of the chemistry/physics programs at Louisiana Tech University (LA Tech) by incorporating nano-scale surface characterization techniques into the undergraduate laboratory and research components of the curricula.

This proposal requests the funding for an Atomic Force Microscope (AFM) mainly for training undergraduates. This equipment will have a positive impact on the chemistry/physics undergraduate education. In addition, chemical-, mechanical-, bio-medical-, nano-systems-engineering students at LA Tech will also benefit. Our ungraduates will gain the knowledge and skills to integrate basic concepts of nano-science with the engineering fundamentals in an ever expanding field of nanotechnology. This will provide greater employment opportunities to them, and contribute to the economic growth of the State in several ways;

a. Our students will gain hands on experience in nano-scale techniques to investigate the structure with relation to their electro/magnetic/spectral properties of materials and help to predict their industrial applications.
b. By providing training to students to participate in research projects in nanotechnology conducted by Louisiana Tech research centers.
c. By the campus-wide-multidisciplinary use of new equipment with other deciplines.
d. By increasing recruitment and retention of new students and faculty.
e. By placing faculty at a better position to establish interactions with the industries in the region and to provide technical support and expertise.
f. By increasing the Prospects of receiving external funding from federal agencies and corporations.

A plan exists to increase faculty expertise/training to successfully incorporate AFM/SPM equipment and experiments into the curricula. The completion of this enhancement project will be possible within one years of its inception.

(Form 2, rev.2007)

TABLE OF CONTENT

Incorporation of Nano-scale Surface Characterization Techniques into LA Tech Chemistry/Physics/Integrated Labs

4. NARRATIVE AND BIBLIOGRAPHY

a. CURRENT SITUATION

a.1 Institutional Description

Louisiana Tech University is a state-assisted and Commission on Colleges of the Southern Association of Colleges and Schools (SACS) accredited public university in the north-central Louisiana. Tech University is striving to be a leader in the area by promoting multidisciplinary research through research centers such as the Institute for Micromanufacturing (IfM) dedicated to the realization of commercially-viable micro- and nanosystems, and the Center for Entrepreneurship and Information Technology (CEnIT) to facilitate innovations in IT and entrepreneurship to enhance the regional economy.

As a selective admissions University, it offers a broad range of fully accredited bachelors, masters, and doctoral programs in a wide range of disciplines through five colleges: Administration & Business, Liberal Arts, Education, Engineering & Science (COES), and Applied & Natural Sciences (ANS). The university has maintained a student enrollment well over 11,000 with about 9,500 undergraduate students who are mainly (~80%) come from Louisiana and the rest are from south-east region, other states and many foreign countries. Louisiana Tech has established university-wide multidisciplinary research by creating research centers: Institute for Micromanufacturing (IfM), Center for Biomedical Engineering and Rehabilitation Science (CyBERS) and a Center for Applied Physics (CAPS) using federal and state funds. One of the recent triumphs of the university is the establishment of a Bachelor of Science degree program in Nanosystems with the approval of Board of Regents of Louisiana. The university has recognized the importance of these innovative programs to prepare graduates with the knowledge and skills to apply basic science and engineering fundamentals in ever expanding areas of technology to increase employment opportunities for students and the economic growth of the State.

a.2 Rationale for Project

In order increase enrollment and retention of math, chemistry and physics majors the COES has developed an integrated science curriculum (ISC). Science majors participating in ISC sponsored chemistry and physics courses get hands-on experience to make connections between science and mathematics, between macro-, micro- and nano-scale and an increasing understanding of scientific method and problem solving skills early in their education.

In order to maximize the use instrumentation and cost-effectiveness in providing hands-on experience to students taking higher level lectures/labs, the departmental resources for Chemistry, Physics and Materials Science (CPMS) are organized into a CPMS laboratory which is closely tied to the chemistry, physics and ISC laboratory courses. The CPMS Lab instrumentation needs are changing at a faster rate compared to the traditional areas of sciences since the nanotechnology is growing at much faster space by discovering new materials and developing applications. Therefore, this proposal is a plan to extend and modernize Louisiana Tech's chemistry/physics/ integrated science curricula to meet the teaching and research need of our students to fit the 21st century technology. The atomic force microscope (AFM)[1], was invented[2] in 1986 by Binnig, Quate and Gerber. Like all other scanning probe microscopes (SPM), AFM utilizes a sharp probe tip mounted on the end of a microcantilever[3,4] moving over the surface of a sample and undergoing bending in response to the Van der Waals force between the probe tip and the sample surface.

The primary goal of this project is to improve nanotechnology hands-on experience through an interdisciplinary science environment provided by the new atomic force/scanning probe microscope (AFM/SPM) system consolidated with the existing chemistry and physics instrumentation.

The CPMS Laboratory's teaching and research component are organized into thirteen areas: 1) Electron Magnetism, 2) Nuclear Magnetism, 3) Thermal Analysis, 4) Synthesis of Ceramic Materials, 5) Synthesis of Inorganic & Organometallic, 6) Nanoparticle Synthesis, 7) Inert Atmosphere handling, 8) X-ray Diffraction, 9) Separations & Analysis Techniques,10) Molecular Spectroscopy, 11) Polarimetry, 12) Electrochemistry and 13) Surface Characterizations.

Table 1:Summery of the Concepts Areas Covered by the CPMS Lab Instrumentation.

1) Electron Magnetism: a. Diamagentism * c. Ferromagnetism * b. Paramagnetism * **2) Nuclear Magnetism**: a. Nuclear Magnetic Resonance# **3) Thermal Analysis**: a. Differential Thermal Analysis* b. Thermal Gravimetric Analysis* **4) Synthesis of Ceramic Materials** a. High temperature superconductors * b. Sol-gel synthesis * **5) Synthesis of Organomettlac & Inorganics** a. Organometallic * b. Inorganic* c. Photochemical Reactions* c. Hydrothermal (high pressure) synthesis* d. Polymeric* **6) Nano-particles Synthesis** a. Chemical synthesis * b. Centrifuge* b. Ball Milling # **(Need a Ball mill)- this will be considered in future proposals**	**7) Inert Atmosphere handling** a. Vacuum/Schlenk line* b. Dry box* **8) X-ray Diffraction**: a. Powder Diffraction* **9) Separations & Analysis Techniques** a. Gas Chromatography * b. GC Mass Spectroscopy* c. Liquid Chromatography* **10) Molecular Spectroscopy**: a. UV-Vis * b. Infra-Red IR* c. Fluorecence* **11) Polarimetry** * Polarimeter **12) Electrochemistry*** Electrochemical analyzer **13) Surface Characterization** SEM and EDX analysis* AFM Microscopy# **- this proposal**

*Adequate Instrumentation; # Need instrumentation

After careful review of concepts and available instrumentation, we have determined that the nano-scale surface characterization area needs additional instrumentation and incorporating them will have the greatest impact on the CPMS laboratory performance. We plan to:

- Acquire a robust AFM/SPM system suitable for teaching undergraduate the nano-scale structure.
- Integrate the AFM/SPM system into existing chemistry, physics and integrated science curricula at Louisiana Tech.
- Develop experiments/demonstrations and hands-on laboratory activities to enhance student interest in the identified chemistry and physics courses.

The CPMS Lab was established through funding from the university, BoRSF and other external sources. It has a unique relationship with the other science departments and the research centers by providing instrumentation access to many undergraduate and graduate students, and research faculty in diverse areas of science and engineering programs at the university. This relationship maximizes the instrument utilization and cost-effectiveness. The university has recognized the importance of CPMS lab and devoted adequate funding for the upkeep of the existing equipment so that they remain in excellent condition.

The CPMS Lab mission is to expose undergraduate and graduate students to the fundamental of inorganic/physical chemistry, material sciences and nano-science that underlie high-tech industries essential for the economic growth of the State/Nation. The instrumentation of CPMS Laboratory will be maintained to produce a trained workforce as planned by the Louisiana States Vision 2020. More specifically, it will increase the general levels of knowledge and technical capabilities of the physical science and engineering students-our future workforce, necessary to start and develop local high-tech industries to explore new technologies and practical applications based on nanotechnology which is going play a major factor in the future economy.

What is currently missing from the chemistry, physics and integrated science curricula is the lack of adequate AFM/SPM instrumentation to conduct nano-scale surface characterizations to bridge the gap that students experience in connecting the micro/macro and to the nano-scale. Related SPM methods such as scanning electron microscopy (SEM) and transmission electron microscopy (TEM) to investigate nano-scale are much more complicated/expensive[3] instruments and require high vacuum and special sample preparation. The hands-on learning activities using the AFM/SPM instrumentation is a prelude to SEM and TEM and can significantly improve student interest and allow chemistry, physics and integrated science laboratory components accomplish the goal of introducing nano-scale concepts early in their education.

a.3 Impact on Existing Resources

A list of major departmental equipment relevant to this project is given in the proposal **APPENDIX a**. The acquisition of new AFM/SPM instrumentation will have a great impact on existing CPMS equipment: Scintag Powder X-ray Diffractometer

(PXRD), 5) Magnetometer-magnetic susceptibility system, Shimadzu Differential Thermal analyzer (DTA), Shimadzu Thermal Gravimetric analyzer (TGA), Vacuum Atmosphere-Dry-box and Vacuum-line synthesis of air sensitive compounds, The Reactors, Furnaces and Temperature Controls available for the synthesize polymeric, ceramic, superconducting and catalytic materials, and the NMR spectrometer. New AFM/SPM instrumentation[3] will impact them by providing additional data collection capabilities and correlations to support their experimental investigations.

Using new equipment our chemistry and physics students will be able to see the nano-scale features[3] of polymer composites, phase transitions, surface texture, defects, crack/scratch propagation, coatings, nanoparticles, carbon nanotubes, crystal structures, cells, bio-molecules, semiconductors, data storage and advanced optical materials.

b. THE ENHANCEMENT PLAN

b.1 Project Goals and Objectives

The quality if CPMS Laboratory has been continuously improved by acquiring state-of-the-art instrumentation over a period of 15 yrs. However, it needs further improvement in instrumentation to keep up with the new developments in nanotechnology and the material sciences as the new applications are discovered at a faster pace.

After conducting a thorough review of fundamental concepts, equipment in hand, and commercially available instrumentation in the area, for chemistry, physics and materials science as shown in the table 1, we have developed a plan for the CPMS Lab enhancement.

In order to address the needs of the students participating in chemistry, physics, materials science and integrated science courses at Louisiana Tech, the PIs (Drs. Siriwardane, Ji, Sawyer, and Deese) propose to incorporate Agilent Technologies AFM/SPM System and Desktop PC and printer and software for AFM/SPM system in to the integrated CPMS Laboratory of the chemistry and physics departments.

b.2 Work Plan of Proposed Project

As a group, the chemistry and physics faculty members are under one administrative unit sharing resources, office and laboratory space in the same building. They have a long history of cooperative participation in undergraduate curriculum development activities. Chemistry and physics have many overlapping areas in the curricula such as spectroscopy, quantum mechanics, electro-magnetic properties, and the solid-state.

The proposed enhancement will expose our students to nano-scale surface characterization techniques to investigate wide range of polymers, coatings, inorganic solids, nanoparticles, crystalline materials, semiconductor, data storage and advanced optical materials and biological samples,.

Agilent Technologies Series 5400 AFM/SPM System integrated to a Desktop PC and printer and software for AFM/SPM system satisfy the most critical need: the nano-scale surface characterization instrumentation.

Our objectives are to 1) purchase the much needed AFM/SPM instrumentation 2) integrate them with existing instrumentation 3) develop new laboratory experiments for chemistry, physics and integrated science laboratory courses, and 4) satisfy teaching and research needs of the chemistry, physics and engineering faculty. Drs. Siriwardane and Ji will oversee the objectives 1 & 2: bidding, purchasing, installation, and streamlining of the equipment. Drs. Siriwardane, Ji, Sawyer, and Deese will develop the new laboratory experiments (objective 3) and demonstrations. Dr. Jayne Garno of the chemistry department at LSU, who is an expert in the area of AFM/SPM will help the PI, Dr. Siriwardane in initial faculty training and developing laboratory (Her support letter is attached in the proposal **APPENDIX e**).

Upon the completion of the first three objectives all PIs will develop a plan to train students and meet faculty research needs. Table 2 outlines the schedule of activities.

Table 2. Project Schedule and Investigator Responsibilities

A - Siriwardane, B - Ji, C - Sawyer, D – Deese, E –Other Chemistry and Physics faculty

Activities **Coating Process Parameters**	**2008-2009 Quarter**			
	Summer	**Fall**	**Winter**	**Spring**
1) Planning meeting upon funding approval	A, B, C,D,E			
2) Instrumentation specs & Bidding	A			
3) Installation of instrumentation	A			
4) Streamlining Instrument & selection of experiments	A, B	A, B		
5) Development of experiments & demonstrations (Dr. Garno will assist)		A, B, C, D		
6) Incorporation of new experiments and demonstrations to chemistry physics courses		A, B, C, D	A, B, C, D	A, B, C, D
7) Develop a plan to train students and faculty (Dr. Garno will assist)			A,B, C, D, E	
8) Student & faculty surveys		A, B,C,D,E	A, B, C, D,E	A,B,C,D,E
9) Final Report preparation				A,B, E

b.3 Evidence of Potential to Achieve Recognized Eminence

In order to increase the level of campus-wide-multidisciplinary research performance, Louisiana Tech has created an Institute for Micromanufacturing (IfM), a Center for Biomedical Engineering and Rehabilitation Science (CyBERS) and Center for Applied Physics (CAPS) using federal and state funds.

Louisiana Tech has a steadily increasing graduate student population and produced over 30 Ph.D. degrees a year for the last two years. This level of performance has helped Louisiana Tech to move from a doctoral III to II institution with a major research component. Within the last few years three more new multidisciplinary Ph.D. programs in micro/nanotechnology materials, construction systems and engineering physics have been approved by the Louisiana Board of Regents recognizing the progress Louisiana Tech has made in the area of nanotechnology.

Currently, eight doctoral programs are offered in Applied Computational Analysis and Modeling (ACAM), Business Administration, Counseling Psychology, Biomedical Engineering, Education, Engineering with Micro/Nanoelectronics emphasis, engineering with Materials/Construction systems emphasis and Engineering Physics. The COES is planning to establish a Ph.D. program in Molecular Science and Nanotechnology (MSNT) and has already established an MS degree program in MSNT. The AFM/SPM instrumentation requested in this enhancement proposal is in line with the future needs and infrastructure improvements of these new programs necessary for achieving eminence at National, or International level.

Louisiana Tech's IfM is a world leader in micro and nanotechnology. One of the PIs of this proposal, Dr. Haifeng (Frank) Ji who is holding a joint faculty position with the chemistry and the IfM, has recently developed an innovative sensor based on microcantilever technology for detecting low levels chemical or bimolecular agents. Another joint chemistry/physics/ IfM faculty member, Dr. Yuri M. Lvov, is an expert in layer-by-layer (LbL) assembly of alternating layers of oppositely charged polyelectrolytes and nanoparticles. The proposed AFM/SPM instrumentation will help them by having pool of trained undergraduate students to participate in their research projects related to nanotechnology.

