

Philippine Council for Advanced Science and Technology
Research and Development
Human Resources and Institution Development Division

Scholar's Thesis/Dissertation Progress Report

For the ☐ 1st ☐ 2nd ☐ 3rd ☒ 4th Quarter/Year 2

THESIS TITLE: Transfer Matrix Method for Silicon-based Microcavity	
GRANTEE: ASTHRDP - DOST	DEGREE PROGRAM: MS Physics
DURATION: 2 years	
DATE STARTED: June 2009	EXPECTED DATE OF COMPLETION: May 20, 2011
OBJECTIVES: This study investigates silicon-based microcavities for future optical applications. This also examines the reflectivity of grown and fabricated multilayered structures. Specifically, it aims the following: <ol style="list-style-type: none">1. Design a simulation algorithm using transfer matrix method.<ol style="list-style-type: none">a. Simulate the transmittivity of a silicon-based (a - Si₃N₄: H) microcavity by using transfer matrix method and compare the experimental results to the established result obtained by Ballarini et al.b. Characterize the reflectivity of grown and fabricated multilayered structures from NIP, UP-Diliman.c. Simulate the reflectivity of the given multilayered structures and compare results from the experiment.2. Design silicon-based microcavities with an optimum coupling between photon and exciton using transfer matrix method.	
SCHEDULE OF ACTIVITIES: June –August: Conceptualize research project/research proposal presentation. September – October: Model the silicon-based microcavity of Ballarini. November- December: Characterize and simulate the multilayered structures from NIP, UP-Diliman January – March: Improve the experiment for reflectivity and the refractive index of Silicon Nitride April: Design a silicon-based microcavity with an optimum coupling. Final analysis of all the results. 1 st week of May: Finalize manuscript draft and submit to panel members. 2 nd week of May: Tentative schedule of final thesis defense. 3 rd to 4 th week of May: Finalize manuscript based from the recommendation of panel examiners. Printing and submission of bound copies.	

RESULTS AND DISCUSSION:

1. Modeling a-SiN microcavities

The general profile a-SiN:H microcavity for calculated transmission spectrum well agrees with the measured one (experiment) by Ballarini. Further improvement on the refractive index model of a-SiN is needed to accurately model the microcavity.

2. Predicting Reflectivity of Multilayered Structures

Transfer matrix method is also used to characterize multilayered structures like microcavities, multiple quantum wells (MQWs) and high-electron mobility transistors (HEMTs). Conversely, for multilayered structures (MQW 318, HEMT 316 and HEMT 326) from NIP, UP Diliman, their calculated reflectance spectrum fairly fit the measured spectrum. Noises are also evident around 200 – 400 nm and 1000 – 1100 nm. This difference between the calculated spectrum and the measured spectrum does not imply the ineffectiveness of transfer matrix program to determine the multilayered structures' reflectance. The reason might be in the experiment since the transfer matrix method properly fits the transmission spectrum of Ballarini's microcavity. The possible reason for the noise from 200-400 nm is the optics used in the experiment. The optics tends to absorb the UV rays which result to poor and noisy signals. Conversely, the noise from 1000-1100 nm is due to the spectrometer which is no longer sensitive at this range. So, further examination is needed particularly in the reflectivity experiment. Supplementary characterization of the multilayered structures for reflectance will be considered such as UV-VIS.

PROBLEMS ENCOUNTERED/PROPOSED SOLUTIONS:

1. Modeling a-SiN microcavities

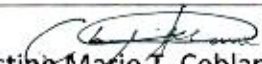
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REMARKS: At present, this research project has demonstrated and partially attained its goals and objectives. Silicon-based microcavities were modeled using Transfer matrix program. Partial results of analytical modeling and Ballarini agree well.

Prepared by:


Christine Marie T. Cebalano
Grantee's name/signature

This portion is to be filled up by adviser and returned to PCASTRD in a sealed envelope together with the scholar's report:

PERCENTAGE OF TOTAL WORK COMPLETED:

About 90%

COMMENTS:

Christine is at the final stages of her work. She's just optimizing her designed microcavity so that there's a huge coupling between photons and excitons. With her current work habits, I am confident that she would be able to defend before the end of this summer.


Ryan B. Balili, Ph. D.

