INSTRUMENTATION PHYSICS LABORATORY

SINCE 1983

National Institute of Physics
Instrumentation Physics Laboratory Annual Report
Period: 01 January - 31 December 2019

Prepared and submitted by:
> Caesar A. Saloma, PhD
> Coordinator, Instrumentation Physics Program (1 August – 31 December 2019)

With assistance from:
> Anthony Paul N. Fox
> University Research Associate I, Instrumentation Physics Laboratory (IPL)

> Samantha Ruth C. Lahoz
> Student Assistant, IPL

I. Executive Summary

A. Activities of the Research Group
1. Organization as of December 2019

    a. Regular members: PhD Faculty: 5
    b. Student Members: 56 (38 BS + 10 MS + 8 PhD)
    c.
2. Mentoring - Number of Graduates
Period: 2nd Sem 2018-2019, Midyear 2018-2019, 1st Sem 2019-2020

    BS Physics: 5
    BS Applied Physics: 12
    MS Physics: 5

B. Research Highlights

1. No. of publications in international peer-reviewed journals (ISI/SCI and Scopus-listed journals: 4
2. No. of publications in local journals (non-ISI/non-SCI, e.g. Science Diliman): 3
3. No. of international conference presentations (with full paper in proceedings): 2
4. No. of international conference presentations (without full paper): 6
5. No. of local conference presentations: with (e.g. SPP Physics Conference) and without full paper (eg NRCP- ASM): 43
6. No. of chapters in books: 1

7. No. of patents: 0
8. No. of NIP funded projects: 5
9. No. of non-NIP funded projects: (2)
10. No. of major equipment acquired/upgraded: 0
11. No. of research travels abroad (Outbound): 3
12. No. of visiting researchers:
13. No. of MOAs with local or foreign institutions and other external collaborators: (1)

C. Extension Work Highlights

1. No. of Extension Work Activities: (3)
2. No. of Research Interns/OJT's (Non-NIP), for trainings held at NIP: 14

D. Main Challenges Encountered and Proposed Solutions

The primary challenge of IPL is to increase the number of PhD graduates that it produces per academic year. Accomplishing the said objective is hampered by: (1) lack of additional PhD faculty members to serve as research supervisors, and (2) absence of a PhD program in Applied Physics which has discouraged many BS Applied Physics graduates from proceeding to enroll in the graduate programs of NIP.

Clearly, the aforementioned problems are solved by improving the ability of NIP and IPL to attract more PhD faculty applicants from all over the world and by developing a tenable PhD degree program in applied physics. Having more PhD faculty members and producing more PhD graduates would enhance the scientific productivity of IPL as measured in terms of peer-reviewed publications and technical presentations.

E. Awards or Accreditations Received/Positions of Responsibility Held and Other Accomplishments
1. No. of national awards, accreditations received, positions of responsibility held: 6
2. No. of international awards, accreditations received, positions of responsibility held: 0
3. Other accomplishments: 0

II. Technical Report

A. Activities of the Research Group

The IPL provides qualified PhD, MS and BS students of NIP with an enabling and nurturing environment that allows them to pursue their research projects successfully in fulfillment of their dissertation/thesis degree requirement. Each IPL undergraduate student-member is assigned an IPL PhD thesis supervisor who will direct his or her thesis research and guide his/her steady development as a young scientist. To become a student-member a qualified applicant needs to complete and perform well in the application process. The number of applicants who are be admitted to laboratory membership is determined by the number of IPL PhD faculty supervisors available.

Over the years, the IPL has consistently presented and published its research results in technical conferences and peer-reviewed scientific journals. It also hosts a number of senior high school students as part of the Summer Internship Program of NIP.