Louisiana Tech has also established as a leader in the science education in the region. One of the Co-PIs, Dr. William C. Deese, is an expert in the area of chemical education, especially teacher education. His work has involved a significant amount of interaction with science teachers in North Louisiana through ongoing teacher education programs. He and other chemistry faculty have consistently supported area high school students in their science fair projects. This project will help to maintain this leadership, to extend the awareness of nanotechnology among the secondary school students/ teachers and to attract and recruit new students to chemistry and physics departments through demonstrations during teacher/student visits to the campus.

b.4 Impact on Curriculum and Instruction

Chemistry has maintained SACS and ACS accreditation of the BS program (consisting of 50 majors) for over 25 years and continues to improve the through teaching/laboratory enhancements. This enhancement is in line with the recent ACS emphasis on introducing multidisciplinary materials-nano-science experiments into the chemistry curriculum.

The chemistry program also participates in a interdisciplinary masters degree program in Molecular Science & Nanotechnology (MSNT) (20 students) and in the interdisciplinary Ph.D. programs in Applied Computational Analysis & Modeling (ACAM) (20).

The physics program offers accredited B.S. (50 majors), M.S. (20 students) and a new Ph.D. in Engineering Physics (5). The physics program also offers a minor requiring fourteen hours beyond the general physics courses.

This project will have significant impact on the chemistry/physics laboratory courses all of which contain a laboratory or demonstration component. The proposed nano-scale surface characterization instrumentation will help the chemistry and physics departments to meet their accreditation requirements, and to maintain the programs at a higher quality at state and national level.

Currently, each academic year, over 200 science majors at sophomore, junior and senior levels are taught analytical, inorganic/organic and physical chemistry in about eight different laboratory components in the following courses. Over 150 science students in sophomore, junior and senior levels are taught physics: optics, electricity and magnetism, quantum mechanics, and solid-state (see **APPENDIX b**).

In addition to the usual synthetic work in the CHEM 281, CHEM 481, CHEM 498, and CHEM 584, the chemistry majors also use the FT-IR, FT-NMR, UV-vis, magnetometer, electrochemical analyzer, DTA, TGA, to characterize their products. The capability to see their structures at nano-scale of the products students have synthesized will significantly impact their understanding of the close relationship that exists between the properties and structural theories developed at the atomic scale of these materials. Also, the students will be engaging in inquiry based learning and their critical thinking skills will be enhanced. In a similar fashion, selected physics courses and new experiments will significantly enrich the student learning environment in the physics curriculum.

This enhancement will indirectly benefit the general chemistry/physics courses will also indirectly benefit from the incorporation of presentations and demonstrations based on the fundamental concepts and demonstrations based on AFM/SPM analysis of materials. In CHEM 471, the high school science teachers from the surrounding area participate in a program to learn methods, materials, and activities for teaching chemistry. They also visit the Louisiana Tech campus frequently with their students. Demonstrations by La Tech faculty to visiting high schools using new AFM/SPM equipment and software will create an awareness of nano-scale surface characterization techniques of new materials among secondary students and teachers.

A major beneficiary of this enhancement is students pursuing independent undergraduate research in chemistry and physics. In CHEM 498, PHY 435 (see **APPENDIX b**) chemistry and physics seniors undertake research projects. These collateral courses (CHEM 498 substituted for CMEN 450C) provide additional opportunities for undergraduates are in the closely related disciplines such as chemical engineering. These students will greatly benefit from the new nano-scale surface characterization by being able to undertake research problems with an in-depth analysis of arrangement of atoms and their relation to electrical, magnetic, spectral and thermal character of the synthesized materials using inert atmosphere/high temp-/pressure/photochemical/ceramic methods under the supervision and guidance of a faculty member from chemistry and physics. The details of these courses (**APPENDIX b**), concept demonstrations and specific laboratory experiments (**APPENDIX c**) are attached as appendices.

The course numbers and enrollment data is summarized in table 3. Details of the course contents are given in the **APPENDIX b**.

Table 3. Affected courses and Enrollments in Chemistry/Physics/Integrated Courses

Chemistry		Physics	
CHEM 103: (80)-A, E	•CHEM 498:(15)- A,C,D	PHYS 261:(40)–C,E	•PHYS 424: (10) – C, E
CHEM 104: (80)-A,E	•CHEM 502: (20) – C,E	PHYS 304:(20)–C,E	•PHYS 425: (10) – C, E
• CHEM 205: (20)- B	•CHEM 584: (15) - A	PHYS 320: : (20) –C,E	•PHYS 435: (10) – C, E
• CHEM 281: (15)- A	•CHEM 586: (15) - C	•PHYS 408: (10) –C,E	•PHYS 470C: (10)-A,B,E
• CHEM 313: (45)- E	•CHEM 471: (15)- D	•PHYS 409: (8) – C, E	•PHYS 503: (5) -C,E
• CHEM 314: (10)- E	•CHEM 481: (10)- A	•PHYS 410: (10) – C, E	•PHYS 511: (8)- C, E
• CHEM 315: (10) –E		•PHYS 412: (10) – C, E	•PHYS 512: (8) = C, E
• CHEM 466: (15)- A,B,E		•PHYS 420: (10) – C, E	•PHYS 522: (20)- C, E
		•PHYS 422: (10) – C, E	
• Number of students directly affected yearly = 325			

A - Siriwardane, B- Ji, C - Sawyer, D - Deese, E - other Chemistry and Physics faculty

CHEM = chemistry, PHY =physics, numbers inside parenthesis is yearly enrollment.

b.5 Impact on Quality of Students

The COES science program (chemistry and physics) has approximately 100 undergraduate students but provide a large number of service courses for the students (~1000) in the engineering programs as well as other natural/biological science majors.

The students participating in the affected chemistry and physics courses belong to a wide range of career pursuits such as chemistry, physics, engineering, mathematics, biology, agriculture, and health related areas. Almost 80% of the students attending are from the state of Louisiana and are mainly from Lincoln, Bossier, Caddo, Bienville, and Ouachita Parishes in north central Louisiana. The average ACT score of chemistry and physics majors were 24.2 and 26.7, respectively. This enhancement will significantly improve the quality and job placement of our graduating seniors.

The departments of chemistry and physics provide a teaching and research environment to prepare students for successful careers in chemistry, physics, science education, bio-medical professions. Each year approximately half the students who graduate with a major in chemistry and physics will attend graduate/professional school and the rest will join the workforce. Approximately 25% of the chemistry graduates will go to medical school, 25% will enter chemical industry. and others join health related careers. Early introduction to hands-on experience help them to make connections between science and mathematics, to increase awareness of scientific method and develop problem solving skills, and to participation in research that will prepare our undergraduates for careers in high-tech industry and encourage pursuing graduate studies.

We are all blind at the nano-scale hindering our conceptual understanding of nanotechnology. The impact of AFM/SPM instrumentation on student education is equal to giving a walking stick (AFM probe tips) to a blind person to scan the terrain to understand the surface features. It will significantly improve the student learning nano-scale concepts early in chemistry, physics and integrated science curricula. The students will be able to grasp important concepts, properties applications at of nano-scale because of the hands-on experience new equipment provide.

As a result of this enhancement, students will, by first-hand experience, learn that the faculty, the departments, the University and the State deeply care about their education and the excellent opportunities to pursue a degree in science or engineering are available to them in their home state. The equipment will provide a positive learning experience and incentives to stay in the state.

b.6 Impact on Faculty Development

Currently, the chemistry department consists of ten faculty members with Ph.D.s inorganic(2), analytical(1), physical chemistry(3), organic chemistry(2), biochemistry(1) all of whom are actively involved in research or chemical education, and one faculty member with a M.S. degree (organic & general) to coordinate freshman level courses.

The physics faculty consists of eleven staff members with Ph.D.'s all of whom are actively involved in research associated with the research centers: Center for Applied Physics (CAPS)/CyBERS/or IfM.

The acquisition of AFM/SPM instrumentation will have a great impact on faculty development by improving the quality and effectiveness of faculty teaching and research. The availability of the new equipment will allow them to add new modules[3,4,5,6] to upgrade their classroom materials, laboratory experiments and research techniques. The lack of the AFM/SPM equipment has hindered of research carried out by the PIs by not having a pool of trained students. This will be true for many other faculty members in the COES because the concepts of nano-scale are general to many sciences and engineering disciplines. This enhancement allows the chemistry and physics faculty to keep up with the latest developments in the nano-scale techniques for materials characterization which is going to play an important role in science education and new technology in the future. Currently, the chemistry and physics departments are searching for new faculty with materials science/nanotechnology expertise and the new instrumentation will help to attract qualified candidates because of its impact on their teaching and research. In addition, the proposed equipment will place the current and new faculty in a better position to make contact with area industry and to compete for the external funds earmarked for nanotechnology, and teacher preparation/ secondary student programs.

b.7 Performance Measures

Performance measures will be based the accomplishment of the objectives outlined in the Table 2 (page 5) with a time line. Our project objectives are:

1) Survey of AFM/SPM Instrumentation specs to find the best match for the chemistry/physics teaching/laboratory needs.
2) Bidding and selecting a vendor that provides most capabilities at a competitive price.
3) Installation of equipment and formulating scheduling plan and a routine maintenance plan.
4) Streamlining new and existing instruments based on their compatibility.
5) Selection and development of experiments/demonstrations[4,5,6] for chemistry/physics courses.
6) Development of a plan to train students and faculty, and to maximize their use.

Through weekly e-mail and reporting, and monthly Four-PI-Project Management Team meetings, we will continuously assess our progress. The Team will conduct the internal evaluation and self-assessment as well as external assessment with the help of student & faculty using AFM/PSM instrumentation. Each objective will be evaluated based on the initial goals and their timely accomplishments.

c. EQUIPMENT

1.c Equipment Request

In order to improve the effectiveness the CPMS Laboratory we plan to purchase an Agilent Technologies Series 5400 AFM/SPM (see **APPENDIX c** for more detail) the expenditure in line item A and B a total of $ 75,598 is for the purchase of following components:

1) **Microscope and electronics** ($19,686)
2) **Controller ($37,287)**
3) **Multipurpose scanner** ($ 11,915)
4) **Detector and AFM nose cones** for multi-purpose scanners ($ 3,075)
5) **Noise and Vibration Isolation Chamber** ($3,635)
6) **PicoView Software** for the microscope control, data acquisition. data manipulation and to interface the computer to controller ($2,200)
7) **Supplies and Startup kit** ($ 2,285)
8) **installation and onsite training** ($2,753)

c.2 Equipment on Hand for Project

CPMS Lab equipment those are located in the same floor and building with direct access to students and faculty participating in the laboratory experiments and research:

1) **<u>SEM/EDXS System</u>: AMRAY 1820** software and computer.
2) **<u>MAGNETOMETER</u>**: Magnetic Susceptibility System.

3) **DIFFERENTIAL THERMAL ANALYSIS**: **SHIMADZU DTA-50** Thermal Analyzer software and computer.
4) **THERMAL GRAVIMETRIC ANALYSIS**: **SHIMADZU** TGA-50/50H Thermal Analyzer software and computer.
5) **SPECIAL CHEMICAL SYNTHESIS**: (Organometallic, Inorganics and sol-gel, and nanoparticle): a) **Parr High Pressure Bomb (Autoclave),** b) **ACE GLASS-** Photochemical Reactor c) and d) Temperature/stirrer Control Unit .
6) **CONVENTIONAL CHEMICAL SYNTHESIS**: a) Glassware, b) heating mantles, c) pH meters, and e) thermometers and f) temperature and stirrer control.
7) **NUCLEAR MAGNETISM: Multinuclear JOELGSX-270 MHz High Resolution FT-NMR** Spectrometer Model, computer and software.
8) **INERT ATMOSPHERE HANDLING**: a) Vacuum **atmospheres -dry box and dry train**, precision balance, b) **Custom made Vacuum Line-** with McLeod gauge, Fractionation, and reaction train, gas collecting bulbs and vacuum pump. c) **Schlenk line** for N_2/intergas/vacuum handling.
9) **SEPARATIONS & ANALYSIS TECHNIQUES**: a) **Hewlett Packard-Model 5890A Gas Chromatograph,** b) **VARIAN-Saturn 2200**-MS and CP-3800 GC-GC/MS system.
10) **X-RAY DIFFRACTION**: **SCINTAG MZ4 powder Diffractometer** system and computer and software.
11) **MOLECULAR SPECTROSCOPY**: a) **SHIMADZU UV-visible Spectrometer** with computer and software, b) **MATTSON Genesis II Series**: FT-IR Spectrometer.
12) **ELECTROCHEMISTRY: EG&G/Princeton-Perkin Elmer** Potentiostat/Galvanostat model 263A:Electrochemical Analyzer.
13) **TEMPERATURE PROGRAMMED FURNACES**: Ceramic synthesis.
14) **AUTOMATIC POLARIMETER**: The **AUTOPOL V** Polarimeter

c.3 Equipment Housing and Maintenance

New AFM/SPM instrumentation will be housed in an adjoining room to chemistry/physics/integrated science labs. These laboratories are currently designated as the Chemistry/Physics/Integrated Instrumentation Labs (2 labs, ~1500 sq. ft. each) and Inorganic Chemistry Laboratory with a fume hood (~1500 sq. ft.). Maintenance service for the AFM/SPM instrumentation is based on service contract or pay by the visit is usually available from the manufacturer. There is a strong commitment from the college (COES) to provide maintenance funds, when needed, from a contingency fund or student laboratory fees. Most of our equipment has served the unit well beyond their regular lifetime (10-15 yr). For example, we have obtained funds to replace photohelic gauge ($750) of our 10 yrs old dry box from research grant, to upgrade ($25,000) the magnet of our 15 yr old high resolution NMR, and to replace the X-ray tube ($3,500) and the scintillation detector ($1,500) of our ten years old X-ray diffractometer using college funds. The instrument maintenance is mainly achieved thorough the dedication of faculty, student training, and the administrations commitment to maintaining accreditation requirements. All electronic equipment and computers in the college are serviced by the technical staff of the COES.

d. FACULTY AND STAFF EXPERTISE

Lead-PI, Upali Siriwardane, a professor of chemistry will bear the primary responsibility for the purchase, installation, and integration of the new AFM/SPM instrumentation equipment to chemistry/physics/ science curricula. He teaches inorganic chemistry and freshmen chemistry, and has participated in several NSF sponsored workshops organized by Auburn University, Georgia State and Tech to incorporate inorganic chemistry experiments and materials science concepts and experiments into chemistry curriculum. Recently, he spend a year of sabbatical leave at department of chemistry, LSU, Baton Rouge and participated in research to synthesize supramolecular compounds and to investigate their guest/host properties. He also worked with Dr. Jayne Garno who is an expert in the area of AFM/SPM to learn more about AFM/SPM techniques. He will be spending two months of summer 2008 on a research internship at LSU. Dr. Garno has agreed to sponsor him by submitting a grant proposal to the ACS PRF program under her current ACS PRF grant (Her support letter is attached in the proposal **APPENDIX e**).

