Research Accomplishments of the NIP CMPL Semiconductor Research Group
January 1, 2015 - December 31, 2015

Prepared by:
Elmer S. Estacio
Program Coordinator
Jan. 4, 2015

I. Executive Summary

A. Activities of the Research Group
1. Organization
a. Group Members
Regular members – 3 members
Student members – 63 members
b. Apprentices (NIP students) – 0 apprentice

2. Mentoring
Number of Graduates
BS Physics/Applied Physics - 5
MS Physics – 2 graduate
MS MSE – 5 graduate

B. Research Highlights
1. Number of papers published/accepted for publications in international peer-reviewed journals (ISI/SCI and Scopus-listed journals) – 9 papers
2. Numbers of local conference papers: With full paper (in print proceedings, e.g. SPP-Congress) – 27 papers
3. Number of non-NIP funded projects – 5 projects

C. Extension Work Highlights
1. Number of Research Interns/ OJT's (Non-NIP), for trainings held at NIP – 4 interns

II. Technical Report

A. Activities of the Research group

The Condensed Matter Physics Laboratory Semiconductor Group (CMPL Semicon) is one of the two clusters of the five research laboratories/groups of the National Institute of Physics. Its research programs are directed to fabrication, characterization and production of devices out of semiconductor materials such as gallium arsenide, metal oxides, etc. The lab is divided into subgroups according to research topic, project or material where each members are taught important concepts and techniques to further their growth as future scientists.

The lab offers membership to incoming 4th/5th year BS Physics/Applied Physics and internship program for incoming 4th year high school students from PSHS System. The internship program provides hands on experience to the students

with the goal of giving them insights on how research is done in the laboratory and inspire them to take undergraduate or graduate degrees in Physics.

1. Organization

a. Group Members

List of Group Members

Regular members (Faculty/ REPS):

Armando Somintac
Arnel Salvador
Elmer Estacio

Student members (B3, B4, B5 /M1, M2, M3 /P1, P2, P3):

Archel Escaro
Erick John Carlo Solibet
Timothy Vincent Recla
Miguel Yee Bacaoco
Harold Co
Ron Aves
Arvin Jay Escolano
Mylenne Manrique
Querubin Garcia III
Kerr Aban Cervantes
Al Araneta Ahmad
Hannah Villanueva
Cammile Carinan
Raymund Veloz
Karl Cedric Gonzales
Ely Victor Julius Ganzon
John Paul Ferrolino
Philippe Tingzon
Rhenish Simon
Alexander delos Reyes
John Daniel Vasquez
Evelyn Navarro
Debinya Buenafe
Renebeth Payod
Cecil Angub
Christopher Jude Vergara
Eloise Anguluan
Vida Sayson
Vladimir Sarmiento
Angela Faustino
Michael Rey Cainglet
Ar Jay Sura
Dyan Buan
Catherine Tugado
Mary Grace Lanwang
Jhosabel Samper
Aldrin Bendal

Noel Jesus Oliver, Jr
Jamie Mendoza
Vernalyn Copa
Marleane Ferrer
Mae Agatha Tumanguil
Precy Mae Calaque
Sheryl Vizcara
Mark Jason Felix
Arven Cafe
Anthony Tuico
Laureen Ida Ballesteros
Horace Husay
Efren Suratos
Joybelle Lopez
Gerald Angelo Catindig
Vincent Mejarito
Aldrin Tan
Yuta Rola
Joselito Muldera
Rafael Jaculbia
Cyril Sadia
Lorenzo Lopez Jr.
Neil Irvin Cabello
Evan Angelo Mondarte
Maria Herminia Balgos
Ramon delos Santos

c. Summary

		Number
Regular Members		3
Student Members		
	B3 (Physics/Appl. Physics)	0
	B4	4
	B5	12
	M1 (Physics/ MSE)	8
	M2	11
	M3 and up	21
	P1 (Physics/ MSE)	3
	P2	0
	P3	5
	Total no. of regular members and student members:	66
Apprentices (NIP)		0

2. Mentoring

a. List of Graduates (i.e., graduated from January 1, 2015 to December 31, 2015)

2nd sem (thesis defense date is within January 2015 to May 2015)

BS Physics /Applied Physics
Name: Rosa Miranda
Thesis Title: “Photoreflectance Spectroscopy of Low-Temperature Molecular Beam Epitaxy Grown Gallium Arsenide Films”
Adviser: Dr. Elmer Estacio

Name: John Paul Ferrolino
Thesis Title: “Electrical Properties of Annealed Schottky-Ohmic (Aube-Auge) Pair Contact to n-GaAs in MSM Planar”
Adviser: Dr. Armando Somintac