1. Organization
a. Group members as of December 2019

PhD Faculty (5)
1. Prof. Caesar A. Saloma, PhD
2. Prof. Maricor N. Soriano, PhD
3. Prof. Giovanni A. Tapang, PhD
4. Prof. May T. Lim, PhD
5. Assoc. Prof. Johnrob Y. Bantang, PhD

Active Adjunct Researchers:
1. Prof. Cynthia Palmes-Saloma (NIMBB)
2. Dr. Ranzivelle Marianne Roxas-Villanueva (UPLB)
3. Dr. Atchong Hilario (Projects)
4. Dr. Marissa G. Pastor (University of San Carlos)
5. Dr. Rene C. Batac (DLSU)

Student Members
PhD Students (8)
PhD1 (1)
1. Jamika Ann Roque
PhD2 (2)
1. Christian Valgomera
2. Chester Balingit
PhD3 (3)
1. Ritz Ann Aguilar
2. Alfred Abella
3. Damian Dailisan
PhD+ (1)
1. Wynn Improso
PhD++(1)
1. Teresa Pulido

MS Students (10)
MS1 (2)
1. Kristen Joyce Cervantes
2. Mark Jeremy Narag
MS2 (8)
1. Joshua Jesli Santiago
2. Anthony Paul Fox
3. Wilbur Galarion Jr

4. Micholo Lanz Medrana
5. Jayson Cubero
6. Jan Parvin Zoluaga
7. Ivan Fenis
8. Joshua Abuel

Undergraduate Students (38)
BS5 (32)
1. Kit Guial
2. Joshua Velez
3. Rafael Bagood
4. Adrielle Theresa Cusi
5. Alec Rigonan
6. Raymond Luke Rebong
7. Rhei Joven Juan
8. Andrea Rica Advincula
9. Lou Josef Tan
10. Creo Baylon
11. Kenneth Domingo
12. Rene Principe Jr
13. Stephanie Anne Vergara
14. Daniella Hernandez
15. Eric Reyes
16. Paolo Mawis
17. Emil Mateo
18. Karl Reyes
19. Patricia Pangilinan
20. Chris Dion Bautista
21. Jona Vistal
22. John Algodon
23. Charles Jason Diz
24. Crizzia Mielle De Castro
25. Kelvin Bartilad
26. Kenneth Leo
27. Reinier Xander Ramos
28. Samantha Ruth Lahoz
29. Matthew Joseph Banaag
30. Jose Macalintal
31. Rian Fritz Jalandoni
32. Charles Louie Fernan

BS4 (4)
1. Jemima Bian Anila
2. Jireh Vera Cruz
3. Tisha Bagasala
4. Sarakiel Rayco

BS3 (2)
1. Beatriz Movido
2. Karl Aleta

Summary of Membership in IPL as of December 2019:

Membership Type	Category	Number
PhD Faculty		5
Student Members	BS3	2
	BS4	4
	BS5	32
	MS1	2
	MS2	8
	PhD1	1
	PhD2	2
	PhD3	3
	PhD+	1
	PhD++	1
	Total	61

2. Mentoring

a.) List of Graduates

Program	Student Name	Thesis Title	Defense Date in 2019	Adviser(s)
BS Applied Physics	Hannah Christina C. Arjonillo	Towards a more accurate monte carlo analysis of propagating focused gaussian beam in scattering media	May-15	Dr Saloma (CS)
BS Physics	Joshua V. Velez	Precisting the segregation of vertically and periodically-shaken confined binary granular mixtures from the center-of-mass flight times of each component	Dec-09	CS Dr Junius Andre Balista
MS Physics	Roland Albert A. Romero	Philippine landfall prediction of tropical cyclones in the Pacific using supervised back propagation neural networks	May-16	CS Dr Tapang (GT)
BS Physics	Kristen Joyce R. Cervantes	Information flow in noisy random networks	May-15	GT