He has completed several projects funded by the Board of Regents Support Fund (BoRSF) (See previous BoRSF support and Biographical Sketch for more details). He has already incorporated materials characterization techniques based on X-ray diffraction, differential thermal analysis, thermal gravimetric analysis, electrochemical analysis and magneto-electrical property analysis into the CPMS laboratory. He has experience in the development of hands-on laboratory activities for lower level science and engineering courses. His research expertise and interests are in the areas of inorganic and organometallic chemistry, especially main group and transition metal compounds. He is also a PI of two DOE funded research grants for developing catalysts for Fisher Tropsch reactions and development of hydrogen separation membranes (Nb, Ta) and catalysts (Ni, Cu, Ce) for water-gas-shift reaction. He is also involved with chemical synthesis of nanoparticles and sol-gel preparation of catalyst supports such as alumina, silica and chromia to hold the nanoparticles. Dr. Siriwardane has over 82 research publications to date (see his **Biographical Sketch**).

PI, Dr. Frank Ji is an associate professor holding a joint faculty position in the chemistry department and Institute for Micromanufacturing (IfM) of Louisiana Tech. Currently he is teaching organic and polymer chemistry courses and plans to develop a chemistry curriculum to include experiments involving nano-scale surface characterization techniques. He also teaches a graduate level course, CHEM 502, in polymer science. Dr. Ji is an expert (see his **Biographical Sketch**) in the area of microcantilevers which forms the basis for AFM techniques and he is using them to detect trace quantities of pollutants and nerve agents. His research interests are in the areas of microcantilevers, chem- and bio- sensors, organic synthesis, combinatorial chemistry, host-guest interactions, molecular recognition, surface modification, fluorescent sensors, electron and energy transfer processes, organic and organometallic, photophysics and photochemistry, conjugated polymers, and molecular logic gates. Many chemistry undergraduates have participated in his research and proposed AFM/SPM equipment will help him train students and expand his research investigations.

PI, Dr. Sawyer is an associate professor of Physics at Louisiana Tech University. He is also the Academic Director of Chemistry and Physics. He teaches undergraduate/graduate level physics courses. His is a strong supporter of chemistry/physics laboratory integration. He is also involved with the COES efforts to integrate develop curricula in both engineering and science. His efforts are funded by Dept. of Education Action Agenda and a NSF CCLI grant. His integrated curriculum development experience will greatly helped to achieve the objectives of this enhancement. His research expertise is in Experimental High Energy Physics and he has over 195 publications. He is the PI of a funded by the Department of Energy to investigate high energy particles(see his **Biographical Sketch**). He is also a member of several experiments at large accelerator facilities.

PI, Dr. Deese is a professor of chemistry and teaches freshmen chemistry and teacher preparation courses. His research interests are in the synthesis and characterization of olefin compounds of platinum (II), which contain two metal centers. He is also an expert in the area of chemical education, especially teacher education. His work has involved a significant amount of interaction with science teachers in North Louisiana. One of his recent teacher preparation projects titled, "Chemistry Concepts and Connections for Teachers," was funded by the NSF at 1.6 M. He served as the co-director of several NSF funded projects on teacher enhancement for middle grade math and science educators (see his **Biographical Sketch**). During the past several years he has conducted many workshops and made many presentations to show the power of chemical demonstration at many regional and national meetings. These workshops have led to a solid relationship with over 200 science teachers across North Louisiana. Dr. Deese has gained valuable experience in conducting chemical demonstrations in a studio environment while making regular appearances on a local television talk show. He will be the key person to extend the benefit of this enhancement to create an awareness of nano-scale among high school students and recruit chemistry and physics majors.

e. ECONOMIC AND/OR CULTURAL DEVELOPMENT AND IMPACT

e.1 Relationships With Industrial/Institutional Sponsors

Louisiana Tech's Center for Entrepreneurship and Information Technology (CEnIT) enables the faculty, students, and external partners to produce and apply nano-technological innovations in IT and find entrepreneurship that enhance the regional economy. PIs of this proposal also have been assisting companies in the region with their product development needs. For example, we have helped, Calsite Ruston Inc.

Grambling LA, Rare Earth Labs, Eldora do AR, for their research and development needs using our instruments.

Chemistry and physics faculty at Louisiana Tech have close collaborations with the University of Louisiana at Monroe (ULM). We share our instruments to support the research needs of our students. Lead-PI, Dr. Siriwardane also collaborates with GSU Physics on DOE funded projects (see his **Biographical Sketch**). We also have an inter-institutional cooperative program (ICP) with neighboring Grambling State University (GSU) and joint faculty appointment program (JFAP), La Tech has shared chemistry and physics laboratory courses and equipment with GSU for many years. Therefore the impact of this enhancement project will extend to the graduate and undergraduate chemistry and physics undergraduates at GSU.

e.2 Promotion of Economic Development and/or Cultural Resources

The chemical and allied industries are a major part of the economic activity in Louisiana. People with training in chemistry, chemical engineering or physics play a major role in the technical and management workforce of these industries. It is, therefore, a benefit to the economy of Louisiana to educate these people at a state-of-the-art level so that they can effectively contribute to the economic well being of these major industries. Again, one can properly argue that our students trained in AFM/SPM instruments can make an effective contribution to growth of high-tech industry in the area. Educating our college students at state-of-the-art levels has both short and long term effects on the economic development of the State of Louisiana. In the short term, it can provides an adequate supply of well-educated people to staff the many technical positions currently available in Louisiana's high tech industries which is expected to grow rapidly with infrastructure development. And, in the long term, it could create a workforce knowledgeable in nanotechnology that can compete with the workforces of similar industries throughout our global economy, a factor important to keep jobs in US and affect our economy; this could become more important to the well being of the state of Louisiana.

f. ADDITIONAL FUNDING SOURCES

Currently, no cost for the project will be shared through contributions from external organizations.

g. BIBILIOGRAPHY

1) http://en.wikipedia.org/wiki/Atomic_force_microscope
2) http://spm.phy.bris.ac.uk/techniques/AFM/
3) http://www.afmuniversity.org/
4) http://stm2.nrl.navy.mil/how-afm/how-afm.html
5) "A Mechanical Microscope: High-speed Atomic Force Microscopy," Humphris, A., Miles, M., Hobbs, *J.*, *Applied Physics Letters*, **2005**, 86, 034106-034109.
6) "Getting Physical with Your Chemistry: Mechanically Investigating Local Structure and Properties of Surfaces with the Atomic Force Microscope," William F. Heinz, Heinz, William F.; Hoh, Jan H., *J. Chem. Educ.* **2005** *82* 695.

5. PREVIOUS BOARD OF REGENTS SUPPORT FUND AWARDS

The Lead-PI of this proposal has taken the primary responsibility for the planning and development of the chemistry, physics and materials science (CPMS) Laboratory. The BoRSF funding he and other chemistry/physics faculty received has significantly increased the effectiveness of teaching and research components of the chemistry/physics departments and past funding have helped to maintain the quality of the curricula and recruiting new students and faculty, and increasing external funding. The nano-scale characterization instrumentation proposed takes the CPMS Laboratory to a higher level.

A. **For Upali Siriwardane**

1) Enhancement of Inorganic Laboratory, LEQSF-1990-91-ENH-23, $ 48,988, June 1990-May 1991.

The results of the project are:

The grant has helped the chemistry department to purchase basic equipment, Dry-Box, vacuum-line, FT-IR and various other equipment for the inorganic laboratory. Inorganic chemistry lecture, laboratory courses, and research were expanded to include following experiments to provide hands on experience in handling and synthesizing air sensitive compounds.

2) Modernization of Freshman Chemistry program, LEQSF-93-077, $ 31,500, June 1993-May 1994.

Video editing and presentation system (projection panels, several professional grade VCRs, video Editing equipment and software, two video cameras, a library of video disks and tapes) were purchased in order to create video tapes of demonstrations, lectures and tutorials. Freshman and chemistry students can borrow these tapes from the audio-visual section of the Prescott Memorial Library.

3) Incorporation Materials Science into Chemistry and Physics Curricula: LEQSF (1996-97)-ENH-TR-31 (Louisiana Education Quality Support Fund) Undergraduate Enhancement Program: $44,500, July 1996-June 1997.

The results of the project are:

An X-ray Powder Diffractometer, software and a databank were purchased to incorporate solid-state characterization and analysis of materials. Lecture and laboratory courses were developed as shown below to include a materials science emphasis.

4) Incorporation of Electrochemical, Magnetic & Thermal Experiments into Chemistry Laboratories at Louisiana Tech. BoRSF (1999-00)-ENH-TR- 37(Louisiana Education Quality Support Fund) Undergraduate Enhancement Program: $36,500, July 1999-June 2000.

Even though this proposal asked for funds to purchase a magnetometer, the budget approved was reduced to a level that we had enough funds only to purchase a thermal and electrochemical equipment to incorporate thermal (DTA) and electrochemical characterization and analysis of materials. Lecture and laboratory courses were developed to include thermal and electrochemical emphasis.

5) "Incorporation of Magnetic & Thermal Gravimetric Analysis, and High Temperature Synthesis into LA Tech Chemistry and Physics Curriculum," Louisiana Education Quality Support Fund -LEQSF-2005-2006- ENH-TR-37, Undergraduate Enhancement Program: $ 53,952, 2005-2006.

The fund from this grant allowed us to a purchase a magnetometer, to incorporate thermal gravimetric analysis (TGA) unit to the DTA unit. Lecture and laboratory courses were developed to include magnetic and thermal gravimetric analyses.

6. BUDGET AND BUDGET NARRATIVE

a. BUDGET

BOARD OF REGENTS SUPPORT FUND
TRADITIONAL AND UNDERGRADUATE ENHANCEMENT, FY 2008-2009

Budget and Budget Justification Pages

Directions: Each line item under the columns "Support Fund Money Requested," "Institutional Match," and "Private Sector/Other Match" must be itemized, fully explained, and justified **on a separate budget justification page(s).** Attach additional justification pages as needed.

Title of Proposal: **Incorporation of Nano-scale Surface Characterization Techniques into LA Tech Chemistry/Physics Integrated Labs**
Project Director(s): **Upali Siriwardane, Haifeng Ji, H. Lee Sawyer, Jr and William C. Deese**
Institution(s) of Higher Education: **Louisiana Tech University**

PROPOSED BUDGET:

	Support Fund Money Requested	Institutional Match[1]	Private/Other Match[2]
A. Equipment[3]	$ 75,598		
B. Software	$ 2,200		
C. Supplies	$ 2,285		
D. Shipping/handling	$ 2,401		
E. Installation	$ 2,753		
F. Personnel training			
G. Other			
1. Desktop & Printer		$ 1,500	
2. Faculty Release		$ 17,916 (in-kind)	
3.			
4.			
5. (etc.)			
H. Indirect costs **22% of J**	Not allowed	$ 18,753	
I. Maintenance	Strongly discouraged		
J. Total costs (A-I)	$85,238	$ 38,168	

1 Stipulate whether in-cash or in-kind. The Board strongly encourages the sharing of costs for proposed projects. Applicants and institutional officials should note, however, that the employing institution will be required to honor the commitments made in the original proposal before any awards are made. Discounts for equipment purchases are not allowable as institutional match.

2 The budget page(s) must reflect and the budget justification pages must explain any external funds that are claimed in the proposal. External funds and their expenditure must be accounted for in the same manner as Support Fund money and institutional match.

3 Equipment. If applicable, itemize and describe briefly the proposed equipment and its intended use in the project. Include the name, model number, and manufacturer(s).

(TR and UG Enhancement Program Budget and Budget Justification, Rev. 8/2007)

6. BUDGET AND BUDGET NARRATIVE

b. BUDGET NARRATIVE

Line item A (\$ 75,598)

The **\$ 75,598** expenditure in line **item A** (equipment) is for the purchase of **Agilent Technologies Series 5400 AFM/SPM** with following components:

1) **Microscope and electronics** (\$19,686.00)
2) **The Controller** (\$ 39,487.00)
3) **Multipurpose scanner,** (\$ 11,915)
4) **Detector and AFM nose cone** (\$3,075)
5) **multi-purpose scanners** (\$ 3,075.00)

Line item B (\$2,200)

PicoView Software for the microscope control, data acquisition. data manipulation and to interface the computer to controller (\$2,200)

line item C

Supplies and startup kit (\$ 2,285)

line item D (\$ 2,401)

The **\$ 2,401** in line **item D,** (3% of item A, B, C) is for shipping and handing of equipment, software and supplies.

line item E (\$ 2,753)

Line item E (**\$ 2,753)** is for the installation and onsite training on Agilent Technologies Series 5400 AFM/SPM microscope.

Line item G (\$1,500)

1. Desktop PC and Printer for AFM/SPM System (\$1,500) – A desktop PC and printer to be permanently setup with the AFM/SPMsystem will be purchased. The PC is Dell Pentium 4 3GHz processor with 80 GB hard drive, 17 inch flat panel monitor, CD-Rom drive and wireless network. A HP color printer will also be purchased to provide color hard copies of scans and analyses.

2. Institutional match (**\$17,916, in-kind)**

The **item G,** a total of **\$17,916,** is an **institutional match** for three PIs (Drs. Siriwardane, Ji and Sawyer) release time to work on this project. This include **\$ 6,241**, 10% of (\$62,411, 9 month academic year salary of PI -Siriwardane), **\$ 3,650**, 5% of (\$73,005, 9 month academic year salary of PI -Ji) and **\$ 3,529**, 5% of (\$70,575, 12 month academic year salary of PI -Sawyer), and fringe benefit **\$ 4496** (33.5 % of PI salaries \$13420) for time spent on purchasing equipment, preparing experimental procedures & writing instructions for new experiments and training laboratory assistants to assist in the hands-on teaching of nano-scale surface chemistry/physics experiments.

Line item H Institutional match- Indirect Cost **(\$18,753)**

Louisiana Tech university waives, **\$18,753 (in-kind),** the indirect costs normally allowed at the rate of 22% for the state grants of the requested funding, **\$85,238** from the BoRSF.

Line item A-J

Total of **\$85,238** is requested from the BoRSF. Louisiana Tech university match is **\$\$38,168.**

7. BIOGRAPHICAL SKETCHES
a. Upali Siriwardane

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and consultants and collaborators. Begin with the principal investigator/program director. Photocopy this page for each person.

Name **Upali Siriwardane**	Position Title **Professor of Chemistry**

EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training.

INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED	FIELD OF STUDY
1) **University of Sri Lanka**, Peradeniya, Sri Lanka	B.Sc.	1976	Chemistry
2) **Concordia University**, Montreal, Canada	M.S.	1981	Inorganic/Analytical Chemistry/ X-ray Crystallography
3)**The Ohio State University**, Columbus, Ohio	Ph.D.	1985	Organometallic/Inorganic Chemistry/ X-ray Crystallography
4) **Research Associate/Staff X-ray Crystallographer**, Department of Chemistry, Southern Methodist University, Dallas, TX	--	1986-1989	X-ray Diifraction/Synthesis and characterization of Group14 Heterocarborane complexes

RESEARCH AND PROFESSIONAL EXPERIENCE: Starting with present position, list, in reverse chronological order, previous relevant employment, experience, and honors. Key personnel includes the principal investigator and any other individuals who participate in the development or execution of the project. Key personnel typically will include all individuals with doctoral or other professional degrees, but in some projects will include individuals at the masters or baccalaureate level provided they contribute in a substantive way to the development or execution of the project. Include present membership on any Federal Government public advisory committee. List, in reverse chronological order, the titles, all authors, and complete references to pertinent publications during the past five years and to representative earlier publications pertinent to this application. DO NOT EXCEED TWO PAGES.
DO NOT EXCEED TWO PAGES.

CONTACT INFORMATION

P. O. Box 10348, Chemistry Program, Louisiana Tech University, Ruston LA 71272
Tel. (318) 257-4941; Fax: (318) 257-3823; e-mail: upali@chem.latech.edu ; Webpage: http://www.chem.latech.edu/~upali/

EMPLOYMENT HISTORY

1993-present: **Professor**, Department of Chemistry, Louisiana Tech University, Ruston, LA 71272.
2006-2007: **Visiting Associate Professor**, Department of Chemistry, Louisiana State University, Baton Rouge LA.
1993-2007: **Associate Professor**, Department of Chemistry, Louisiana Tech University, Ruston, LA 71272.
1989-1993 **Assistant Professor**, Department of Chemistry, Louisiana Tech University, Ruston, LA 71272.
1986-1989 **Staff Crystallographer/Research Associate**, Department of Chemistry, Southern Methodist University, Dallas, TX 75275.

PROFESSIONAL ACTIVITIES

Member of American Chemical Society
Member of Sigma Xi Scientific Research Society
Member of Louisiana Academy of Sciences

TEACHING

Courses taught at Louisiana Tech University: CHEM 100, CHEM 101, CHEM 102, CHEM 103 Lab, CHEM 104 Lab, CHEM 120, CHEM121, CHEM 281, CHEM 481(01), CHEM 466, CHEM 585 and CHEM586.

PROJECT EXPERIENCE

- "Development of Low Cost Membranes (Ta,Nb, and Cellulose Acetate) for $H_2/CO_2/CO$ Separation in WGS Reactors," Deparment of Energy, National Energy Technology Laboratory, ($191,000) 2006-2009.
- "Incorporation of Magnetic & Thermal Gravimetric Analysis, and High Temperature Synthesis into LA Tech Chemistry and Physics Curriculum," Louisiana Education Quality Support Fund -LEQSF-2005-2006- ENH-TR-37, Undergraduate Enhancement Program: $ 53,952, 2005-2006.
- "Novel Preparations and Magneto Chemical Characterization of Nano-Particle Mixed AlcoholCatalysts" Deparment of Energy, National Energy Technology Laboratory, $191,000, 2000-2003
- "Incorporating of Electrochemical, Magnetic and Thermal Experiments into Chemistry Laboratories at Louisiana Tech University": LEQSF-1999-2000- ENH-TR-37 (Louisiana Education Quality Support Fund) Undergraduate Enhancement Program: $36,500.
- "High Pressure, Convectively-Enhanced Laser Chemical Vapor Deposition for Rapid Prototyping and Automated Part Manufacture," Co-PI in the project with Dr. James L. Maxwell, Mechanical Engineering, $ 199,068, 1997-2000.
- "Incorporating Materials Science into Chemistry and Physics Curricula": LEQSF(1996-97)-ENH-TR-31. (Louisiana Education Quality Supprt Fund) Undergraduate Enhancement Program: $44,500(1996-1997)
- "Moderization of Freshman Chemistry Program": LEQSF(Louisiana Education Quality Support Fund), (contract number: LEQSF-93-077), $ 31,500, 1993-1994.
- Louisiana Tech University, Faculty Development and Summer Research Grants: $ 6000, 1989-1994.

- Involvement of North Louisiana Secondary Students in Experimental Chemistry," LaSER(Louisiana Stimulus for Excellence in Research- Human Resource Development Program-EPSCoR-NSF): $30,000, 1991-1992.
- " Analysis of Transformer Oil" SWEPCO(South Western Electrical Power Company, $ 110,000, 1992-1994.
- LEQSF(Louisiana Education Quality Support Fund), "Enhancement of Inorganic Chemistry Laboratories": (contract number LEQSF(1990-91)-ENH-23, $ 45,988), 1990-1991.
- "Synthesis of Heterocarboranes," NSF-LaSER,$7,000, 1990-1991.

SELECTED PUBLICATIONS (total publications 82)

- "Sol-gel Preparation and Characterization of Nano-particle Fe/Co/Cu Metal Loaded Mesoporous g-Alumina Granules",Upali Siriwardane, Naidu V. Seetala, Naga S. Vegesna, Satyendra Vudarapu, Ramkiran Goduguchinta, Karen Luurtsema, Charlene Jones and Joseph Leonard, Submitted to **Journal of Catalysis (2004)**.
- Shivashankar Suriyanarayanan, Qun Gu, Upali Siriwardane and Donald T. Haynie,"Interaction of Indium (III) with DNA: Prelude to Fabrication of Low Melting Point Conductive Nanowires,"Nanotechnology, Submitted for publication **(2007)**. (PDF)
- Upali Siriwardane, Naidu V. Seetala, Naga S. Vegesna, Satyendra Vudarapu, Karen Luurtsema, and Joseph Leonard, "Comparison of metal loading of Fe/Co/Cu mesoporous g-alumina catalysts prepared by three sol-gel methods," Submitted to Applied Catalysis: A General **(2006)**.(PDF)
- Krithi Shetty, Shihuai Zhao, Wei Cao, Upali Siriwardane, Naidu V. Seetala and Debashi Kuila, " Synthesis and Characterization of non-noble nanocatalysts for hydrogen production in mircoreactors" Journal of Power Sources (Accepted for pub.ication) **(2006)**. (PDF)
- Venkata S. Nagineni, Shihuai Zhao, Avinash Potluri, Yu Liang, Upali Siriwardane, Naidu V. Seetala, Ji Fang, James Palmer,| and Debasish Kuila, "Microreactors for Syngas Conversion to Higher Alkanes: Characterization of Sol-Gel-Encapsulated Nanoscale Fe-Co Catalysts in the Microchannels", *Ind. Eng. Chem. Res.*, **44** (15), 5602 -5607**(2005)**. (PDF)
- S. Zhao, V. S. Nagineni, Y. Liang, J. Hu, R. K. Aithal, N.V. Seetala, J. Fang, U. Siriwardane, R. S. Besser, K. Varahramyan, J. Palmer, R. Nassar, D. Kuila "Microreactor Research and Development at Louisiana Tech University: Fabrication of Silicon Microchannel Reactors for Catalyst Studies on Conversion of Cyclohexene and Syngas to Alkanes", Book Chapter, ACS Symposium Series 914, Chapter 5, 84-101**(2005)**. (PDF)
- D. Kuila.; V.S. Nagineni; S. Zhao; H. Indukuri; Y. Liang; A. Potluri; U. Siriwardane; N. Seetala; J. Fang. "Characterization of Alumina and Silica Sol-Gel Encapsulated Fe/Co/Ru Nanocatalysts in Microchannel Reactors for F-T Synthesis of Higher Alkanes" Materials Research Society Symposium Proceedings (Nanoengineered Assemblies and Advanced Micro/Nanosystems) 820, 51-56**(2004)**. (PDF)
- "Microreactor Research and Development at Louisiana Tech University: Fabrication of Silicon Microchannel Reactors for Catalyst Studies on Conversion of Cyclohexene as a Prototype and Syngas to Alkanes", S. Zhao.; V. Nagineni; Y. Liang.; J. Hu; R. Aithal; N. Seetala.; J. Fang; U. Siriwardane; R. Besser; K. Varahramyan; J. Palmer; R. Nassar; D. Kuila, Accepted for publication in ***ACS Symposium Series on Microreactors* 2004**.
- S.V. Naidu, U. Sririwardane, A.N. Murty, N.S. Vegesna, J. Nwizugbu, J. Leonard, and C.R. Jones, SEM, EDX and Magnetization Studies of Fe and Co Nanoparticle Catalysts on Sol-gel Prepared Mesoporous g-alumina, Microscopy & Microanalysis, Vol. 9, Suppl. 2, **(2003)** 408.
- "Preparation and Characterization of Nano-structured Particulate Catalytic Materials", Baiyun Tong, Upali Siriwardane, Seetala, V. Naidu, Akundi N. Murty, and Zhenchen Zhong. Materials Research Society (MRS) Annual Fall Meeting **(2001)**, November 25 - December 1, **2001**, Boston, MA.
- Narayan S. Hosmane, Jimin Yang, Kai-Juan Lu, Hongming Zhang, Upali Siriwardane. M. Safiqul Islam, Julie L. C. Thomas, and John A. Maguire, "Chemistry of C-Trimethylsilyl-Substituted Heterocarboranes. 25. Syntheses, Structures and Reactivities of $GeCl_3$-Substituted Half-Sandwich Germacarboranes, closo-1-Ge-2-$(SiMe_3)$-3-(R)-5-$(GeCl_3)$-2,3-$C_2B_4H_3$ (R = $SiMe_3$, Me, and H)," Organometallics **1998**, 17, 2784-2796.
- Shafeek Ashroff, M.S., Stan A. Napper, Paul N. Hale, Jr., Upali Siriwardane, and Debi P. Mukherjee,"Cyclic Fatigue of Hydroxyapatite-coated Titanium Alloy impant Material-Effect of Crystallinity," Journal of Long- Term Effect of Medical Implants, **1996**, 6, 143-155.
- Colacot J. Thomas, Lei Jia, Hongming Zhang, Upali Siriwardane, John A. Maguire, Ying Wang, Karen A. Brooks, Vikram P. Weiss, and Narayan S. Hosamne,"Chemistry of C-Trimethylsilyl-Substituted Heterocarboranes. 17. Syntheses, Structures, and Reactions of Bent-Sandwich, d^0 Ziecobacarboranes of the "Carbon Adjacent" C_2B_4 Carborane Systems," Organometallics., **1995**, 14,1365-76.
- Jeanette A. Krause, Upali Siriwardane, Terese A. Salupo, Joseph R. Wermer, David W. Knoeppel and Sheldon G. Shore, "Prepartion of Osmium trinuclear carbonyl anion $[Os_3(CO)_{11}]^{2-}$ and its reactions with dodecacarbonyltriosmium: Structure of $[Et_4N][HOs_3(CO)_{11}]$ and $H_2Os_4(CO)_{13}$," J. Organomet. Chem., **1993**, 454, 267-71
- John J. Buynak, H.B. Borate, Grady W. Lamb, Dipti D. Khasnis, Chad Husting, Harold Isom, Upali Siriwardane,"Synthesis of 6-Vinylidenepenams" *J.Org. Chem.* **1993**, 58, 1325-1335.
- Dilip V. Khasnis, Michael Lattman, Upali Siriwardane and Hongming Zhang. "Chealate-control of Diphosphines around Platinum(II): η5-Cylenphosphoranide-promoted Formation of Heterobimetallics", *Organometallics*, **1992**, 11, 2075-2079.
- Reed J. Blau, Mary S. Goetz, Ronda R. Howe, Cheri J. Smith, Rong-Jer Tsay, and Upali Siriwardane, "Thermodynamic and Kinetic Stability of Bis (η^3-allyl)bis(μ^2-η^3-allyl) and Bis(η^3-methallyl)bis(μ^2-η^3-Methallyl) dimolibdenum(II) Isomers and Evidence for their Lewis Base Catalysed Isomerization", *Organometallics*, **1991**, 10, 3259-3266.

7. BIOGRAPHICAL SKETCHES
b. Dr. Haifeng (Frank) Ji

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and consultants and collaborators. Begin with the principal investigator/program director. Photocopy this page for each person.

Name **Haifeng (Frank) Ji**	Position Title **Associate Professor of Chemistry**

EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training.

INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED	FIELD OF STUDY
University of Florida	Postdoctoral Associate	1998-2000	Life & Materials Science
Chinese Academy of Sciences	Ph.D.	1996	Chemistry
Sichuan University	B.S.	1991	Chemistry

RESEARCH AND PROFESSIONAL EXPERIENCE: Starting with present position, list, in reverse chronological order, previous relevant employment, experience, and honors. Key personnel includes the principal investigator and any other individuals who participate in the development or execution of the project. Key personnel typically will include all individuals with doctoral or other professional degrees, but in some projects will include individuals at the masters or baccalaureate level provided they contribute in a substantive way to the development or execution of the project. Include present membership on any Federal Government public advisory committee. List, in reverse chronological order, the titles, all authors, and complete references to pertinent publications during the past five years and to representative earlier publications pertinent to this application. DO NOT EXCEED TWO PAGES.