Name: Jermaine Nicole Barce
Thesis Title: “UV-Vis Spectra of Polycrystalline Cu_xO Thin Films Grown Via Spray Pyrolysis”
Adviser: Dr. Armando Somintac

Name: Al Ahmad
Thesis Title: “Piezoelectric Nanogenerator based on Zinc Oxide Nanowires and Surface Textured P-Type Silicon”
Adviser: Dr. Armando Somintac

Name: Crizia Alcantara
Thesis Title: “Temperature Dependent Photoluminescence Studies of MBE Grown Self-Assembled InAs/GaAs Quantum Dots”
Adviser: Dr. Elmer Estacio

MS Physics
Name: Arvin Mabilangan
Thesis Title: “Temperature Dependent Optical Characterization of the Photoluminescence Bands in Electrochemically Etched Porous Silicon”
Adviser: Dr. Armando Somintac

MS Material Science and Engineering
Name: Mark Jayson Felix
Thesis Title: “Terahertz Emission in Silicon Nanopyramids and Terahertz Filters Based on Ait-Acetate Stack”
Adviser: Dr. Elmer Estacio

Name: Ed Adrian Dilla
Thesis Title: "Titanium Dioxide Nanotube-Based Module for Dye Testing"
Adviser: Dr. Armando Somintac

Name: Lorenzo Lopez, Jr
Thesis Title: "Thermo-optic Coefficient of Electrochemically-etched Porous Silicon Layers"
Adviser: Dr. Armando Somintac

Name: Julie Lebitania
Thesis Title: "Anodized Titanium Dioxide Nanotube Film and Its Application for Adsorption and Spectroscopic Detection of Copper (II) Ions in Water"
Adviser: Dr. Armando Somintac

Name: Evan Angelo Mondarte
Thesis Title: "Investigation of Al-doped ZnO and N-doped CuxO Thin Films deposited via Spray Pyrolysis for Thermoelectric Energy Harvesting"
Adviser: Dr. Elmer Estacio

b. Summary

Course	2nd sem (AY2014-15)	Mid-year (AY2014-15)	1st sem (AY 2015-16)	Total
BS Physics				
BS Applied Physics				
MS Physics	2			
MS MSE	4			
PhD Physics				
PhD MSE				

B. Research Highlights (publications/ patents/ research travels)

1. List of papers published/accepted for publications in international peer-reviewed journals (ISI/SCI indexed (and other Scopus-listed peer-reviewed journals))

Article in a print journal

Mashkovich, E. A., Shugurov, A. I., Ozawa, S., Estacio, E., Tani, M., & Bakunov, M. I. (2015). “Noncollinear Electro-Optic Sampling of Terahertz Waves in a Thick GaAs Crystal”. *Terahertz Science and Technology, IEEE Transactions on*, *5*(5), 732-736.

Presto, J. M. M., Prieto, E. A. P., Omambac, K. M., Afalla, J. P. C., Lumantas, D. A. O., Salvador, A. A., ... & Tani, M. (2015). Confined photocarrier transport in InAs pyramidal quantum dots via terahertz time-domain spectroscopy. *Optics Express*, *23*(11), 14532-14540.

Sadia, C. P., Muldera, J., Estacio, E. S., Somintac, A. S., Salvador, A. A., Que, C. T., ... & Tani, M. (2015). Interruption-assisted epitaxy of faceted p-InAs on buffered GaSb for terahertz emitters. *Applied Physics Express*, *8*(3), 035501.

Jaculbia, R. B., Abrenica, J. M., Estacio, E. S., Salvador, A. A., & Somintac, A. S. (2015). Terahertz emission from aluminum-doped ZnO–nGaAs heterostructure

investigated using reflection-mode terahertz time-domain spectroscopy. *Applied Physics Express*, *8*(12), 122101.

Balgos, M. H., Afalla, J. P., Vizcara, S., Lumantas, D., Estacio, E., Salvador, A., & Somintac, A. Temperature behavior of unstrained (GaAs/AlGaAs) and strained (InGaAs/GaAs) quantum well bandgaps.*Optical and Quantum Electronics*, 1-11.

Empizo, M. J. F., Yamanoi, K., Fukuda, K., Arita, R., Minami, Y., Shimizu, T., ... & Salvador, A. A. (2015). Photoluminescence investigations of bulk and microstructured ZnO crystals for scintillator applications. *Journal of Ceramic Processing Research*, *16*(1), 98-101.

Empizo, M. J. F., Yamanoi, K., Santos-Putungan, A. B., Arita, R., Minami, Y., Luong, M. V., ... & Sarmago, R. V. (2015). Blue-shifted and picosecond amplified UV emission from aqueous chemical grown ZnO microrods. *Optical Materials*, *48*, 179-184.