BS Physics	Jamika Ann e. Roque	Sub-millimeter wave transmission spectra of 2D polymer metamaterials using a finite-difference time-domain method	May-15	GT
BS Physics	Sheenly Anne P. Saavedra	Dynamics of internet access user activities using a recurrence plot analysis	May-06	Dr Bantang (JB)
MS Physics	Krister Jazz P. Urog	Statistical physics of robustness in complex biological networks	Jul-23	JB
MS Physics	Cephas Olivier V. Cabatit	Prisoner's dilemma game dynamics on complex networks via a modified radiation model of migration	Jul-24	JB
BS Applied Physics	Richmond L. Crisostomo	Morphological Characterization and optimization in branching biological systems	May-06	JB
BS Applied Physics	Reinier Xander A. Ramos	Dynamics of a neronal lattice network with a linear activation function using cellular automata modelling	May-06	JB
BS Applied Physics	John Adrian Y. Asuncion	Statistical dynamics of a forest-fire model with periodic and spatially targeted tree burning	May-15	JB Dr Rene Batac (RB)
BS Applied Physics	Ciara D. Janer	Modified recurrence network analysis of spatio-temporal dynamical events	May-15	JB RB
BS Applied Physics	Merimae S. Villamayor	Cooperation dominance in an iterate prisoner's dilemma game on a lattice in the presence of punishing agents	May-15	JB RB
BS Applied Physics	Mark Jeremy G. Narag	Luna or not? Identifying Juan Luna paintings using texture and CNN features as inputs to machine learning algorithms	May-06	Dr Soriano (MS)
BS Applied Physics	Rhei Joven G. Juan	License plate detection and recognition in challenging conditions	Dec-09	MS
MS Physics	Michelle Cirunay	Spatio-temporal analysis of road network evolution: A case study of Manila, Philippines	May-16	MS RB
BS Applied Physics	Cyd Kristoff Redelosa	Network measurement of traffic analysis zones using transportation network company travel time data	May-15	Dr Lim (ML)
BS Applied Physics	Maria Loraine R. Menorca	Data-driven modeling of networking in academic conferences	May-15	ML
BS Applied Physics	Joseph Roel J. Mabajen	Price Characterization of procured products in the PHILGEPS platform using kernel fitting	May-06	ML

BS Applied Physics	John Paul Emmanuel L. Algodon	Estimation of rainfall interpolation reliability and attack vulnerability	Jul-24	ML
BS Physics	Jejomar Y. Derecho	Trends in the spread of global news in the English language	May-06	ML
MS Physics	Louie John M. Rubio	Multiscale analysis of large datasets	May-17	ML

Summary of Graduates in 2019

	2nd Sem AY 2018-2019	Midyear AY 2018-2019	1st Sem AY 2018-2019	Total/ Program
BS Physics	4	0	1	5
BS Applied Physics	10	1	1	12
MS Physics	3	2	0	5
Total	17	3	2	22

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

1. List of papers published/accepted for publications in international peer-reviewed: 4

a. Abella, A.P., Soriano, M.N. (2019). Detection and visualization of water surface three-wave resonance via a synthetic Schlieren method. Physica Scripta, 94(3). https://doi.org/10.1088/1402-4896/aaf83a.

b. Dailisan, D.N., Lim, M.T. (2019). Vehicular traffic modeling with greedy lane-changing and inordinate waiting. Physica A: Statistical Mechanics and its Applications, 521, Pages 715-723. https://doi.org/10.1016/j.physa.2019.01.107

c. Rubio, L.J.M., Dailisan, D.N., Osorio, M.J.P., David, C.C., Lim, M. T.(2019). Modeling the residential distribution of enrolled students to assess boundary-induced disparities in public school access. Plos One. https://doi.org/10.1371/journal.pone.0222766

d. Aguilar, R.A., Hermosa, N., Soriano, M.N. (2019). Low-cost Fourier ghost imaging using a light-dependent resistor. American Journal of Physics, 87 (12), Pages 976-981. https://doi.org/10.1119/10.0000163

Number of papers published in local journals (SCOPUS-indexed): 3

e. Saloma C.A. (2019). Brain Drain and Inbreeding in the Training of Future Filipino Scientists. Philipp. J. Sci 148-1

f. Saloma C.A. (2019). Valuable Lessons from a Decade of ERDT and ASTHRDP Implementation. Philipp. J. Sci 148-2

g. Saloma C.A. (2019). Journal Status Report 2019, Philipp. J. Sci 148-3

2. Number of international conference presentations (with full paper in print proceedings): 2

a. R. T. Bahia, M. C. Estur, A. C. Blanco, and M. Soriano (2019), Illuminance mapping of nighttime road environment using unmanned aerial system. Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLII-4/W19, 39–46, https://doi.org/10.5194/isprs-archives-XLII-4-W19-39-2019.

b. K. G. Jubilo, M. R. Algodon, E. M. Torres, Z. D. Abraham, A. Ide-Ektessabi, and M. Soriano (2019). Lost waterways: clues from digitized historical maps of Manila and other Philippine cities. Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLII-4/W19, 249–254, https://doi.org/10.5194/isprs-archives-XLII-4-W19-249-2019.