CONTACT INFORMATION

P. O. Box 10348, Physics Program, Louisiana Tech University, Ruston LA 71272
Office: Room 343 CTH, Room 218 in the Institute for Micromanufacturing,
Tel. (318) 257-4066/5125; Fax: (318) 257-3823
e-mail: hji@chem.latech.edu, Webpage: http://www.latech.edu/tech/engr/ifm/faculty_staff/ji.html

EMPLOYMENT HISTORY

Associate Professor of Chemistry, College of Engineering and Science, 2006-present
Assistant Professor of Chemistry, College of Engineering and Science, 2000-2006
Assistant Professor of Institute for Micromanufacturing, College of Engineering and Science, 2000-2006

SELECTED PUBLICATIONS (out of 60 peer-reviewed papers)

PEER-REVIEWED SELECTED PUBLICATIONS

- Q. Chen, J. Fang, H.-F. Ji, "Design and Fabrication of SiO2 Microcantilever Using Isotropic Etching with ICP", accepted, **2007**, *IEEE Sensor Journal*,
- Xiaolei Shi, Qi Chen, Ji Fang, Koday Varahramyan, and Hai-Feng Ji, "Al_2O_3 Coated Microcantilevers for Detection of Moisture at ppm Level", *Sen. Actua. B.* **2007**, in press.
- Q. Chen, J. Fang, H.-F. Ji, "Isotropic etch for SiO2 microcantilever release with ICP system", **2007**, In press. Microelectronics Engineering.
- Sreepriya Velanki, H. –F. Ji, T. Thundat, D. A. Blake, "Detection of Cd^{2+} Using Antibody Based Microcantilevers". *Ultramicroscopy*, **2007**, *107*, 1123-1128.
- Y. Lu, H.-F. Ji, "Fabrication of Microcoil/Microsprings for Novel Chemical and Biological Sensing", *Sen. Actua. B: Chem.* **2007**, *123*, 937-941.
- Chandana Karnati, Hongwei Du, Hai-Feng Ji, X. Xu, Yuri Lvov, Wilfred Chen, Ashok Mulchandani "Organophosphrus Hydrolyase Multilayer Modified Microcantilevers for Organophosphorus Detection", *Biosensor Bioelectronics*, **2007**, *22*, 2636-2642.
- H.-F. Ji "Chemical Specificity in Nanomechanical Sensors", *J. Solid State Phenomena.* **2007,** *121-123,* 499-502.
- X. Yan, K. Hill, H.-F. Ji "Surface Stress Changes Induced by Conformational Changes of Proteins", *Langmuir*, **2006**, *22*, 11241-11244.
- Chandana Karnati, Hongwei Du, Hai-Feng Ji, Yuri Lvov, Wilfred Chen, Ashok Mulchandani "Organophosphrus Hydrolyase Multilayer Modified Microcantilevers for Organophosphorus Detection", *Biosensor Bioelectronics*, **2006**, *95*, 333-341.
- Sreepriya Velanki, and Hai-feng Ji "Detection of Feline Coronavirus Using Microcantilever Sensors", *Meas. Sci. Technol.* **2006**, 2964-2968.
- H.-F. Ji, Y. Yang, X. Xu, G. M. Brown, "A Calixarene Based Fluorescent Sr^{2+} and Ca^{2+} probe", *Organic & Biomolecular Chemistry.* Org. Biomol. Chem. **2006**, *4*, 770-772.
- H.-F. Ji, Y. Lu, H. Du, "Coil and Microcoil for Chem/Bio Sensing", *Appl. Phys. Lett.* **2006**, 63504-063504-3.
- Y. Lu, V. Chivukula, M. Wang, H.-F. Ji, "Simulation and Fabrication of Piezoresistive Microbridge for Chem/Biosensors", *J. Micromech. Microeng.* **2006**, *16*, 692-698.
- X. Yan, H.-F. Ji, T. Thundat, "Microcantilever Biosensing", *Current Analytical Chemistry*, **2006,** 2, 297-307

- Yanjun Tang, Xiaohe Xu, Fang Ji, Yu Liang, Hai-Feng Ji* "Perfluorocarbon Nanofilament Array Formation on SiO_2 and the Hyperhydrophobicity of the Surface" *IEEE Transaction on Nanotechnology*, **2006**, 5(4), 415-419.
- X. Yan, K. Hill, X. Shi, H.-F. Ji "Microcantilevers Modified by Horseradish Peroxidase (HRP) Intercalated Nano-Assembly for Hydrogen Peroxide Detection" accepted, *Anal. Sci.* **2006,** 22, 205-208.
- X. Xu, etc. "Intramolecular Triplet Energy Transfer in Donor-Acceptor Molecules Linked by Flexible-Rigid Block Block" *Chem. Eur. J.* **2006**, 12, 5238-5245.
- J. S. Mao, S. Kondu, H. F. Ji, M. J. McShane, "Study of the pH-sensitivity of Chitosan/gelatin hydrogel in neutral pH range by microcantilever methods" *Biotechnology and Bioengineering,* **2006**, 95(3), 333-341
- V. Chivukula, M. Wang, H.-F. Ji, J. Fang, K. Varahramyan, "Simulation of SiO2 based Piezoresistive Microcantilevers", *Sensors and Acturators, A.* **2006**, 125(2), 526-533.
- X. Yan and H.-F. Ji "Glucose Oxidase Multilayer Modified Microcantilever for Glucose Measurement", *Anal. Chem.* **2005**, 77(19), 6197-6204
- Hai-Feng Ji, Yifei Zhang, Vemana Purathomam, Bala Ramuchandran, Donald T. Haynie, Thomas Thundat "1,6-hexanedithiol monolayers as a receptor for specific recognition of CH_3Hg^+", *Analyst*, **2005**, 130, 1577 - 1579
- H.-F. Ji, X. Yan, and M. J. McShane, "Experimental and Theoretical Aspects of Glucose Measurement Using a Microcantilever Modified by Enzyme-Containing Polyacrylamide", *Diabetes Technology & Therapeutics*, **2005**, 7(6), 986-995
- W. Zhou, A. Khaliq, Y. Tang, H.-F. Ji, R. R. Selmic "Simulation and Design of Piezoelectric Microcantilever Chemical Sensors" *Sensors and Actuators, A*, **2005**, 125,(1), 108-114
- Z. Haque, H.-F. Ji "Pretecting Polyaniline Conducting Wire From Oxidation Using A Gas-Nonpermissive Coating" *Thin Solid Film,* **2005**, 448/1-2, 149-152
- L. Pinnaduwage, H.-F. Ji, and T. Thundat, "Moore's Law in Homeland Defense: MEMS with Chemical Specificity" *IEEE Sensors,* **2005**, 5, 774-785
- Y. Tang, H.-F. Ji, "Microcantilevers for in situ pulse measurement". *Instrument Science & Technology,* **2005**, 33, 131-136
- 45. D. Kommireddy, J. Shi, X. Yang, H. Ji, Y. Lvov, "Electrostatic Layer-by-Layer Nanoassembly: Films, Cantilever, Micropatterns and Nanocapsules", *Proc. SPIE*, **2005**, 5592, 120-131
- H.-F. Ji, X. Yan, J. Zhang, T. Thundat, "Molecular Recognition of Biowarfare Agents Using Micromechanical Sensors" Expert Review of Molecular Diagnostics. **2004**, 4(6), 859-866
- H. –F. Ji, Y. Feng, X. Xu, T. Thundat, G. M. Brown, "Converting Photons to Nanomechanical Motion" Chem. Commun. **2004**, 2532
- X. Yan, H.-F. Ji, Y. Lvov, "Glucose Monitoring Using Microcantilever Modified by GOx Using Layer-by-Layer Technology" Chem. Phys. Lett. **2004**, *396*, 34-37
- J. Zhang, H.-F. Ji, "E. Coli Recognition Using E. Coli O157:H7 Modified Microcantilevers", Anal. Sci. **2004**, 20, 585-587
- Y. Tang, H.-F. Ji, J. Fang, T. Thundat, G. Brown, "Detection of Femtomolar Concentration of HF Using an SiO2 Microcantilever" Anal. Chem. **2004,** 76(9) 2478-2481
- Y. Zhang, G. M. Brown, D. Snow, R. Sterling, H.-F. Ji, "A pH Sensor Based on a Microcantilever Coated with Intelligent Hydrogel", Instrument Science & Technology, **2004**, 32, 361-369
- K. Liu, H.-F. Ji, "Detection of Pb2+ Using a Hydrogel Swelling Microcantilever Sensor", Anal. Sci., **2004**, 20, 9-11
- Yifei Zhang, Srinivasan P Venkatachalan, Hao Xu, Xiaohe Xu, Prasad Joshi, Hai-Feng Ji*, Marvin Schulte "Binding-Driven Micromechanical Motion for Novel Label-free Drug Discovery" Biosensors & Bioelectronics, **2004,** 19, 1473-1478
- X. Yan, Y. Tang, H.-F. Ji, Y. Lvov, T. Thundat "Detection of Organophosphate Using an AChE-Coated Microcantilever" Instrument Science & Technology. **2004**, 32, 175-183

SYNERGISTIC ACTIVITIES

- Recognized by the "popular" press -- Chemical and Engineering News, March 20, 2000, Science/Technology Concentrations. http://pubs.acs.org/isubscribe/journals/cen/78/i12/7812scic.html.
- Developed a piezoelectric methods for chemical and biological sensing and a novel drug screening technology based on microcantilevers, both invention disclosures filled in 2002.
- NIH ZRG1 panel reviewer since 2002 and proposal reviewer for DOE.
- NSF SENSOR program panel reviewer
- Manuscripts constant peer reviewer: J. Amer. Chem. Soc. and Langmuir.
- Developed a new course Polymer Principles for Electrical Engineering and Mechanical Engineering at Tech.

COLLABORATORS AND OTHER AFFILIATIONS

- Dr. Don Haynie, Loiuisana Tech University
- Dr. Thomas Thundat, Oak Ridge National Laboratory
- Dr. Gilbert Brown, Oak Ridge National Laboratory
- Dr. Reza Dabestani, Oak Ridge National Laboratory
- Dr. Marvin Schulte, University of Louisiana at Monroe

7. BIOGRAPHICAL SKETCHES
c. Dr. H. Lee Sawyer, Jr.

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and consultants and collaborators. Begin with the principal investigator/program director. Photocopy this page for each person.

Name **H. Lee Sawyer, Jr**	Position Title **Associate Professor of Physics**

EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training.

INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED	FIELD OF STUDY
The Florida State University, Tallahassee, FL	Ph.D.	1991	Physics, Florida State University Advisor: David Levinthal
Northeast Louisiana University, Monroe LA	B.S.	1985	Physics, Magna cum Laude

RESEARCH AND PROFESSIONAL EXPERIENCE: Starting with present position, list, in reverse chronological order, previous relevant employment, experience, and honors. Key personnel includes the principal investigator and any other individuals who participate in the development or execution of the project. Key personnel typically will include all individuals with doctoral or other professional degrees, but in some projects will include individuals at the masters or baccalaureate level provided they contribute in a substantive way to the development or execution of the project. Include present membership on any Federal Government public advisory committee.
List, in reverse chronological order, the titles, all authors, and complete references to pertinent publications during the past five years and to representative earlier publications pertinent to this application.
DO NOT EXCEED TWO PAGES.

CONTACT INFORMATION

P. O. Box 10348, Physics Program, Louisiana Tech University, Ruston LA 71272
Office: Office: Carson-Taylor Hall, Room 316
Email: sawyer@phys.latech.edu Phone:
Phone: (318) 257 4053; Fax: (318) 257-3823

EMPLOYMENT HISTORY

2003-present:Associate Professor of Physics and Interim Academic Director of Chemistry and Physics, Louisiana Tech University.
1997 – 2003 : Assistant Professor of Physics, Louisiana Tech University
1992 - 1996 : Postdoctoral Researcher, The University of Texas at Arlington.
1991-1992 : Postdoctoral Researcher, The Florida State University.
1985 - 1991 : Graduate Assistant, The Florida State University.
1983 - 1985 : Undergraduate Lab Assistant, Northeast Louisiana University.
1978 - 1983 : Library Assistant, Ouachita Parish Public Library.

HONORARY SOCIETIES

- Sigma Xi research honor society:
- Sigma Pi Sigma physics honor society
- Advisor for Louisiana Tech chapter.
- Phi Kappa Phi honor society
- Mortar Board honor and service society

PROFESSIONAL AFFILIATIONS

American Physical Society, including

- A.P.S. Division of Particles and Fields,
- A.P.S. International Physics Group, and
- A.P.S. Physics and Society Forum.
- American Association of Physics Teachers
- Society of Physics Students
- Advisor for Louisiana Tech chapter.
- Zone 10 (LA,AR, MS, western TN) representative on national SPS council
  Fermilab Users Group

TEACHING

Courses Louisiana Tech University: PHY 201, PHYS 202, PHYS 416 PHYS 418 (Modern Lab I),PHYS 417 (Modern II),PHYS 419 (Modern Lab II),PHYS 422 (Mechanics I), PHYS 423 (Mechanics II), PHYS 462, PHYS 465 (PHYS of Sound Honors Course) and PHYS 540 (Computational Methods in PHYS I) PHYS

PROJECT EXPERIENCE

- "Research in Experimental High Energy Physics", funded by the Department of Energy. Lee Sawyer (PI); Z.D. Greenwood (Co-PI). Amount of Grant: $510,000 over three years, beginning in 2002. Renewed for 2005-2008.

- "Evaluation of a GEM-based Tracker for Forward Tracking at the NLC". Supplemental request to the Dept.of Energy,as part of the American Next Linear Collider Working Group proposal. Amount of Grant: $37, 3490 (2003), $35,000 (2004).
- "Research in Experimental High Energy Physics", funded by the Department of Energy. Kathleen Johnston, PI; Lee Sawyer and Z.D. Greenwood, Co-PI. Amount of Grant: $465,000 over three years, beginning in 1999.
- "Development of Object-Oriented Software for High Energy Physics Experiments", funded by LA Board of Regents' Educational Quality Support Fund. Lee Sawyer, PI. Amount of Grant : $68,000 over two years, beginning in 1999.
- Startup funding, Louisiana Tech Engineering and Science Foundation. Lee Sawyer, PI, Amount of Grant: $14,000 in 1997.
- "Memorandum of Understanding with Fermi National Accelerator Laboratory", covering construction of the ICD upgrade electronics and design of the ICD fiber optic cables. Lee Sawyer, PI. Amount of grant: $26,838 for FY1997, $87,000 for 1998-99, $18,000 for 2000-2001.
- Dept. of Education Action Agenda grant "Implementing an Integrated Engineering Curriculum" (major participant. Received salary support)
- NSF Major Research Instrumentation grant. "The Multidisciplinary Engineering Equipment Team" (major participant. In charge of purchasing and installing computers and PC board design station)
  NSF CCLI grant. "Integrated Science Curriculum Development" (major participant) $200,000

SELECTED PUBLICATIONS

Over 96 published peer-reviewed articles and papers since coming to Louisiana Tech University (195 publications in total),

- "Improved W Boson Mass Measurement With The D0 Detector." V.M. Abazov, *et al.* Phys.Rev.D66:012001 (2002)
- "A Direct Measurement Of W Boson Decay Width." V.M. Abazov, *et al.* Phys.Rev.D66:032008 (2002)
- "Inclusive Jet Production In p Anti-p Collisions. " B. Abbott *et al.* Phys.Rev.Lett.86:1707-1712 (2001)
- "Differential Cross-Section For W Boson Production As A Function Of Transverse Momentum In p Anti-p Collisions At $\sqrt{s}$ = 1.8 TeV. " B. Abbott *et al.* Phys.Lett.B513:292-300 (2001)
- "Search For Large Extra Dimensions In Dielectron And Diphoton Production. " B. Abbott *et al.* Phys.Rev.Lett.86:1156-1161 (2001)
- "Cosmic Ray Tests Of The D0 Preshower Detector. " Baringer, P ; et al.; Nucl.Instrum.Meth.A469:295-310 (2001)
- "A Search For Dilepton Signatures From Minimal Low-Energy Supergravity In p Anti-p Collisions At $\sqrt{s}$ = 1.8-TeV. "By D0 Collaboration (B. Abbott *et al.*). Phys. Rev. D63:091102 (2001)
- "Results From A New Combined Test Of An Electromagnetic Liquid Argon Calorimeter With A Hadronic Scintillating-Tile Calorimeter. By ATLAS Collaboration (S. Akhmadalev *et al.*). Nucl.Instrum.Meth.A449:461-477 (2000)
- "A Measurement of the W Boson Mass Using Electrons at Large Rapidities. " B. Abbott *et al.*, Fermilab-Pub-99/259-E. Phys. Rev. Lett. 84:222-2227 (2000)
- "Differential Production Cross Section Of *Z* Bosons as a Function of Transverse Momentum at$\sqrt{s}$ =1.8 TeV. " B. Abbott *et al.*, Phys. Rev. Lett. 84:2792-2797 (2000)
- "Direct Measurement of the Top Quark Mass. " S. Abachi *et al.*, Fermilab-Pub-97/059-E Phys. Rev. Letters 79, p 1197 (1997)

7. BIOGRAPHICAL SKETCHS.
d. Dr. William C. Deese

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and consultants and collaborators. Begin with the principal investigator/program director. Photocopy this page for each person.