Empizo, M. J. F., Yamanoi, K., Mori, K., Arita, R., Iwano, K., Takabatake, M., ... & Abe, Y. (2015). Gamma-ray irradiation effects on the optical properties of bulk ZnO single crystals. *Applied Physics Express*, *8*(6), 061101.

delos Santos, R., Ibañes, J. J., Balgos, M. H., Jaculbia, R., Afalla, J. P., Bailon-Somintac, M., ... & Tsuzuki, S. (2015). Dynamics of Optically-Generated Carriers in Si (100) and Si (111) Substrate-Grown GaAs/AlGaAs Core-Shell Nanowires. *Nanoscale research letters*, *10*(1), 1-5.

Sub-total (9)

2. List of local conference papers

E Anguluan, JDE Vasquez, J Herber, AS Somintac, AA Salvador, ES Estacio. 2015. “Influence of ultrathin films on the terahertz emission of germanium” In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 3A-4.

Zosa, M. A. H. and R. V. Sarmago. 2015. “Structural and optical properties of ZnO microrods as fast and efficient UV scintillator materials” In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 5B-07.

JN Pangasinan, HT Salazar Jr., AA Salvador, RV Sarmago, R Arita, MJF Empizo, K Yamanoi, Y Minami, T Shimizu, N Sarukura. 2015. “Intense UV emission and lasing action of a single, free-standing and post heat-treated ZnO microribbon” In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- PA-12.

A De Los Reyes, E Anguluan, JDE Vasquez, J Muldera, PM Tingzon, A Mabilangan, JC Ragasa, ES Estacio, AA Salvador “Temperature-dependent photoluminescence spectroscopy of silicon nanowires grown via silver assisted chemical etching” In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd*

Physics Congress, Vigan City, June 3-6, SPP2015- PB-26.

A Tuico, JP Ferrolino, G Catindig, MH Balgos, EA Prieto, J Muldera, A Somintac, A Salvador, E Estacio. 2015. "Prototype terahertz photoconductive antenna detector based on a low-temperature-grown gallium arsenide substrate" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 1A-04.

LG Gerna, HF Husay, RC Garcia, JA Barce, AA Salvador, ES Estacio, AS Somintac. 2015. "Copper oxide nanowires as photocatalyst in the degradation of methylene blue organic dye" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 1B-03.

A Ahmad, C Vergara, L Ballesteros, A Tuico, H Husay, J Ferrelino, E Estacio, AA Salvador, AS Somintac. 2015. "Piezoelectric nanogenerator based on zinc oxide nanowires and surface-textured p-silicon" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 1B-05.

MJ Felix, DA Lumantas, J Muldera, AS Somintac, AA Salvador, ES Estacio. 2015. "Antireflection and light emission properties of silicon nanopyramids." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 3A-02.

MB Faustino, LP Lopez, A Afalla, M Felix, J Muldera, J Ferrolino, AA Salvador, AS Somintac, ES Estacio. 2015. "Fluorine-doped SnO2 thin film as chemiresistive gas
sensor for room temperature monitoring of fish freshness" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 3A-06.

LM Ballesteros, CT Vergara, AS Somintac. 2015. "Preliminary results on the Fe-doping of ZnO microstructure grown by carbothermal reduction method." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 3C-01.

JP Lopez, MB Faustino, JE Muldera, AS Somintac, AA Salvador, ES Estacio, IS Martinez. 2015. "Demonstration of second-harmonic generation microscopy" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 5A-2.

CC Alcantara, JDE Vasquez, AA Salvador, AS Somintac, ES Estacio. 2015. "Temperature-dependent photoluminescence studies of MBE-grown InAs/GaAs quantum dots" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 5A-4.

A De Los Reyes, SA Vizcara, J Muldera, H Rillera-Bardolaza, LP Lopez Jr., R Delos Santos, AS Somintac, AA Salvador, ES Estacio. 2015. "Externally applied magnetic field-effects on the terahertz emission from p-type and n-type InAs

wafers" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 5A-06.

AS Escaro, EJC Solibet, A Tuico, V Copa, A Somintac. 2015. "Fabrication of photoswitch device based on zinc oxide nanorods" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 5B-01.

JM Lopez, AI Café, LIM Ballesteros, LP Lopez Jr., MAB Faustino, AA Salvador, AS Somintac. 2015. "Optical characterization of tin oxide-coated porous silicon" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- 5B-03.

J Amado, C Arcilla, RV Sarmago, ES Estacio, AS Somintac, AA Salvador. 2015. "Synthesis of YBa2Cu3O7-δ (Y123) High-Tc superconductors from Y:Ba:Cu = 3:5:8 stoichiometric ratio" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- PA-09.

RC Garcia, HAF Husay, MA Tumanguil, AA Salvador, AS Somintac. 2015. "Spontaneous growth of CuO nanowires through direct thermal oxidation of Cu sheets" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- PA-17.