3. **Number of international conference presentations (WITHOUT full paper (ie, short abstract only)): 6**
   1. Lahoz, S.R.C. and Bantang, J.Y., 'Neuronal avalanches in a stochastic compartmental model of neuronal culture spiking dynamics', 16th International Conference on Molecular Systems Biology, De La Salle University, Manila, Philippines, October 28-31, 2019.
   2. Ramos, R.X.A. and Bantang, J.Y., 'Classification of the dynamics of an outer-totalistic 2D and quasi-3D cellular automata simplistic models of neuronal patches', 16th International Conference on Molecular Systems Biology, De La Salle University, Manila, Philippines, October 28-31, 2019.
   3. Jalandoni, R.F. and Bantang, J.Y., 'Mechanical stress generated by a 2D model of cancer growth using a Centroidal Voronoi Tessellations', 16th International Conference on Molecular Systems Biology, De La Salle University, Manila, Philippines, October 28-31, 2019.
   4. Lahoz, S.R.C. and Bantang, J.Y., 'Neuronal avalanches in a stochastic compartmental model of neuronal culture spiking dynamics', BrainConnects 9th Neuroscience International Symposium: Bridging Brains – Enriching Minds. St. Luke's Medical Center, Global City, Taguig City, Philippines. October 23-25, 2019.
   5. Ramos, R.X.A. and Bantang, J.Y., 'An outer-totalistic 2D and quasi-3D cellular automata simplistic models of neuronal patches', BrainConnects 9th Neuroscience International Symposium: Bridging Brains – Enriching Minds. St. Luke's Medical Center, Global City, Taguig City, Philippines. October 23-25, 2019.
   6. Jalandoni, R.F. and Bantang, J.Y., 'Mechanical stress generated by a 2D model of cancer growth using a Centroidal Voronoi Tessellations', BrainConnects 9th Neuroscience International Symposium: Bridging Brains – Enriching Minds. St. Luke's Medical Center, Global City, Taguig City, Philippines. October 23-25, 2019.

4. **Number of local conference presentations: With full paper (in print proceedings, eg SPP-congress) and Without full paper (eg NRCP- ASM): 43**

   1. Rosario, R. and Saloma C.A. (2019). An effective way to locate a Jollibee or McDonald's store in the National Capital Region. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.
   2. Janer, C.DO., Bantang, J.Y., and Batac, R.C. (2019). Robustness of the recurrence network analysis method with respect to data loss. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.
   3. Menorca, M.R.L. and Lim, M.T. (2019). Simulating network formation through in-person interaction in a limited budget environment. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.
   4. CIrunay, M.T., Batac R.C. and Soriano, M.N. (2019). Invariant statistical property throughout the road network evolution of Manila. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.
   5. Crisostomo, R.L. and Bantang, J.Y. (2019). Sunlight allocation in an L-system tree model. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.
   6. Mabajen, J.R.J. and Lim, M.T. (2019). Price characterization of import goods from Customs dataset. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.
   7. Dailisan, D.N. and Lim, M.T. (2019). Jamming transitions in a mixed traffic cellular automata model. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

8. Balingit, A.C.M., Dailisan, D.N. and Lim, M.T. (2019). Mesoscopic simulation of road networks with time biasing of signalized intersections. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

9. Bagood, R.A.M., Balista, J.A.F. and Saloma, C.A. (2019). Modified inelastic bouncing ball model of the segregation of binary granular mixture: Numerical simulation. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

10. Villamayor, M.S., Bantang, J.Y., and Batac, R.C. (2019). Cooperation levels of iterated Prisoner's dilemma game with punishing agents and strategy update processes. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

11. Diaz, C.J. and Lim, M.T. (2019). Urbanization and barangay convexity relationship analysis. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

12. Romero, R.A.A., Tapang, G.A. and Saloma, C.A. (2019). High accuracy Philippine landfall prediction of Pacific cyclones at their genesis using neural networks. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

13. Bartilad, K.B., Dailisan, D.N., and Lim, M.T. (2019). Estimating pedestrian traffic using bike share data. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

14. Rubio, L.J.M., Dailisan, D.N., Osorio, M.J.P., David, C.C., and Lim, M.T. (2019). Assessing public elementary school quality in the Philippines. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