Name **Deese, William C.**	Position Title **Professor of Chemistry**

EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training.

INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED	FIELD OF STUDY
University of Central Arkansas; Conway, Arkansas	B.S.	1976	Chemistry
University of Arkansas; Fayetteville, Arkansas	Ph.D.	1981	Inorganic Chemistry

RESEARCH AND PROFESSIONAL EXPERIENCE: Starting with present position, list, in reverse chronological order, previous relevant employment, experience, and honors. Key personnel includes the principal investigator and any other individuals who participate in the development or execution of the project. Key personnel typically will include all individuals with doctoral or other professional degrees, but in some projects will include individuals at the masters or baccalaureate level provided they contribute in a substantive way to the development or execution of the project. Include present membership on any Federal Government public advisory committee. List, in reverse chronological order, the titles, all authors, and complete references to pertinent publications during the past five years and to representative earlier publications pertinent to this application. DO NOT EXCEED TWO PAGES.

CONTACT INFORMATION

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Chemistry Program
Louisiana Tech University
Ruston LA 71272
Tel. (318) 257-4066; Fax: (318) 257-3823
e-mail: wcdeese@chem.latech.edu
Webpage: http://www.chem.LaTech.edu/~deese/

EMPLOYMENT(1996 - present) Professor; Louisiana Tech University
- (1988 - 1996) Associate Professor; Louisiana Tech University
- (1981 - 1988) Assistant Professor; Louisiana Tech University

HONORS
- Faculty Senate Chair Award - 1991
- Finalist for F.J. Taylor Undergraduate Teaching Award - 1992
- Chemical Manufactures Association Catalysts Award Nominee – 1994
- F. J. Taylor Foundation Undergraduate Teaching Award – 1996
- Carnegie Foundation Professors of theYear Award Nominee - 1996
- College of Engineering and Science Outstanding Achievement in Teaching – 1998
- College of Engineering and Science Excellence in Education Award - 2001

FUNDED PROJECTS IN SCIENCE EDUCATION (PI or Co-Director)
- Louisiana Tech University Faculty Development Awards - "Participation in the 11th Biennial Conference on Chemical Education". ($1000)
- Dwight Eisenhower MSEA, "The North Louisiana Chemical Education Improvement Project". (Funded 1990, $43,000)
- LEQSF, "Enhancement of Inorganic Chemistry Laboratories". (Funded Fall, 1990, $45,988)
- NSF-LaSER, "Involvement of North Louisiana Students in Experimental Chemistry". (Funded May, 1991, $30,000)
- NSF, "Middle School Math/Science Project". (Funded Jan., 1992 through May, 1996, $501,000)
- LEQSF, "Enhancement of General Chemistry Program at Louisiana Tech University". (Funded 1993, $31,000)
- Dwight Eisenhower MSEA, "Collaborative Chemistry Team Teaching Project". (Funded 1993-94, $33,000)
- Henry and Camille Dreyfus Foundation, "Developing and Assessing Conceptual Understanding of Chemistry with Demonstrations." (Funded June, 1997 – June 1998, $20,000)
- Louisiana Space Consortium, "Developing and Assessing Conceptual Understanding of Chemistry with Demonstrations." (Funded June, 1997 – June 1998, $7,366)
- Educational Advancement Foundation, "Effect of Science Demonstrations on Student Achievement in Introductory Chemistry Classes" (Funded Fall, 1998 - Fall, 1999, $20,000)
- Louisiana Collaborative for Excellence in the Preparation of Teachers, "Continuation of Research Starter Grant" (Funded January - July, 2000, $41,756.)

- Louisiana Systemic Initiatives Project (LaSIP), "Incorporating the History of Science into the Science Curriculum" (Funded June - September, 2001, $25,075).
- National Science Foundation, "Chemistry Concepts and Connections for Teachers". (Funded Fall 2001 - Spring 2005, $1,600,000)

LIST OF PUBLICATIONS

- "Demonstrating Molecular Shapes", W. C. Deese, Journal of College Science Teaching, Vol.XVI, (Nov., 1986).
- "A Miniature Hot Air Balloon and Charles' Law", W. C. Deese, Journal of Chemical Education, Vol. 67, 672 (1990).
- "Using Science Demonstrations to Assess Conceptual Understanding and Critical Thinking", Radford, Ramsey, and Deese, The Science Teacher, Vol. 62, No. 7, 52-55, (Oct., 1995).
- "Demonstrating the Bowling Ball in the Boat Puzzle", W.C. Deese, R. Hamburg, The Physics Teacher, Vol. 34, No. 3, 197 (Mar.,1996).
  "Diffusion of Gases Through Punctured Balloons", W. C. Deese, A. M. Washburn, Journal of Chemical Education Vol. 73, 540 (1996).
- "The Ring of Fire Demonstration", W. C. Deese, CHEM 13 NEWS, 8, (Nov., 1996).
- "Experimenting with Interdisciplinary Science", L. L. Ramsey, D. L. Radford, W. C. Deese, *Journal of Chemical Education*, **74,** No. 8, 946, (Aug., 1997).
- "Evaporation", W. C. Deese, *Encyclopedia Encarta 2000.*
- "Using Demonstration Assessments to Improve Learning", *Journal of Chemical Education*, Vol. 77, 1151-1516 (Nov. 2000).

WORKSHOPS CONDUCTED FOR TEACHERS OF SCIENCE

- Laboratory Safety for the High School Chemistry Teacher.
- Microscale Laboratory Experiments for High School Chemistry.
- Managing the High School Chemistry Storeroom.
- Dilution Solutions - Solution Preparation Workshop.
- Building Molecular Models.
- Chemistry Demonstration Kits: A Make-it, Take-it Workshop.
- Chemical Activities for K-6 Science Teachers
- Polymer Science Activities for Middle School Teachers
- Chemistry Demonstration Kits (II): Another Make-it, Take-it Workshop.
- Teaching About the Physical Behavior of Matter in Elementary Science.
- Cooperative Learning in the Elementary Science Classroom.
- Teaching Science with Materials Made from Plastic Bottles.

SCIENCE AND THE GENERAL PUBLIC

- Numerous Presentations to School Groups and to Civic Clubs Demonstrating How Science Can Be Fun.
- Weekly Segment on "KTVE AM Show" Showing How Science Can Be Fun. (Channel 10, Monroe, Louisiana 1992-94)
- "KTVE AM Show Science Puzzler", Monthly Segment in 1994.
- "Science Matters", weekly segment on KNOE TV's "Kidsworld", 1995.

8. CURRENT AND PENDING SUPPORT

a. Dr. Upali Siriwardane

(From ALL sources, including Board of Regents Support Fund)

The following information MUST be provided for each investigator and other senior personnel. Use additional sheets as necessary.

NAME OF INVESTIGATOR: **Upali Siriwardane**

Status of Support: ___Current _X_Pending ___Submission Planned in Near Future

Contract Number/Proposal Title: Incorporation of Nano-scale Surface Characterization Techniques into LA Tech Chemistry/Physics Integrated Labs

Source of Support: Louisiana Board of Regents - Enhancement Program FY-2007-2008

Award Amount (or Annual Rate): $ 85,238 Period Covered: 07/01/08-06/30-09

Location of Activity: Louisiana Tech University

Person-Months or % of Effort Committed to the Project: 10 Cal Yr 10 Acad 10 Summ

---

Status of Support: _X_Current ___Pending ___Submission Planned in Near Future

Contract Number/Proposal Title: "Development of Low Cost Membranes (Ta, Nb, and Cellulose Acetate) for $H_2/CO_2/CO$ Separation in WGS Reactors,", ($191,000) 2006-2009.

Source of Support: Deparment of Energy, National Energy Technology Laboratory

Award Amount (or Annual Rate): $ 191,000 Period Covered: 2006-2009

Location of Activity: Louisiana Tech University

Person-Months or % of Effort Committed to the Project: 15 Cal Yr 10 Acad 30 Summ

---

Status of Support: ___Current ___Pending ___Submission Planned in Near Future

Contract Number/Proposal Title:

Source of Support:

Award Amount (or Annual Rate): $___ Period Covered:___

Location of Activity:

Person-Months or % of Effort Committed to the Project: ___Cal Yr ___Acad ___Summ

---

Status of Support: ___Current ___Pending ___Submission Planned in Near Future

Contract Number/Proposal Title:

Source of Support:

Award Amount (or Annual Rate): $___ Period Covered:___

Location of Activity:

Person-Months or % of Effort Committed to the Project: ___Cal Yr ___Acad ___Summ

(Form 3, rev.2007)

8. CURRENT AND PENDING SUPPORT

b. Dr. Haifeng (Frank) Ji

(From ALL sources, including Board of Regents Support Fund)

The following information MUST be provided for each investigator and other senior personnel. Use additional sheets as necessary.

NAME OF INVESTIGATOR: **Haifeng (Frank) Ji**

Contract Number/Proposal Title: Incorporation of Nano-scale Surface Characterization Techniques into LA Tech Chemistry/Physics Integrated Labs

Source of Support: Louisiana Board of Regents – Enhancement Program FY-2007-2008

Award Amount (or Annual Rate): $___85,238___ Period Covered:__07/01/08-06/30-09___

Location of Activity: Louisiana Tech University

Person-Months or % of Effort Committed to the Project: __5__Cal Yr _ 5_Acad _____Summ

---

Status of Support: _ X_Current ___Pending ___Submission Planned in Near Future

Contract Number/Proposal Title: Microcantilever Surface Modification of OPH Enzymes for OP Detection

Source of Support: NSF

Award Amount (or Annual Rate): $___$225,000___ Period Covered:_ 10/1/2004-9/30/2008__

Location of Activity: Louisiana Tech University

Person-Months or % of Effort Committed to the Project: _10__Cal Yr __!0_Acad __!0_Summ

---

Status of Support: _X_Current ___Pending ___Submission Planned in Near Future

Contract Number/Proposal Title: Microcantilever Sensors for Measurement of Low Level Moisture in Natural Gas

Source of Support: Louisiana Board of Regent ITRS

Award Amount (or Annual Rate): $_322,564__________ Period Covered:_ 9/1/2006-8/31/2009___

Location of Activity: Louisiana Tech University

Person-Months or % of Effort Committed to the Project: _10__Cal Yr __!0_Acad __!0_Summ

---

Status of Support: _X_Current ___Pending ___Submission Planned in Near Future

Contract Number/Proposal Title: Microsensors for Detection of Toxic Proteins and Bacteria, NSF SBIR Phase I.

Source of Support: National Science Foundation

Award Amount (or Annual Rate): $__$100,000________ Period Covered:_ 7/1/2007-6/30/2008____

Location of Activity: Louisiana Tech and Sensacoil Inc.

Person-Months or % of Effort Committed to the Project_10__Cal Yr __!0_Acad __!0_Summ

(Form 3, rev.2007)

8. CURRENT AND PENDING SUPPORT

c. Dr. H. Lee Sawyer, Jr

(From ALL sources, including Board of Regents Support Fund)

The following information MUST be provided for each investigator and other senior personnel. Use additional sheets as necessary.

NAME OF INVESTIGATOR: **H. Lee Sawyer, Jr**

Status of Support: ___Current _X__Pending ___Submission Planned in Near Future

Contract Number/Proposal Title: Incorporation of Nano-scale Surface Characterization Techniques into LA Tech Chemistry/Physics Integrated Labs

Source of Support: Louisiana Board of Regents – Enhancement Program

Award Amount (or Annual Rate): $____85,238______________________ Period Covered:__07/01/08-06/30-09____

Location of Activity: Louisiana Tech University

Person-Months or % of Effort Committed to the Project: __5__Cal Yr _5_Acad _____Summ

---

Status of Support: _X_Current ___Pending ___Submission Planned in Near Future

Project/Proposal Title: Research in High energy Physics at Fermi National Accelerator Laboratory

Source of Support: Dept. of Energy

Award Amount (or Annual Rate): $_230,00______________ Period Covered:__June, 2007 - June, 2008_______

Location of Activity: Louisiana Tech University

Person-Months or % of Effort Committed to the Project: _____Cal Yr __3__Acad __2__Summ

---

Status of Support: _X__Current ___Pending ___Submission Planned in Near Future

Project/Proposal Title: Neutron-Enhanced Calorimetry for Hadrons

Source of Support: Dept. of Energy Advanced Detector Program

Award Amount (or Annual Rate): $_34,000___________ Period Covered:__Oct, 2007 – Sept, 2008___

Location of Activity: Louisiana Tech University

Person-Months or % of Effort Committed to the Project: _____Cal Yr __10_Acad _____Summ

---

Status of Support: ___Current ___Pending ___Submission Planned in Near Future

Contract Number/Proposal Title:

Source of Support:

Award Amount (or Annual Rate): $________________________ Period Covered:__________________

Location of Activity:

Person-Months or % of Effort Committed to the Project: _____Cal Yr _____Acad _____Summ

(Form 3, rev.2007)

8. CURRENT AND PENDING SUPPORT
d. William C. Deese

(From ALL sources, including Board of Regents Support Fund)

The following information MUST be provided for each investigator and other senior personnel. Use additional sheets as necessary.