A Tuico, JP Ferrolino, G Catindig, PM Tingzon, V Copa, EA Prieto, E Estacio, A Salvador, A Somintac. 2015. "Development of zinc oxide film as an anti-reflection coating for low-temperature-grown gallium arsenide infrared photodetector" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- PA-19.

JE Muldera, MM Balgos, LP Lopez, E Prieto, K Gonzales, CP Sadia, AS Somintac, AA Salvador, ES Estacio, AS Somintac. 2015. "Percent composition of copper oxide thin films" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- PB-04.

JN Barce, A Tuico, HA Husay, M Tumaguil, ES Estacio, AA Salvador, AS Somintac. 2015. "Percent composition of copper oxide thin films" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- PB-09.

MA Cainglet, AA Salvador, AS Somintac. 2015. "Resistance response of a nanoporous silicon gas
sensor in the presence of alcohol vapour" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- PA-17.

JP Ferrolino, LK Pulutan, A Somintac. 2015. "Electrical properties of Schottky-Ohmic pair contact compared to Schottky-Schottky and Ohmic-Ohmic pair contact in planar configuration" In *Proceedings of the Samahang Pisika ng*

Pilipinas: 33rd Physics Congress, Vigan City, June 3-6, SPP2015- PB-15. JP Mendoza, AS Somintac. 2015. "The Investigation of Ag-TiO2-Ti as possible surface enhanced Raman spectroscopy substrate" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- PB-17. EJC Solibet, A Escaro, A Tuico, EA Mondarte, V Copa, AS Somintac. 2015. "Development of aluminum nitride as temperature sensor for clinical applications" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- PB-23. Al Café, JM Lopez, LP Lopez Jr., AA Salvador. 2015. "Effective refractive index determination of porous silicon based Distributed Bragg reflector for liquid sensor application" In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015- PB-24.
Sub-total (27)

3. List of non-NIP funded projects (e.g. EIDR, ECWRG, OVCRD Outright, NRCP, etc.)

Project Leader	Title	Period/ Phase no.	Amount
Dr. Armando Somintac	Synthesis of Aluminum Nitride via RF Magnetron Sputtering	Aug1 2014-Jul31 2015	PHP 300, 000.00
Dr. Armando Somintac	Sensors for Agricultural and Fishery Ecosystems and Harvests Safety	Nov1 2014-Oct31 2015	PHP 5,000,000.00
Dr. Armando Somintac	Photocarrier Distribution and Dynamics in MBE grown quantum well systems	Apr 27, 2015 - Oct 27, 2016	PHP 600, 000.00
Dr. Arnel Salvador	Fabrication and Testing of MBE - Grown As/AlxGa1-xAs Quantum Well Laser Diodes	Aug1 2014-Jul31 2015	PHP 300, 000.00
Dr. Elmer Estacio	MBE Grown InAs Films as Semiconductoor Terahetz Emitters	Aug1 2014-Jul31 2016	PHP 300, 000.00
Sub-total (5)			

C. Extension Work Highlights

1. List of Research Interns/ OJT's (Non-NIP), for trainings held at NIP {Please enumerate names and affiliations, e.g., PSHS, UNP, etc}

Name	School/ Organization	Program; and Duration, dates	NIP Personnel/ Contact person	Remarks: (Indicate if covered by MOA, project, etc.)
Jayson Cabanilla	UNP	Apr-May 2015	Vernalyn Copa	
Kyle dela Torre	PSHS-CvisC	Jun-July 2015	Vernalyn Copa	covered by MOA
Mark Dominic Enriquez	PSHS-EVC	Jun-July 2015	Vernalyn Copa	covered by MOA
Faye Espalmado	PSHS-BRC	Jun-July 2015	Vernalyn Copa	covered by MOA