15. Algodon, J.P.E.L. and Lim, M.T. (2019). Interpolation reliability of Philippine rainfall measurements. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

16. Santiago, J.J.D. and Saloma, C.A. (2019). Self-organized criticality in an hourglass. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

17. Darilag, R.C.T., Abella, A.P., and Soriano, M.N. (2019). Experimental simulation of eddy formation in Sibuyan and Bohol sea. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

18. Narag, M.J.G., and Soriano, M.N. (2019). False positives reveal relationships among impressionist painters. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

19. Cusi, A.T.DL., Tapang, G.A., and Saloma, C.A. (2019). Measurement of apparent Brownian motion diffusion coefficient under finite spatial and temporal detector resolution. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

20. Aguilar, R.A., Hermosa, N., and Soriano M.N. (2019). Low-cost Fourier ghost imaging using a photoresistor. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

21. Juan, R.J.G. and Soriano, M.N. (2019). Effect of downsampling on the quality and resolution of super-resolved images. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

22. Medrana, M.L.B. and Soriano, M.N. (2019). Depth simulation of underwater images for data augmentation. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

23. Matthew Joseph Ribano Banaag, Johnrob Yap Bantang (2019). Dynamics of a singular particle on a 1D oscillating floor. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

24. Veloria, A., Perez, G.J., Tapang, G.A., Comiso, J. (2019). From TRMM to GPM: verifying the continuity of satellite-derived rainfall through comparison with Philippine synoptic measurements. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

25. Mawis, P.R.D., Improso, W.D.G.D., and Tapang, G.A. (2019). Characterizing pixel crosstalk in a transmissive spatial light modulator. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

26. Reyes, E.J.V.C., Improso, W.D.G.D., and Tapang, G.A. (2019). Point spread function robustness in galvanometer beam scanning. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

27. Fox, A.P.N., Tapang, G.A. and Saloma, C.A. (2019). Semiconductor laser optical feedback Mach-Zehnder interferometer. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

28. Sales, H.G.L. and Tapang, G.A. (2019). Information flow in a dynamic weighted Erdös-Rényi network with different noise-enhanced node capacities. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

29. Derecho, J.Y. and Lim, M.T. (2019). Thematic trends in worldwide news reporting in the English language. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

30. Ramos, R.X.A. and Bantang, J.Y. (2019). Totalistic cellular automata model of a neuronal network on a spherical surface. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

31. Roque, J.A.E. and Tapang, G.A. (2019). Sub-millimeter wave transmission spectra of 2D polymer metamaterials using a Finite-Difference Time-Domain method. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

32. Arjonillo, H.C.C. and Saloma, C.A. (2019). Curvature correction and Mie scattering in Monte Carlo analysis of propagating focused Gaussian beam in scattering media. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

33. Fenis, I.M., Dailisan, D.N., and Lim, M.T. (2019). Interplay of behavior and traffic dynamics at U-turn slots. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

34. Zoluaga, J.P.B. and Tapang, G.A. (2019). Correlation dendrograms based on word adjacency co-occurrence language network parameters. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

35. Cervantes, K.J.R. and Tapang, G.A. (2019). Information flow in random networks with varying effective node capacities. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

36. Leo, K.M. and Lim, M.T. (2019). Assortativity and resiliency of a Brownian bug network. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

37. Saavedra, S.A.P. and Bantang, J.Y. (2019). Recurrence plot analysis of Internet access user activity. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

38. Lahoz, S.R.C. and Bantang, J.Y. (2019). Burst distributions in stochastic rate model of neuronal populations. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

39. de Castro, C.M.M. and Lim, M.T. (2019). Determining senatorial voting archetypes through hyperspectral unmixing. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

40. Domingo, K.V. and Soriano, M.N. (2019). Frequency domain reconstruction of stochastically sampled signals based on compressive sensing. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

41. Redelosa, C.K. and Lim, M.T. (2019). Traffic analysis zones-based resource allocation analysis using Uber Movement data. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

42. Naces, C.J.R., Licuanan, W., and Soriano, M.N. (2019). Comparison of shadow rugosity versus chain-tape rugosity values from 3D coral reef models. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

43. Baylon, C. and Soriano, M.N. (2019). Increasing Picavet stability by extending the off-string axis. Proceedings of the 37th Samahang Pisika ng Pilipinas Physics Conference, Tagbilaran City, Bohol, Philippines, May 29 – June 1, 2019.