NAME OF INVESTIGATOR: **William C. Deese**

Contract Number/Proposal Title: Incorporation of Nano-scale Surface Characterization Techniques into LA Tech Chemistry/Physics Integrated Labs

Source of Support: Louisiana Board of Regents – Enhancement Program

Award Amount (or Annual Rate): $__85,238__ Period Covered:__07/01/08-06/30-09__

Location of Activity: Louisiana Tech University

Person-Months or % of Effort Committed to the Project: : __5__Cal Yr _5_Acad _____Summ

---

Status of Support: ___Current ___Pending ___Submission Planned in Near Future

Contract Number/Proposal Title:

Source of Support:

Award Amount (or Annual Rate): $__________ Period Covered:__________

Location of Activity:

Person-Months or % of Effort Committed to the Project: _____Cal Yr _____Acad _____Summ

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Status of Support: ___Current ___Pending ___Submission Planned in Near Future

Contract Number/Proposal Title:

Source of Support:

Award Amount (or Annual Rate): $__________ Period Covered:__________

Location of Activity:

Person-Months or % of Effort Committed to the Project: _____Cal Yr _____Acad _____Summ

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Status of Support: ___Current ___Pending ___Submission Planned in Near Future

Contract Number/Proposal Title:

Source of Support:

Award Amount (or Annual Rate): $__________ Period Covered:__________

Location of Activity:

Person-Months or % of Effort Committed to the Project: _____Cal Yr _____Acad _____Summ

(Form 3, rev.2007)

9. **PPOPOSAL APPENDIX**

a. List of CPMS Laboratory Equipment

1) **JEOL 270MHz High Resolution FT-NMR Spectrometer** Model Multinuclear GSX-270 (09-21-1990,$ 173,000). This NMR was recently upgrade with a new Silicon Graphics 2 computer and Delta 3.2.2 NMR software ($ 55,000 January 2001). Windows software and magnet rebuilding ($25,000, 2006).
2) **SCINTAG MZ4 powder Diffractometer system** and Scintag's DMSNT multi-user diffraction management software package (1997, $ 50,000).
3) **VARIAN-Saturn 2200-MS and CP-3800 GC-GC/MS system** computer and software. (2002, $ 90,000)
4) **SEM and EDXS system:** AMRAY 1820 with Energy Dispersive X-Ray Spectrometer. SEM resolution: 3.5 nm at 30 kV and magnification up to 500,000X. EDXS has elemental analysis capability from B to U with a resolution better than 145 eV.
5) **MAGNETOMETER- MAGNETIC SUSCEPTIBILITY SYSTEM**: This unit consists of a magnet, power supply to the magnet(Elgar Electronics Corporation), ultra sensitive microbalance (C I Electronics Ltd), computer and software needed for measuring voltage, temperature, weight (magnetic susceptibility and magnetization). ($38,000, March 2006).
6) **SHIMADZU DTA-50 Thermal Analyzer** software and computer ($27,000, March 2000).
7) **SHIMADZU TGA-50H Thermal Gravimetric Analyzer** software and computer ($20,000 March 2006).
8) **SHIMADZU UV-vis Spectrometer**, computer and software ($ 2000,$27,000).
9) **EG&G-Perkin Elmer Potentiostat/Galvanostat** model 263A:Electrochemical Analyzer($15,000, April 2000).
10) **PARR INSTRUMENT- High Pressure Bomb (Autoclave)** (452HC2-7316082682) and Temperature Control Unit (06/1981, $ 2,266)
11) **VACUUM ATMOSPHERES -DRY BOX** (10-30-90, $ 16,200).
12) **VACUUM LINE**- with McLeod gauge, Fractionation, and reaction train, gas collecting bulbs, 1402B Sargent Welch vacuum pump (10/1990 $ 7,000)
13) **ACE GLASS- Photochemical Reactor**. (11/1990, $1,300).
14) **HEWLETT PACKARD-Model 5890A GC**, (10/1990, $ 12,400)
15) **GCB Vanata AA Spectrometer** with 20 halo cathode tube lamps (1997, $ 23,000).
16) **WATERS ASSOCIATES liquid chromatograph** including read out control system ($ 10,950).
17) **HART SCIENTIFIC DSC:** temperature range 0- 100°C, This instrument will not perform thermal experiments or demonstrations proposed in this project because of the limited temperature range, unreliabile computer interface , or the obsolete software (1985).
18) **HITACHI UV-visible Spectrometer** with a built in Recorder. (08/1982, $ 11980).
19) **HITACHI UV-fluorescence spectrometer** (1995, $25,000)
20) **HITACHI UV-visible Spectrometer** with a built in Recorder. (08/1982, $ 11980)
21) **BAUSCH & LOMB Polarizing Microscope**. (06/1980, $ 4,251)
22) **VWR SCIENTIFIC- Ploarimeter** Model SR-6 (11/1990, $3,500)
23) <u>AUTOMATIC POLARIMETER</u>: The **AUTOPOL V** Polarimeter
24) **CARL-ZEISS JENA ABBE** Refractometer.
25) **BECKMAN model J2-21** centrifuge. (07/1981, $ 30,000).
26) **PACKARD TRI-CARB liquid scintillation spectrometer**. (08/1981, $ 8,250).
27) **PERKINS ELMER HPLC**: with several columns for the analysis.
28) **MATTSON FT-IR Spectroscopy: Instrument FT-IR**: 2020 Galaxy Series FT-IR Spectrometer including a Pentium computer data work station, HP plotter and Saddler IR library.

29) **FURNACES FRO HIGH TEMPERATURE REACTIONS**

- **Lindberg/ Blue M Box Furnace 100-1200°C**,208/240Volts, 50/60Hz, 4500 Watts, Multi Segment, Single Program, Chamber Dimensions,13"W x 11"D x 7"H
- **Lindberg/ Blue M Box Furnaces 500-1500°**,208/240Volts, 50/60Hz, 6400 Watts, 16 Segment, single Program Chamber Dimensions 6"W x 12"D x 5"H, Vertical Lift Door,
- **Lindberg/ Blue M Tube Furnace 1100°**, 208/240V, 50/60Hz 3800 Watts 1100° Solid, Three Zone, 16 Segment Integrated Controller, Temperature Range 100°C to 1100°C Heated Zone Dimensions 35" x 17" x 21" 1"
- **Tube Furnace Split-Hinge,** 120V, 50/60 Hz 800 Watts Single Zone, Integrated Controller,
- Lindberg/ Blue M Temperature Range 00°C to 1100°C Heated Zone Dimensions 15" x 11" x 16"
- Temperature Controllers for chemical reactors
- **THEROLYNE High temperature furnace 1200°C Box Furnace**/Model BF51842.

30) **CANBERRA HPGe detector**: A high energy resolution gamma detector used for positron annihilation gamma radiation, Doppler broadening measurement studies.

31) **CANBERRA Series 20 MCA** For gamma spectroscopy studies: multichannel analyzer

32) **HALL EFFECT** Gaussmeter Probe (Model mG-5D)

33) **KEITHLEY 220 Current For Hall effect Measurements** source 485 picoammeter measurement system

34) **KIETHLEY 195 Multimeter: For four probe** resistively measurement.

35) **COMPUTER LAB**

Ten (chemistry) and twelve (physics) computers (Pentium processor) with panel terminals connected to the network server (Unix/Windows operating system); Program include: MS-word, SciFinder, ChemDraw, ChemWindows, REFLEX, QPRO, sigmaplot, Quatro, MNDO (for energy calculation), Auxm, Mathematica, HyperChem, NUTS NMR data Software, Carline Crystallography 3.0, WINGX for single crystal X-ray Data, and FIRST (IR software). There are four computer projectors and two large screen TVs mounted on movable carts for classroom and laboratory computer demonstrations.

43) **VIDEO PRODUCTION UNIT**

This system includes three Panasonic Professional grade VCRs & two camcoders, Pentium computer with Video-Machine video editing system software, Infocus color projection device, Nview computer video projection device, Proxima 16 color projection device, Two 32" &25" GE TVs and two VCR for classroom presentation of Video.

b. Course description

Affected Chemistry & Physics Courses

b.1 Chemistry Courses

CHEM 103: Integrated General Chemistry: Theory and practice of general chemistry for science majors.

CHEM 104: Integrated General Chemistry: Theory and practice of general chemistry for science majors.

CHEM 205: Analytical Chemistry: Analytical Chemistry: Theory and practice of analytical chemistry.

CHEM 281: Intermediate Inorganic Chemistry: Introduction to Inorganic Chemistry including a Systematic Study of the Periodic Table with emphasis on the Structure, Properties and Reactivity of Inorganic Compounds. This course contains a laboratory component.

CHEM 313: Physical Chemistry: Physical Chemistry Laboratory: Laboratory experiments in physical chemistry. Several experiments deal with the properties of gases, liquids and solids.

CHEM 314: Physical Chemistry Laboratory Component: Physical Chemistry Laboratory: Laboratory experiments in physical chemistry. Several experiments deal with the properties of gases, liquids and solids.

CHEM 466: Instrumental Analysis: Advanced Analytical Chemistry. Theory and practice of optical methods of analysis, advanced electrochemical techniques and modern separation methods. This course contains a laboratory component.

CHEM 471: Methods, Materials and Activities for Teaching Chemistry: A Course Specially designed for High School Chemistry Instructors. This course contains a laboratory component.

CHEM 481: Advanced Inorganic Chemistry: An advanced study of the fundamentals (Symmetry, Group Theory, Ligand Field Theory Principles of Coordination Chemistry etc.) and the periodic classification of elements, their reactions and other inorganic principles. This course contains a laboratory component.

CHEM 498: Undergraduate Research: Chemistry seniors participate in undergraduate research projects under the supervision of faculty.

CHEM 502: Selected Topics in Organic Chemistry: Areas covered will vary; however they will generally include advanced organic synthesis and related structure identification with emphasis on spectroscopic techniques.

CHEM584: Chemistry of Coordination Compounds: An advanced study of structure, preparation, characterization and properties of transition metal compounds. This course contains a laboratory component.

CHEM 586: Special Topics in Inorganic Chemistry: Following topics are taught on a rotating basis: polymer science, materials science, solid sate structure and X-ray Diffraction, electrical and magnetic properties of materials. This course contains a laboratory component.

b.2 Physics Courses

PHYS 261: General Physics Lab with emphasis on problems in electricity and magnetism, optics, and modern physics.

PHYS 304: Physical Optics: Designed to educate students to the wave theory of light and the beginnings of quantum theory.

PHYS 320: Optics Laboratory: Designed to give students hands-on experience in wave theory of light and the beginnings of quantum theory.

PHYS 408: Electricity and Magnetism Laboratory: Experiments to solidify the fundamental theories of electricity and magnetism.

PHYS 409: Electricity and Magnetism Laboratory: Advanced experiments to solidify the fundamental theories of electricity and magnetism.

PHYS 410: Quantum Mechanics:

PHYS 412: Introduction Solid-state Physics: Introduction to the fundamentals of material structures at the atomic, nano- and micro-scale emphasizing properties.

PHYS 420: Optics Laboratory: Experiments in optics to demonstrate advanced optical phenomena.

PHYS 422: Physical Mechanics. Static, particle dynamics, dynamics of a rigid body, kinetic theory, elasticity, wave motion, and behavior of fluids. Fundamental importance of mechanical principles in all fields of physics emphasized.

PHYS 424: Quantum Mechanics: Quantum theory is designed to introduce students to the mechanics of the microscopic world.

PHYS 425: Selected Topics in Modern Physics. This course includes topics from solid state physics such as crystal structures, band theory, and electric and magnetic properties of solids.

PHYS 435: Undergraduate Research: Chemistry seniors participate in undergraduate research projects under the supervision of faculty.

PHYS 470C: Undergraduate Special Topics, Solid-state Physics: Introduction to solid state physics to study relationship between structure and thermal, electrical, and magnetic properties of materials

PHYS 503: Topics in Physics: This course includes topics from solid state physics such as crystal structures, band theory, and electric and magnetic properties of solids.

PHYS 511: Electromagnetic Theory: Advanced treatment of the theory of electricity and magnetism.

PHYS 512: Solid-State Physics: Advanced solid state physics course to introduce relationship between structure and thermal, electrical, and magnetic properties of materials

PHYS 522: Quantum Mechanics. An outline of the principles of wave mechanics and quantum mechanics, followed by their application to problems in atomic and nuclear theory.

b. **New Demonstrations, Experiments and Research Projects using AFM/SPM System**

Analysis of following demonstrations and experiments various materials could be conducted to correlate the structure and properties of materials using AFM in various mode revealing nano-scale features.

- **Polymer Composites**

An AFM can readily measure images of composite polymers with little or no sample preparation. With techniques such as vibrating phase mode it is possible to visualize differences in the composition in composite polymers.

The local mechanical properties of silica-reinforced silicone composites could be investigated using a atomic force microscopy technique. (Allen T. Chien, Tom Felter, James D. LeMay, Mehdi Balooch Mat. Res. Soc.Volume: 15 Pages: 838-841 (2000))

- **Phase transitions**

As materials undergo phase transitions, they often have changes in their surface structure that can be readily imaged with an AFM. There are many methods for heating a sample including using a heating stage. (B.A.Strukov, S.T.Davitadze, V.V.Lemanov, S.G.Shulman, Y.Uesu and S.Asanuma,

- **Magnetic Materials**

AFM Magnetic Force Microscopy (MFM) mode measures magnetic structures/domains of a surface using a magnetic cantilever. The variations in magnetic forces are measured in acoustic AC mode. MFM is a nondestructive technique that can be used to evaluate magnetic materials and devices or to locate and map magnetic defects on a variety of materials and surfaces.

• **Surface Texture**

Atomic force microscopes give exceptional contrast on samples with little or no surface features. Such contrast is not possible with any other type of microscope.

A metallic surface corrosion study in aqueous NaCl solutions using atomic force microscopy (AFM). Skolnik, Andrew M.; Hughes, W. Christopher; Augustine, Brian H. ames Madison University, Harrisonburg, VA, USA. Chemical Educator [Electronic Publication] (2000), 5(1), 8-13.

• **Defects**

Defects in many types of materials such as metals, crystals, and ceramics are easily measured with an AFM. Because the AFM measures three dimensional surface structure, it is possible to measure not only the area of the defect but also the volume of a defect at a surface.

• **Crack/scratch propagation**

An AFM is ideal for studying crack propagation in surfaces because the AFM gives great contrast on flat samples. If the crack is longer than the FOV of the AFM scanner, it may be necessary to measure several AFM images in succession.

• **Coatings**

Many types of coatings on surfaces are directly measurable with an AFM. The only requirement is that the coating surface roughness be less than the dynamic range of the Z piezo in the AFM.

• **Nanoparticles**

The AFM can easily visualize nanoparticles with sizes ranging from a few nanometers to a few microns. It is possible to measure the size of individual nanoparticles as well as measure the parameter distribution of an ensemble of nanoparticles. Parameters such as particle size, volume, circumference and surface area are readily measured.

Synthesis and Characterization of Gold nano particles of size 5 nm, Daniel, M.-C.; Astruc, D.; Chem. Rev.; (Review); 2004; 104(1); 293-346.

• **Carbon Nanotubes**

High resolution images of both single wall and multi-wall carbon nanotubes are measurable with the AFM. The nanotubes must be dispersed on a flat surface for imaging.

(Imaging Carbon Nanotubes using AFM, Magdalena Preciado López, David Zahora, Monica Plisch, http://www.cns.cornell.edu/documents/Imagingcarbonnanotubes.pdf)

• **Crystal Structures**

Atomic terraces on crystal surfaces are readily measured with an AFM in ambient air.

• **Cells**

An AFM can readily measure images of cells both in ambient air and submerged in a liquid. The cells must be rigidly adhered to a surface for successful imaging. With the AFM it is possible to measure the mechanical activity of a cell by simply placing the probe on the surface of the cell and monitoring the motion of the AFM cantilever. An advantage of the AFM for imaging cells is that the cell does not have to be coated, and in fact can still be alive when imaged.