III. Photos, ISI/SCI publications and Other Appendices

A. Photos (embed in this document)

Group photo taken during celebration for completing the Safe Harvest project

Group photo taken at Dr. Somintac's Birthday Celebration

B. ISI/SCI publications
Summary of Attachments

Attachment B1: delos Santos, R., Ibañes, J. J., Balgos, M. H., Jaculbia, R., Afalla, J. P., Bailon-Somintac, M., ... & Tsuzuki, S. (2015). Dynamics of Optically-Generated Carriers in Si (100) and Si (111) Substrate-Grown GaAs/AlGaAs Core-Shell Nanowires. *Nanoscale research letters*, *10*(1), 1-5.
Attachment B2: Empizo, M. J. F., Yamanoi, K., Mori, K., Arita, R., Iwano, K., Takabatake, M., ... & Abe, Y. (2015). Gamma-ray irradiation effects on the optical properties of bulk ZnO single crystals. *Applied Physics Express*, *8*(6), 061101.
Attachment B3: Empizo, M. J. F., Yamanoi, K., Santos-Putungan, A. B., Arita, R., Minami, Y., Luong, M. V., ... & Sarmago, R. V. (2015). Blue-shifted and picosecond amplified UV emission from aqueous chemical grown ZnO microrods. *Optical Materials*, *48*, 179-184.
Attachment B4: Empizo, M. J. F., Yamanoi, K., Fukuda, K., Arita, R., Minami, Y., Shimizu, T., ... & Salvador, A. A. (2015). Photoluminescence investigations of bulk and microstructured ZnO crystals for scintillator applications. *Journal of Ceramic Processing Research*, *16*(1), 98-101.
Attachment B5: Balgos, M. H., Afalla, J. P., Vizcara, S., Lumantas, D., Estacio, E., Salvador, A., & Somintac, A. Temperature behavior of unstrained (GaAs/AlGaAs) and strained (InGaAs/GaAs) quantum well

bandgaps.*Optical and Quantum Electronics*, 1-11.
Attachment B6: Jaculbia, R. B., Abrenica, J. M., Estacio, E. S., Salvador, A. A., & Somintac, A. S. (2015). Terahertz emission from aluminum-doped ZnO–nGaAs heterostructure investigated using reflection-mode terahertz time-domain spectroscopy. *Applied Physics Express*, *8*(12), 122101.
Attachment B7: Sadia, C. P., Muldera, J., Estacio, E. S., Somintac, A. S., Salvador, A. A., Que, C. T., ... & Tani, M. (2015). Interruption-assisted epitaxy of faceted p-InAs on buffered GaSb for terahertz emitters. *Applied Physics Express*, *8*(3), 035501.
Attachment B8: Mashkovich, E. A., Shugurov, A. I., Ozawa, S., Estacio, E., Tani, M., & Bakunov, M. I. (2015). “Noncollinear Electro-Optic Sampling of Terahertz Waves in a Thick GaAs Crystal”. *Terahertz Science and Technology, IEEE Transactions on*, *5*(5), 732-736.

Research Accomplishments of the NIP CMPL Superconductor Research Group
January 1, 2015 - December 31, 2015

Prepared by:
Roland V. Sarmago, Ph.D.
Program Coordinator
Dec. 18, 2015

I. Executive Summary

A. Activities of the Research Group
2. Organization
a. Group Members
Regular members – 4 members
Student members – 15 members
b. Apprentices (NIP students) – 1 apprentice

2. Mentoring
Number of Graduates
MS Physics – 1 graduate
MS MSE – 1 graduate

B. Research Highlights
1. Number of papers published/accepted for publications in international peer-reviewed journals (ISI/SCI and Scopus-listed journals) – 3 papers
2. Numbers of local conference papers: With full paper (in print proceedings, e.g. SPP-Congress) – 17 papers
3. Number of non-NIP funded projects – 2 projects

C. Extension Work Highlights
1. Number of Research Interns/ OJT's (Non-NIP), for trainings held at NIP – 16 interns

II. Technical Report

A. Activities of the Research group

The lab conducts yearly workshop where the members present research themes, proposals and progress reports. The lab is subdivided into groups according to research topic or material. Aside from a weekly research group meeting where designated members present seminar and progress reports, there are also weekly sub-group meetings where members are able to have in-depth discussion on their respective researches.

The lab also offers internship to incoming 4th/5th year BS Physics/Applied Physics/Education Major in Physics and also incoming 4th year high school students from PSHS. This internship is created with the aim of providing the students perspective on how research in Physics is done, and this, in a way, drives the interest of the students to continue their studies and further take graduate degrees.

1. Organization

a. Group Members

List of Group Members

Regular members (Faculty/ REPS):

Bess Singidas
Francesca Isabel de Vera
Glaiza Rose Ocampo
Hannah R. Bardolaza

Student members (B3, B4, B5 /M1, M2 /P1, P2, P3):

Angelo Rillera
Camille Victoria Cantor
DC Vistro
Hernanie Salazar, Jr.
Isabel Ophelia Fernando
Jerine Amado
Jerome Taguba
Jonalds Tacneng
Maricar Rosete
Nestor Daniel Fernandez
Ray Vargas
Rusty Lopez
Shielo Namuco
Verdad Agulto
Xyrus Galapia

b. Apprentices (NIP)

Adonis Villagomez

c. Summary

		Number
Regular Members		4
Student Members		
	B3 (Physics/Appl. Physics)	
	B4	2
	B5	3
	M1 (Physics/ MSE)	
	M2	
	M3 and up	9
	P1 (Physics/ MSE)	1
	P2	
	P3	
	Total no. of regular members and student members:	19
Apprentices (NIP)		1