ADVISER'S NAME/SIGNATURE

04.20.2011

DATE

**Human Resource and Institution
Development Division
(HRIDD)**

Action Slip

Subject:	Request for extension of Christine Marie T. Cebano		Reference No. 04/05/11/0029
From:	Christine Marie T. Cebano	To:	Engr. Ermie M. Bacarra
Date of Letter:	March 30, 2011	Deadline:	
Date/Time In/Out	Remarks		Acted by
04/05/11	Received		Val
4-5	<i>Rebels pls. Lander</i>		<i>Rebels</i>
4-6	<i>pls. see draft for comment po.</i>		<i>Rebels</i>
4-6	<i>pls. there is an omission. pls. correct and proceed to final printing</i>		<i>Rebels</i>
4-7	<i>inserted</i>		<i>Rebels</i>



REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF SCIENCE AND TECHNOLOGY
PHILIPPINE COUNCIL FOR ADVANCED SCIENCE AND TECHNOLOGY
RESEARCH AND DEVELOPMENT



15 October 2010

MS. CHRISTINE MARIE T. CEBLANO
M.S Physics Student
Department of Physics
MSU-Iligan Institute of Technology
Tibanga, Iligan City

Dear Ms. Cebano:

We are very glad to know that you will actively participate as paper/poster presenter in the 12th SPVM National Conference and Workshop to be held on October 20 to 23, 2010 at the Central Philippine University in Iloilo City. We would like to inform you that we are approving your request for financial assistance amounting to **P13,486.00**, broken down as follows:

Roundtrip airfare CDO-Cebu-Iloilo Iloilo-Cebu-CDO	P5,456.00
Transportation allowance	1,300.00
Terminal fees	630.00
Registration fee	2,500.00
Per diem for 5 days (October 20 to 24, 2010)	3,600.00
TOTAL	P13,486.00


We also wish to remind you that you are required to liquidate the grant by providing us with the original copy of the official receipt for the registration fee, accommodation, used plane ticket and certificate of participation/attendance within five (5) days after the event. In submitting your liquidation report, photocopies of the summary of expenses and receipts are required, in addition to the originals. The summary of expenses should bear your signature and should indicate the date, official receipt no., name of items purchased and the amount. All receipts should be pasted on a bond paper.

May we request you to sign the conforme below and return it to us as soon as possible so that we can process the release of the grant. Please be informed also that the check amounting to **P13,486.00** will be deposited to your Landbank account.

We would like to inform you, however, that the DOST-ASTHRDP adopts the policy that support for paper/poster presentation will be given only once to M.S/Ph.D scholars for the entire duration of the scholarship.

Please be guided accordingly.

Very truly yours,


ERNIE M. BACARRA
Chief, Human Resource and Institution
Development Division

Conforme:

MS. CHRISTINE MARIE T. CEBLANO



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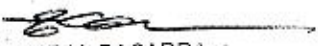
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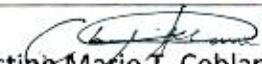
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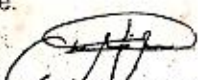
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Development Division

Conforme:


MS. CHRISTINE MARIE T. CEBLANO

September 28, 2010

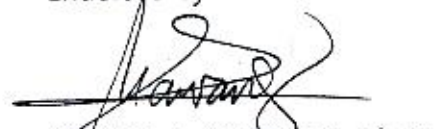
**Itinerary of Travel for the
12th SPVM National Physics Conference and Workshop**

Date	Placed to be visited	Allowable Transportation	Expense per diem	Total amount
10/19/2010	Residence to Iligan Bus Terminal	Taxi		100.00
	Iligan to Cagayan de Oro	Bus		150.00
	CDO terminal to CDO Airport	Taxi		200.00
	CDO Terminal fee			30.00
	CDO to Cebu – Cebu to Iloilo	Plane		2,728.00
	Cebu Terminal fee			200.00
	Iloilo Airport to venue	Taxi		200.00
	Registration fee			2,500.00
10/19-24/2010	Board	1,200 x 4	6x500	3,000.00
	Lodging		6x800	4,800.00
10/24/2010	Venue to Iloilo Airport	Taxi		200.00
	Iloilo Terminal fee			200.00
	Iloilo to Cebu – Cebu to CDO	Plane		2,728.00
	Cebu Terminal fee			200.00
	CDO Airport to CDO Terminal	Taxi		200.00
	CDO to Iligan City	Bus		150.00
	Iligan Bust Terminal to residence	Taxi		100.00
TOTAL			P	17, 686.00

Noted by:


RYAN B. BALILI, Ph. D.
Thesis Adviser

Endorsed by:


SALASA A. NAWANG, Ph. D.
Program Adviser
Chairman, Physics Department
MSU – Iligan Institute of Technology