• **Bio-molecules**

AFM images of bio-molecules such as DNA are easily measured as long as the bio-molecules are directly attached to a surface. Activated substrates are available for creating DNA images with an AFM. There are many examples of AFM DNA images as well as many images of other types of bio-molecules such as proteins.

• **Semiconductors**

Advanced applications include: electrical testing, etch verification, and secondary defect review. AFM operating on Electric Force Microscopy (EFM) mode measures local electrostatic interaction between a conductive tip and a sample through Coulomb forces. EFM can be utilized in many applications, such as characterizing surface electrical properties, detecting defects of an integrated circuit, and measuring the distribution of a particular material on a composite surface.

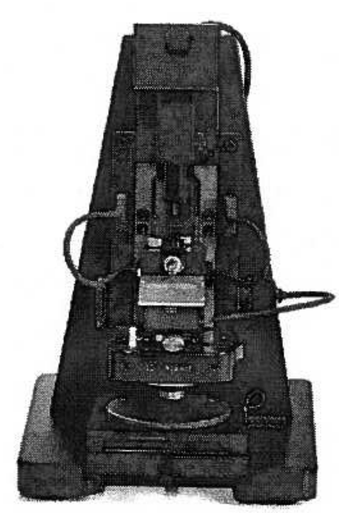
• **Data Storage**

Data storage requires creating structures with nanometer-sized dimensions. The AFM is utilized for product development of both magnetic and optical mass storage devices. Applications in the magnetic storage area include the visualization of magnetic bits, pole tip recession, and platter surface texture. Bits and tracks in DVD and CD-R/W storage media are visualized with an AFM. DVD bit metrology measurements can yield all of the critical dimensions of a bit as well as track dimensions. Specialized software is

• Advanced Optical Materials.

Micro-optical devices are often created from insulating material and cannot be viewed in an SEM/TEM. Further, because they are transparent, an optical profiler does not give accurate metrological measurements. The AFM however, is a mechanical imaging tool and does in fact provide accurate metrological measurements on optically transparent materials.

c. Details of the AFM/SPM System



The Agilent 5400 is a modular AFM/SPM system that can be used for applications in materials science, polymers, general surface characterization and nanolithography. The system also can be easily upgraded to the premier Agilent 5500 AFM/SPM. The scanner has quick-install nose cones, resulting in convenient switching of imaging modes; a scanner that snaps into place; open access to the sample plates; and simple alignment of optics.

Agilent Technologies Series 5400 is specifically design for teaching environments. It provides a combined scanning tunneling microscope and an atomic force microscope to provide a wide range possible applications and instructional topics. The system is robust and easy to use as is needed in a teaching situation. The AFM uses preset AFM chips that do not require any laser alignment. The system includes several test samples for teaching and illustrating the use of the AFM scan heads. A video camera system with XY translation table is included to allow easy positioning of samples under the AFM scan head. An isolation table is also included to minimize environmental effects encountered in a teaching laboratory.

The scanner mounts easily and is held into place with a clamp closure. In addition, the scanner's easy-to-load nose cones mean that switching imaging modes is quick and convenient. These nose cones are made from PEEK polymers, have low chemical reactivity, and can be used in a wide range of solvents. Their straight-forward interchangeability provides tremendous fl exibility.

PicoView Software

Agilent's new 32-bit Windows®-based PicoView is a highly stable software package that offers real-time 3D rendering capabilities. PicoView, along with user-level scripting (C++, Microsoft® Visual Basic®, National Instruments LabVIEW), allows complete control of all scanning parameters and provides the fl exibility required for more complex experiments. An integrated script editor and sample scripts are also included.

Instrument Specifications:

Scanners

Note: Specifications open-loop operation Closed-loop scanners are also available.

Large multi-purpose scanner

Scanning range 90 μm x 90 μm Z range 8 μm

Vertical noise 0.5 Å RMS

Small scanner

Scanning range 9 μm x 9 μm Z range 2 μm

Vertical noise < 0.2 Å RMS

Controller

Input Ten 16-bit channels

Drive 5 channels ± 215 V, 24-bit

Output Four 24-bit channels, ± 10 V

Interface USB

Power 100 - 120 V AC or 220 - 240 V AC 1A; 50 - 60 Hz

Facilities specifications

Acoustic noise Less the 75 dBc

Temperature variation Does not exceed ± 2° F

Humidity variation Does not exceed ± 20% RH

Available Scanning Modes

a) Scanning Probe Microscope (SPM) Contact Modes

In Contact Mode AFM, interatomic van der Waals forces become repulsive as the AFM tip comes in close contact with the sample surface.

b) Scanning Probe Microscope (SPM) Acoustic

Acoustic AC Mode (AAC mode) is an oscillating technique that is less sensitive than MAC Mode, but gentler and less destructive than contact mode. AAC mode excites the cantilever by vibrating the piezo where the cantilever holder is attached.

c) Scanning Probe Microscope (SPM) MAC Mode

Magnetic AC Mode (MAC Mode) is a gentle, nondestructive technique for atomic force microscopy that has been designed for imaging extremely delicate samples. MAC Mode allows researchers to image submolecular structures that cannot be resolved with any other AFM technique. MAC Mode is particularly useful in areas that require high resolution and force sensitivity especially in a liquid environment, such as biology, polymers, and surface science.

d) Scanning Probe Microscope (SPM) LFM

Lateral Force Microscopy (LFM) is useful for studying surfaces that have variations in friction. During contact mode AFM scanning, as the probe is dragged over the surface, changes in surface friction and topographic slope can cause the cantilever to twist and thus create forces on the cantilever that are parallel to the plane of the sample surface.

e) Scanning Probe Microscope (SPM) EFM

Electric Force Microscopy (EFM) measures local electrostatic interaction between a conductive tip and a sample through Coulomb forces. EFM can be utilized in many applications, such as characterizing surface electrical properties, detecting defects of an integrated circuit, and measuring the distribution of a particular material on a composite surface.

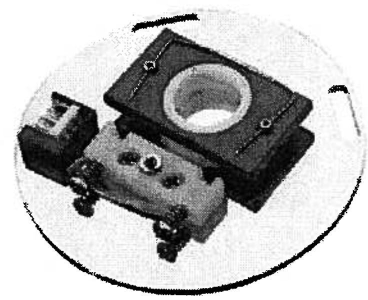
f) Scanning Probe Microscope (SPM)

Magnetic Force Microscopy (MFM) measures magnetic structures/domains of a surface using a magnetic cantilever. The variations in magnetic forces are measured in acoustic AC mode. MFM is a nondestructive technique that can be used to evaluate magnetic materials and devices or to locate and map magnetic defects on a variety of materials and surfaces.

Aomic Force Microscope (AFM) Accessories

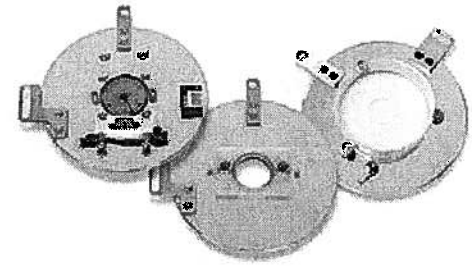
a) Liquid Cells

Agilent's versatile Liquid Cells are designed to provide easy setup, a clean imaging environment, and open-cell accessibility. Each cell is made of Teflon® or Kel-F®, both of which makes thorough cleaning easy and help prevent cross-contamination when the cell is utilized for different experiments. A wide variety of STM/AFM experiments in liquids and/or under lectrochemical and/or temperature control. The liquid cells can be used with aqueous, non-aqueous, or harsh (acid/base) solutions.



b) Sample Plates

Purpose-designed Agilent Sample Pates deliver superior sample stability and ease of use. Magnetic suspension provides easy loading and eliminates mechanical drift. These stand-alone plates permit simple sample mounting and can be used with an unparalleled number of options, such as open liquid cells, flow-through cells, salt-bridge cells (for electrochemistry), Petri dishes (for live-cell imaging), and glass microscope slides. Temperature control is available.



Agilent Technologies

We are happy to provide this non-binding, budgetary pricing information.

BUDGETARY QUOTATION

Agilent Quotation No.	Date	Page
0111-2007-0001	01/OCT/2007	1/3
Quotation Validity	**Est. Weeks Delivery (All Quoted Items)**	
30 DAYS	8-12	
Payment Terms	**Purchase Agreement/Expires**	
NET 30 DAYS	N/A	
Delivery Terms		
DDP-Duty Paid		

Customer Information:
Dr.Upali Siriwardane
Louisiana Tech University
Department of Chemistry
P.O. Box 10348
Ruston, LA 71272
Upali@chem.latech.edu
318-257-4941

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ENGLEWOOD CO 80155-4026
United States

Sales Representative
Steve Ziegler
steve_ziegler@agilent.com
512-331-2193 Office
512-468-8998 Mobile

Quote and Order Assistance Contact
Contact Name: CLARK HELLER
Telephone No: 800-829-4444
Email: usa_orders@agilent.com

Comments

Delivery dates are estimated and subject to availability at the time of order placement. Please reference this quotation number, Purchase Agreement (if applicable) and requested delivery date on your purchase order. Please contact your Agilent Field Engineer for any technical questions.

Agilent Series 5400 AFM

$

Item No.	Product/Description	Net (USD)	Qty	Total (USD)
1	**N9492A** Series 5400 microscope and electronics only Listprice : 19,686.00 USD	19,686.00	1	19,686.00
2	**N9605A** AFM/SPM Controller - Series 5400 or 5500 Listprice : 39,487.00 USD	39,487.00	1	39,487.00
3	**N9521B** Multipurpose scanner, 90 um, 670 nm low coherence - Series 5100, 5400 or 5500 Listprice : 11,915.00 USD	11,915.00	1	11,915.00
4	**N9741A** AFM/LFM detector and N9533A AFM nose cone for multi-purpose scanners Listprice : 3,075.00 USD	3,075.00	1	3,075.00
5	**N9455A** AFM startup kit - Series 5100, 5400 or 5500 Listprice : 2,285.00 USD	2,285.00	1	2,285.00

Agilent Technologies

We are happy to provide this non-binding, budgetary pricing information.

BUDGETARY QUOTATION		
Agilent Quotation No. 0111-2007-0001	**Date** 01/OCT/2007	**Page** 2/3
Expiration Date/ Days 01/OCT/2007 30	**Est. Weeks Delivery (All Quoted Items)** 6-8	
Payment Terms NET 30 DAYS	**Purchase Agreement/Expires** N/A	
Delivery Terms DDP-Duty Paid		

Item No.	Product/Description	Net (USD)	Qty	Total (USD)
6	**N9445A** Noise and vibration isolation chamber - Series 5100, 5400 or 5500 Listprice : 3,635.00 USD	3,635.00	1	3,635.00
7	**N9901B** Installation and training, 2 days Listprice : 2,753.00 USD	2,753.00	1	2,753.00
		Subtotal (USD)		82,836.00
		Discount		
		Total (USD)		**82,836.00**

Notes:

Warranty: One year from date of Receipt of Order

Please Submit Purchase Order to:
Attn: Clark Heller
Agilent Technologies Inc., P.O. Box 4026, Englewood, CO 80155-4026
Phone:303-662-3292
Fax: 1-800-829-4433
e-mail:usa_orders@agilent.com

Sincerely Yours,

Stephen F. Ziegler
Southern US Regional Manager
Nanotechnology Measurement Tools
Agilent Technologies
P: 512-331.2193
C: 512-468-8998
Email: steve_ziegler@agilent.com

Special terms are included with this quotation since special discounts are being granted. Your concurrence with these special terms will be required with any resulting order under this quotation.
Products purchased under this quote must be placed on one purchase order and no products may be added at a later date.

Products must be delivered to one location and no extended delivery is permitted. This is a one-time special discount that will not apply to any future order(s). In the event Agilent reduces the list price of a product on this quotation during the validity of this quotation or prior to shipment, the list price for such products will not be reduced.

The sale of products under this quotation is predicated upon ordering the products and quantities as specified on the quotation. Changes to product mix and/or quantities may affect the discount percentage. Products purchased herein will not qualify to earn discounts or dollar volume under a subsequent Purchase Agreement.

d. Support Letter from Dr. Jayne Garno, LSU Chemistry Department

Louisiana State University **LSU** **DEPARTMENT OF CHEMISTRY**

311 Choppin Hall
Baton Rouge, LA 70803

Phone: 225-578-8942
e-mail: jgarno@lsu.edu

To: Louisiana Board of Regents
RE: Proposal by Professor Upali Siriwardane
Louisiana Tech University

October 8, 2007

Dear Reviewers and Program Officer:

I plan to work closely with Dr. Upali Siriwardane to provide him with high-level training for using scanning probe microscopy (AFM/SPM) for teaching undergraduates and his research efforts. If this grant is awarded, we will submit a grant proposal to the ACS PRF program to sponsor Dr. Siriwardane for a summer research internship at LSU. My laboratory in Baton Rouge is equipped with three state-of-the art scanning probe microscopes, which have software for nanometer-scale lithography and interchangeable AFM and STM scanners. These modern SPM instruments enable multiple imaging modes, including conductive probe AFM/STM in various environments. Our research activities are in surface science and analytical chemistry center around investigations of how chemical structure influences surface properties and molecular self-assembly. We are developing highly-sensitive methods to characterize the structure and properties of thin film materials at the nanoscale, and have complementary work in the developing new nanomaterials being developed by Dr. Siriwardane's research group.

For teaching purposes, my laboratory has been providing feedback to the Nanotechnology Measurements division of Agilent Technologies for beta-testing a user-friendly scanning probe microscope system, the Agilent 5400. Agilent has furnished my group with an instrument free-of-charge, which is used for undergraduate teaching purposes. During 2006 and 2007 a large number of undergraduate researchers were accommodated for beta-testing the educational scanning probe microscope from Agilent. Students were able to give feedback to the manufacturing team about bugs in the software and problems with learning to use the instrument. The beta testing allowed us to give the instrument a trial by fire, and the new prototype microscope met or exceeded my expectations for a workhorse teaching instrument. All of the undergraduates were able to learn basic imaging skills and image processing with a few weeks of training. I am confident that a single summer of research with my group will provide Dr. Siriwardane with the necessary skills for future teaching and research activities.

Since Louisiana Tech University is rather a long commute from the LSU campus, Dr. Siriwardane and his students will commute a distance of several hours to work on instruments in my laboratory as needed. Our expertise and background with scanning probe characterizations, nanofabrication and conductive probe measurements with self-assembled monolayers will be a valuable asset to Dr. Siriwardane's research program at Louisiana Tech University. I anticipate that our collaboration will lead to several interdisciplinary research and chemistry education publications. In fact, his interactions with my graduate students during a summer internship will greatly benefit my efforts as a new investigator at LSU, and I hope that you will give this proposal an excellent rating.

Sincerely,

Jayne C. Garno
Assistant Professor of Chemistry