2. Mentoring

a. List of Graduates (i.e., graduated from January 1, 2015 to December 31, 2015)

2nd sem (thesis defense date is within January 2015 to May 2015)

MS Physics Name: Myles Allen Zosa Thesis Title: Adviser: Dr. Roland Sarmago

Mid-year (thesis defense date is within June 2015 to July 2015)

MS MSE Name: Maricar Rosete Thesis Title: Adviser: Dr. Roland Sarmago

b. Summary

Course	2nd sem (AY2014-15)	Mid-year (AY2014-15)	1st sem (AY 2015-16)	Total
BS Physics				
BS Applied Physics				
MS Physics	1			
MS MSE		1		
PhD Physics				
PhD MSE				

B. Research Highlights (publications/ patents/ research travels)

1. List of papers published/accepted for publications in international peer-reviewed journals (ISI/SCI indexed (and other Scopus-listed peer-reviewed journals))

Article in a print journal

Empizo, M. J. F., K. Yamanoi, A. B. Santos-Putungan, R. Arita, Y. Minami, M. V. Luong, T. Shimizu, E. S. Estacio, A. S. Somintac, A. A. Salvador, R. V. Sarmago and N. Sarukura. 2015. "Blue-shifted and picosecond amplified UV emission from aqueous chemical grown ZnO microrods." *Optical Materials* 48: 179–184.

Empizo, M. J. F., K. Yamanoi, K. Mori, R. Arita, K. Iwano, M. Takabatake, K. Fukuda, T. Hori, Y. Minami, M. V. Luong, Y. Abe, S. Kojima, Y. Arikawa, T. Shimizu, T. Norimatsu, H. Azechi, N. Sarukura, A. A. Salvador, R. V. Sarmago and T. Fukuda. 2015. "Gamma-ray irradiation effects on the optical properties of bulk ZnO single crystals." *Applied Physics Express* 8: 061101.

Empizo, M. J. F., K. Yamanoi, K. Fukuda, R. Arita, Y. Minami, T. Shimizu, N. Sarukura, T. Fukuda, A. B. Santos-Putungan, R. M. Vargas, A. A. Salvador and R. V. Sarmago. 2015. "Photoluminescence investigations of bulk and

microstructured ZnO crystals for scintillator applications." *Journal of Ceramics Processing Research* 16: 98–101.

Jerine Amado and Roland Sarmago. 2015. "AC Magnetic Susceptibility and Morphological Development of YBCO HTS Formed from Y:Ba:Cu = 1:2:3 and 3:5:8." *Journal of Superconductivity and Novel Magnetism* 28: 3455-3461.

Santos-Putungan, A. B., M. J. F. Empizo, K. Yamanoi, R. M. Vargas, R. Arita, Y. Minami, T. Shimizu, A. A. Salvador, R. V. Sarmago and N. Sarukura. 2016. "Intense and fast UV emitting ZnO microrods fabricated by low temperature aqueous chemical growth method." *Journal of Luminescence* 169: 216-219.

Sub-total (5)

2. List of local conference papers

Namuco, S. B., A. M. P. Geronimo and R. V. Sarmago. 2015. "Manganese inclusion on the Ba site of bulk cuprate superconductors (Gd-123 and Y-123)." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-1B-06.

Zosa, M. A. H. and R. V. Sarmago. 2015. "Simulation of a capped carbon nanotube nanoaccelerator with an Ice (1h) Proton Source." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-3C-02.

Singidas, B. G. and R. V. Sarmago. 2015. "Transfer of graphene from copper to SiO2/Si by soft paraffin scaffold." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-3C-06.

Salazar, H. T., A. B. Santos-Putungan, A. A. Salvador, R. V. Sarmago, M. J. F. Empizo, K. Yamanoi, R. Arita and T. Shimizu. "Structural and optical properties of ZnO microrods as fast and efficient UV scintillator materials." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-5B-07.

Taguba, J. C., R. A. Lopez, C. A. Arcilla and R. V. Sarmago. 2015. "Effect of KCL and quenching temperature on the formation of YBCO films via sedimentation deposition." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-PA-08.

Amado, J., C. A. Arcilla and R. V. Sarmago. 2015. "Synthesis of YBa2Cu3O7-x (Y123) high-Tc superconductors from Y:Ba:Cu = 3:5:8 stoichiometric ratio." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-PA-09.

De Vera, F. I. N., J. A. Amado, S. B. Namuco, I. O. D. Fernando, X. A. Galapia, C. A. Arcilla and RV Sarmago. 2015. "Diamagnetism and weak link behavior of In-doped Bi-2212." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd*

Physics Congress, Vigan City, June 3-6, SPP2015-PA-10.