Samahang Pisika ng Visayas at Mindanao
(SEC Reg. No. CN200427840)
c/o Department of Physics, MSU-Iligan Institute of Technology
9200 Iligan City, Philippines
and

Central Philippine University, Iloilo City
HOST UNIVERSITY



September 26, 2010

Dear Prof. Ceblano,

We are happy to inform you that your paper contribution entitled

"Modeling of Amorphous Silicon Nitride Microcavities"

Authors: Christine Marie T. Ceblano and Ryan B. Balili

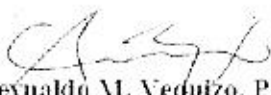
has been accepted for oral presentation at the 12th SPVM National Physics Conference and Workshop on October 21-23, 2010 at the Central Philippine University, Iloilo City.

As to the schedule of your presentation, you will be notified one week prior to the conference schedule.

Your talk is allotted only for 30 minutes inclusive for the 5 minutes question and answer portion. Please prepare your presentation accordingly. A beamer/Multimedia Projector/OHP will be provided in the lecture hall, and you are requested to upload your presentation before the session starts.

We look forward to seeing you in Iloilo City.

Sincerely yours,


Reynaldo M. Vequizo, Ph.D.
President-Elect, SPVM

Modeling of Amorphous Silicon Nitride Microcavities

Christine Marie T. Ceblano^{a*} and Ryan B. Balili^a

^a*Physics Department, Mindanao State University - Iligan Institute of Technology,
A. Bonifacio Avenue, Tibanga, 9200 Iligan City, Philippines*

This paper presents a way to model silicon-based microcavities using transfer matrix (TM) method. The cavity modeled in this paper consists of amorphous silicon nitride distributed Bragg reflectors (DBRs) with $a\text{-Si}_{0.50}\text{N}_{0.50}\text{H}$ emitter layers embedded in between. Transfer matrix algorithm is used to obtain the transmittance spectra of the microcavity. Transmittance is then compared to the established result. Results show that the algorithm works well in simulating transmittance of silicon-based microcavities.

Keywords: silicon-based microcavities, silicon nitride, distributed Bragg reflectors (DBRs), transfer matrix, transmittance

*christineccblano@gmail.com

Action Slip

[illegible]

25 August 2010

MS. CHRISTINE MARIE CEBLANO
Department of Physics
MSU-Iligan Institute of Technology
Andres Bonifacio Ave., Iligan City

Dear Ms. Ceblano:

This has reference to the line-item-budget (LIB) you submitted for your thesis grant. We would like to inform you that we are granting you a research allowance in the amount of **P50,000.00**. The said grant is subject to the usual government accounting and auditing rules and regulations.

Please be reminded that you are required to submit quarterly progress reports of your thesis as per attached form to included evidence of results obtained (pictures, tables graphs, where applicable). Please note that we will not accept a one-time submission of accumulated progress reports covering a number of months.

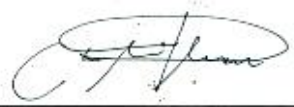
The check representing the first release in the amount of **P40,000.00** will soon be prepared. We will deposit the check to your LBP Savings Account as soon as it is approved/signed. The balance will be released upon submission of a quarter report.

Please sign the conforme below and return it to us as soon as possible.

Very truly yours,

ENGR. ERMIE M. BACARRA
Chief, HRIDD

Conforme:



CHRISTINE MARIE CEBLANO

**Human Resource and Institution
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(HRIDD)**

Action Slip

Subject:	Thesis proposal of Cristine Marie T. Ceblano		Reference No. 24/8/10-00111
From:	Cristine Marie T. Ceblano	To:	
Date of Letter:		Deadline:	
Date/Time In/Out	Remarks		Acted by
08/24/10	Thesis proposal of Cristine Marie T. Ceblano		
8-25	searched for books on thesis title		Shirley
8-25	draft		Shirley
8-26	if there is more of me		Shirley
8-27	software & optical component to be used for PCASTRO IDF		Shirley
9-2	shirley, PCASTRO ~ ASTHRO ? Can we check, if also the search microcavity it seems some people in NIP have done this already		Shirley
9-6-10	No com. ASTHRO re. exp.		Shirley

9-1-10

9-9-10

final for signature
to submit based on the publications and then of
Shirley

25 August 2010

MS. CHRISTINE MARIE CEBLANO
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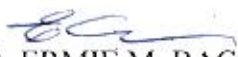
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8 Result(s) found

As of August 25, 2010

LOZADA, LOU SERAFIN
MS Physics
UPD

"Single Route Formation of Doped-Polyaniline/Porous Silicon Heterojunction"