Galapia, X. A., F. I. N. de Vera, I. O. D. Fernando and R. V. Sarmago. 2015. "Borax addition in the MgB2 bulk system." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-PB-13.

Pangasinan, J. N., H. T. Salazar, A. A. Salvador and R. V. Sarmago. 2015. "Intense UV emission and lasing action of a single, free-standing and post heat-treated ZnO microribbon." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-PA-12.

Sayson, L. V. A., H. T. Salazar, R. V. Sarmago, M. J. F. Empizo, K. Yamanoi, T. Shimizu and N. Sarukura. 2015. "Preliminary results on the Fe-doping of ZnO microstructure grown by carbothermal reduction method." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-PA-13.

Rosete, M. M., M. H. Zosa and R. V. Sarmago. 2015. "The effect of colloidal processing using KCL as supporting electrolyte on colloid stability and films of superconducting Bi2Sr2CaCu2O8-x." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-PB-10.

Agulto, V. C., H. T. Salazar and R. V. Sarmago. 2015. "Seeded hydrothermal growth of ZnO nanorods on different substrates." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-PB-11.

De Vera, F. I. N., J. L. Tacneng, X. A. Galapia, C. A. Arcilla and R. V. Sarmago. 2015. "Structure, morphology and normal-state transport properties of indium doped Bi2Sr2CaCu2O8-x films fabricated thru sedimentation process." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-PA-11.

Namuco, S. B. and R. V. Sarmago. 2015. "Effects of Mn on the surface morphology of doped GdBa2-xMnxCu3O7-x sample." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-PB-18.

Vistro, V. DC A. and R. V. Sarmago. 2015. "Observation of the crystal structure and impurity phases of Bi2Sr2CaCu2Oy films grown with polycrystalline Al2O3." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-PB-22.

De Mesa, J. A., A. M. Amo, J. J. Miranda, H. T. Salazar Jr., R. V. Sarmago and W. O. Garcia. 2015. "Growth of ZnO on silicon (100) with oxygen background gas using femtosecond pulsed laser deposition." In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-PA-

15. De Mesa, J. A., A. C. Amo, H. T. Salazar, J. J. Miranda, R. V. Sarmago and W. O. Garcia. 2015. “Catalyst-free deposition of ZnO nanorods on silicon (100) using femtosecond pulsed laser deposition in oxygen background gas.” In *Proceedings of the Samahang Pisika ng Pilipinas: 33rd Physics Congress*, Vigan City, June 3-6, SPP2015-3C-05.
Sub-total (17)

3. List of non-NIP funded projects (e.g. EIDR, ECWRG, OVCRD Outright, NRCP, etc.)

Project Leader	Title	Period/ Phase no.	Amount
Dr. Roland Sarmago	Investigation on crystal defects of carbothermally grown zinc oxide nanostructures	Aug. 16, 2015 to Aug. 15, 2016	P 532, 770.00
Dr. Roland Sarmago	High-temperature synthesis of graphene	July 1, 2015 to June 30, 2016	P 300,000.00
Sub-total (2)			

C. Extension Work Highlights

1. List of Research Interns/ OJT’s (Non-NIP), for trainings held at NIP {Please enumerate names and affiliations, e.g., PSHS, UNP, etc}

Name	School/ Organization	Program; and Duration, dates	NIP Personnel/ Contact person	Remarks: (Indicate if covered by MOA, project, etc.)
Argeena A. Agao-agao	MSU-IIT	Apr-May 2015	Hernanie T. Salazar, Jr.	
Frances Rey U. Cortes	MSU-IIT	Apr-May 2015	Hernanie T. Salazar, Jr.	
Diamond C. Domato	MSU-IIT	Apr-May 2015	Hernanie T. Salazar, Jr.	
Florence Mae B. Espejo	MSU-IIT	Apr-May 2015	Hernanie T. Salazar, Jr.	
Virnie P. Pequit	MSU-IIT	Apr-May 2015	Hernanie T. Salazar, Jr.	
Nikki D. Tagdulang	MSU-IIT	Apr-May 2015	Hernanie T. Salazar, Jr.	
Marcelyn S.	MSU-IIT	Apr-May	Hernanie T.	