ULANO, APRIL
MS Physics, UPD

"Silicon Nitride Synthesis Using Magnetized Sheet Plasma Negative Ion Source"

MATEO, CHERRY MAE
MS Physics, UPD

"Excitonic Transitions in Strained Bulk GaAs and GaAs/AlGaAs Multiple Quantum well bonded on Si and MgO Substrates via Epitaxial Lift-Off Technique"

MANIBOG, KRISTINE
MS Physics, UPD

"Resonant Cavity-Enhanced Devices On Au/Si Substance"

SINGIDASS, BESS
PhD Physics, UPD

"SEM AND AFM ANALYSIS OF NANOSTRUCTURES OF CARBON ON IRON-COATED SILICON SUBSTRATES BY CARBOTHERMAL GROWTH PROCESS"

MANULAT, SANDRA
MS Physics, MSUIT

"Growth Mechanism of Zinc Oxide Thin Films on Si(100) and Si(111) Substrates"

PUTUNGAN, DARWIN
MS Physics, UPD

"KINETIC MONTE CARLO SIMULATIONS OF CO-DEPOSITION OF INDIUM AND TIN ON SILICON(100)-2x1 SURFACE: INVESTIGATION OF CHEMICAL SELECTIVITY AND DIMER ORDERING PHENOMENA"

LOPEZ, JESSICA IRISH
MS Physics, MSUIT

"Simulation Study of Three-Dimensional Granular Flow Using ESyS-Particle"

Republic of the Philippines
Mindanao State University
ILIGAN INSTITUTE OF TECHNOLOGY
Iligan City

SERVICE RECORD
(To be accomplished by Employer)

NAME: OLE, PATRICIO JR. A. (If married woman give also full maiden name.)
(Surname) (Given Name) (MI)

BIRTH: February 12, 1959 Pala-o, Iligan City (Data herein should be checked from birth or baptismal certificate or some other reliable documents.)
(Date) (Place of Birth)

COST CENTER: School of Engineering Technology (SET-Electrical)

This is to certify that the employee named herein above actually rendered services in this Office as shown by the service record below, each line of which is supported by appointment and other papers actually issued by this Office and approved by the authorities concerned.

supported by appointment and other papers actually issued by this Office and approved by the									
SERVICE		RECORD OF EMPLOYMENT		Salary	Office Entity/Division		LV/ABS	SEPARATION	
Inclusive Dates		Designation	Status		Station/Place	Branch	without	(4)	
From	To			(1)	(2)	of Assignment	(3)	Pay	Date
5-22-85	10-05-85	Instructor B	Contr. P	1,802 /mo	MSU-IIT	National	None	10-06-85	Cont expired
6-02-86	6-30-86	Instructor D	- do -	23,892 /a/a	- do -	- do -	*		Re-employed
7-01-86	2-28-87	- do -	- do -	29,148 /a	- do -	- do -	*		NCC# 41
3-01-87	12-31-87	- do -	- do -	30,636 /a	- do -	- do -	*		NCC# 47
1-01-88	3-31-88	- do -	- do -	33,840 /a	- do -	- do -	*		NCC# 51
4-01-88	5-31-88	- do -	Prob.	33,840 /a	- do -	- do -	*		Change status to Prob.
6-01-88	6-30-89	Instructor F	- do -	37,380 /a	- do -	- do -	*		Reclassification
7-01-89	12-31-90	Instructor II	- do -	45,600 /a	- do -	- do -	*		NCC# 56
1-01-91	12-31-93	Instructor III	- do -	49,092 /a	- do -	- do -	*		NCC# 56
1-01-94	10-19-94	- do -	- do -	57,492 /a	- do -	- do -	*		NCC# 72
10-20-94	12-31-94	- do -	Perm.	57,492 /a	- do -	- do -	*		Change status to Perm.
1-01-95	11-30-95	- do -	- do -	69,492 /a	- do -	- do -	*		NCC# 74
12-01-95	12-31-95	Assoc. Professor IV	- do -	119,400 /a	- do -	- do -	*		Reranking
1-01-96	12-31-96	- do -	- do -	143,580 /a	- do -	- do -	*		NBC# 448
1-01-97	10-31-97	- do -	- do -	171,792 /a	- do -	- do -	*		NBC# 458
11-01-97	12-31-98	- do -	- do -	200,004 /a	- do -	- do -	*		NBC# 458
1-01-99	12-31-99	- do -	- do -	205,008 /a	- do -	- do -	*		SG 22/step 2
1-01-2000	6-30-2001	- do -	- do -	225,504 /a	- do -	- do -	*		NBC# 468
7-01-2001	11-30-2001	- do -	- do -	236,784 /a	- do -	- do -	*		NBC# 474
12-01-2001	11-30-2004	- do -	- do -	242,700 /a	- do -	- do -	*		SG 22/step 3
12-01-2004	6-30-2007	- do -	- do -	248,772 /a	- do -	- do -	*		SG 22/step 4
7-01-2007	11-30-2007	- do -	- do -	273,648 /a	- do -	- do -	*		NBC# 511
12-01-2007	6-30-2008	- do -	- do -	280,500 /a	- do -	- do -	*		SG 22/step 5
7-01-2008	To date	- do -	- do -	308,544 /a	- do -	- do -	*		NBC# 516
-x-x-x-x-x-x-x	-x-x-x-x-x-x-x	-x-x-x-x-x-x-x-x-x-x-x-x	-x-x-x-x	-x-x-x-x-x-x-x-x	-x-x-x-x-x-x-x-x	-x-x-x-x	-x-x-x-x		

Issued in compliance with Executive Order No. 54 dated August 10, 1954, and in accordance with Circular No. 58, dated August 10, 1954 of the system.

CERTIFIED CORRECT

July 14, 2009

(Date)

NOTE: Issued for the purpose of: Scholarship Application
Paid under O.R.#. 0285737 dtd 07-14-2009

Estrella G. Abreu
ESTRELLA G. ABREU 714-09
Administrative Officer V
OIC-HRMD *Abreu*

CO-MAKER STATEMENT

KNOW ALL MEN BY THESE PRESENT:

That I, PATRICK A. CLE, Jr. of legal age, Filipino, married/single,
(Co-maker)

with postal address at P-3 POBLACION, NAWUAN, MISAMIS ORIENTAL

bind myself jointly and severally.

with

CHRISTINE MARIE T. CEBLANO

(Principal)

of DON E. SERO ST., COTABATO CITY

(home address)

a grantee under the DOST Accelerated
S&T Human Resource Development Program

In favor of

The DEPARTMENT OF SCIENCE AND TECHNOLOGY (DOST) with principal office
at Gen. Santos Avenue, Taguig, Metro Manila, hereinafter referred to as DOST.

Witnesseth

WHEREAS, the Principal has accepted and signed a Scholarship Contract
with DOST and bound himself/herself to comply with the terms and conditions
stipulated in said Contract and its implementing Guidelines;

WHEREAS, under said Guidelines, it is stipulated that the Principal shall be
bound to pay and reimburse DOST on demand such amount or amounts as may
have been defrayed for the Principal's school fees, allowances and other expenses
incurred by DOST in connection with the scholarship in the event of the Principal's
failure to complete the program covered by the scholarship grant or render the
required year(s) of service.

NOW, THEREFORE, for and in consideration of the foregoing premises, I,
Co-maker of this undertaking, hereby guarantee and warrant to DOST: (1) That the

Principal shall faithfully comply with the terms and conditions stipulated under the Scholarship Contract, and (2) That in such event that the Principal is required by DOST to make reimbursements for failure to complete the scholarship program or render the required year(s) of service, I bind myself to be jointly and severally liable for such obligation upon demand by DOST without need of court action,

IN WITNESS WHEREOF, I have hereunto set my hand this 15th day of

July, 2009 at Iligan City, Philippines.

CHRISTINE MARIE T. CEBLANO
Principal
(Signature over Printed name)

PATRICIO A. OLE JR. (Uncle)
Co-Maker
(Indicate relationship)

SIGNED IN THE PRESENCE OF

CHRISTINE MARIE T. CEBLANO
Witness

ACKNOWLEDGEMENT

Before me, Notary Public for and in CITY OF ILIGAN this 15th day of July, 2009 personally appeared:

NAME	RES. CERT. NO.	DATE/PLACE ISSUED
1. <u>CHRISTINE MARIE T. CEBLANO</u>	<u>07125369</u>	<u>7/12/09</u> <u>ILIGAN City</u>
2. <u>PATRICIO A. OLE JR.</u>	<u>17930853</u>	<u>3/06/09</u> <u>NAAWAN, MS. OR.</u>

Known to me and to be the same persons who executed the foregoing Scholarship Contract and acknowledged to me that the same is their own free act and deed.

Witness my hand, and seal on the date and place above stated.

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Series of

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2009

Notary Public