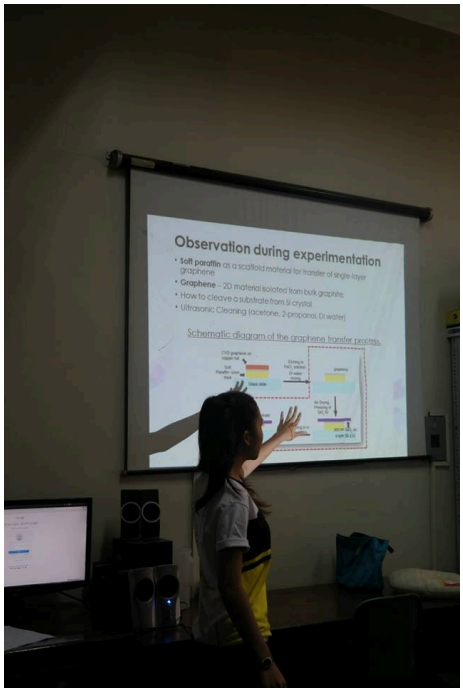
Tasa		2015	Salazar, Jr.	
Richelle B. Vacalares	MSU-IIT	Apr-May 2015	Hernanie T. Salazar, Jr.	
Mark Anthony C. Burgonio	PUP	Apr-May 2015	Hernanie T. Salazar, Jr.	covered by Memorandum of Understanding
Judy L. Escobar	PUP	Apr-May 2015	Hernanie T. Salazar, Jr.	covered by Memorandum of Understanding
Rachel May A. Gamboa	PUP	Apr-May 2015	Hernanie T. Salazar, Jr.	covered by Memorandum of Understanding
Bee Jay Magallanes	UNP	Apr-May 2015	Hernanie T. Salazar, Jr.	
Jerome P. Mecca	UNP	Apr-May 2015	Hernanie T. Salazar, Jr.	
Noel Xavier Fuentes	PSHS-CvisC	Jun-July 2015	Hernanie T. Salazar, Jr.	covered by MOA
Bernard Yepes	PSHS-EVC	Jun-July 2015	Hernanie T. Salazar, Jr.	covered by MOA
Eugene Toribio	PSHS-BRC	Jun-July 2015	Hernanie T. Salazar, Jr.	covered by MOA

IV. Photos, ISI/SCI publications and Other Appendices

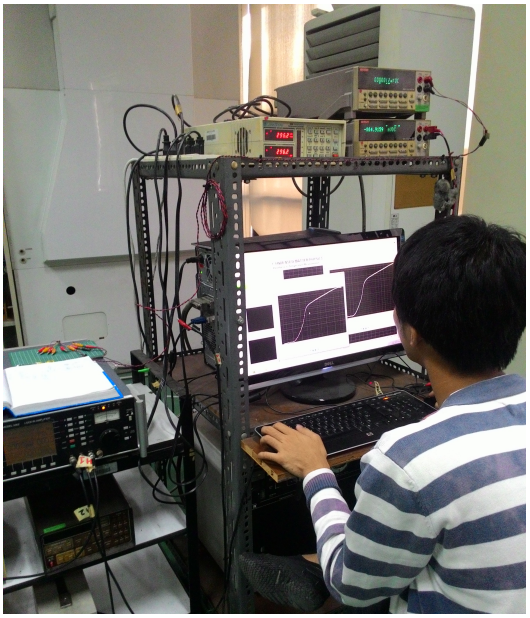
B. Photos (embed in this document)

Group photo taken during Christmas party 2015

Supercon members together with the Batch 2015 immersionists, taken during the culmination program of Summer Immersion Program (SIP) 2015.



Immersion program in the lab involves seminar reports and weekly presentation of progress reports to practice the student interns' oral presentation skills. This photo shows Argeena, intern from MSU-IIT, presenting her progress report.



Resistance-Temperature (RT) measurement station

B. ISI/SCI publications

Summary of Attachments

Attachment B1: Empizo, M. J. F., K. Yamanoi, A. B. Santos-Putungan, R. Arita, Y. Minami, M. V. Luong, T. Shimizu, E. S. Estacio, A. S. Somintac, A. A. Salvador, R. V. Sarmago and N. Sarukura. 2015. “Blue-shifted and picosecond amplified UV emission from aqueous chemical grown ZnO microrods.” *Optical Materials* 48: 179–184.
Attachment B2: Empizo, M. J. F., K. Yamanoi, K. Mori, R. Arita, K. Iwano, M. Takabatake, K. Fukuda, T. Hori, Y. Minami, M. V. Luong, Y. Abe, S. Kojima, Y. Arikawa, T. Shimizu, T. Norimatsu, H. Azechi, N. Sarukura, A. A. Salvador, R. V. Sarmago and T. Fukuda. 2015. “Gamma-ray irradiation effects on the optical properties of bulk ZnO single crystals.” *Applied Physics Express* 8: 061101.
Attachment B3: Empizo, M. J. F., K. Yamanoi, K. Fukuda, R. Arita, Y. Minami, T. Shimizu, N. Sarukura, T. Fukuda, A. B. Santos-Putungan, R. M. Vargas, A. A. Salvador and R. V. Sarmago. 2015. “Photoluminescence investigations of bulk and microstructured ZnO crystals for scintillator applications.” *Journal of Ceramics Processing Research* 16: 98–101.