5. **Number of chapters in books: 1**
   1. Improso, W. D. G. D., Tapang, G. A., & Saloma, C. A. (2019). Suppression of Zeroth-Order Diffraction in Phase-Only Spatial Light Modulator. Springer Series in Optical Sciences, Pages 1-30. https://doi.org/10.1007/978-3-030-12692-6_1

6. **Number of patents: (0)**
7. **Number of NIP funded projects: 5**

Name: Caesar Saloma
Project Tite: Geographic correlation between Jollibee and McDonald's stores in the National Capital Region

Maricor Soriano
Human Motion Capture from CNN-Based Stereometry

Giovanni Tapang
Dimerization of Polyanthracene in Polymethylmethacrylate for reversible light-induced surface modification

May Lim
Mesoscopic modeling of vehicular traffic

Johnrob Bantang
Dynamics of complex biological systems

8. **Number of non-NIP funded projects: 2**
   a. Optical Payload Technology Knowledge Acquisition and Localization (OPTIKAL) DOST-PCIEERD funded
   b. Data Analytics for Research and Education Project 2: Design and analysis of algorithms CHED-PCARI funded
9. **Number of major equipment acquired/upgraded: 0**
10. **Number of research travels abroad (Outbound): 3**
    a. Maricor Soriano - Asia Innovates, Kuala Lumpur, Malaysia, October 15-18, 2019
    b. Maricor Soriano - Meeting with project partners for satellite payload development, Japan (Hokkaido University (HU) and Tokyo Office of HU) Nov 23-28, 2019
    c. Damian Dailisan – Research visit to University of California Berkeley, USA, September 2 – October 31, 2019
11. **Number of visiting researchers:**
12. **Number of MOA's entered with local or foreign institutions and external collaborators: 1**
    a. Hokkaido University and UP Diliman for Primary Payload Development entered into on Dec. 16, 2019

C. **Extension Work Highlights**
   1. **List of Extension Work Activities [*Activities (e.g., trainings, workshops, etc held outside the NIP) conducted for Non-UP clients; Gov't appointments (e.g., NRCP, DOST, etc); and, other involvements based on UP-NIP research expertise]**
      a. Technical Panel on Optics and Photonics , DOST-PCIEERD -Maricor Soriano

b. "Good data vs. bad data: Is this dataset useful? Mini-workshop on transport data exploration and visualization using Python", Department of Transportation – May Lim (DARE Project 2)
c. Proceedings of the Samahang Pisika ng Pilipinas Editorial Board – May Lim

2. List of Research Interns/ OJT's (Non-NIP), for trainings held at NIP (14)

SIP Interns: 6

	Name	PhD Staff Member
	Kirsten Pauline S. Gador	Dr Tapang
	Jonyle T. Suriaga	Dr Tapang
	Lance Fredrick L. De Guzman	Dr Bantang
	Jed Jerrel K. Escaran	Dr Bantang
	Apphia Kezia R. Trillo	Dr Lim
	Andrea Rose V. Franco	Dr Lim

DOST-SEI OJTs (8): 8

	Full Name	Hours completed	OJT period	Adviser
1	Kenneth Leo	240	June 6 - July 26 2019	Dr Lim
2	Kelvin Bartilad	240	June 6 - July 26 2019	ML
3	Crizzia Mielle de Castro	240	June 6 - July 26 2019	ML
4	Charles Jason Diaz	240	June 6 - July 26 2019	ML
5	Andrea Rica Advincula	240	June 3 - July 8 2019	Dr Soriano
6	Rene Principe Jr.	240	June 6 - June 27; July 3 - July19	MS
7	Adrielle Theresa Cusi	240	June 10 - July 19 2019	Dr Saloma
8	Emil Joseph Mateo	240	June 6 -July 19 2019	Dr Tapang

D. Main Challenges Encountered and Proposed Solutions

The main challenge of IPL is the production of more PhD graduates per academic year. Accomplishing the said objective is hampered by the (1) lack of additional PhD faculty members serving as research supervisors, and (2) absence of a PhD program in Applied Physics which discouraging many BS Applied Physics graduates from proceeding to enroll in the PhD or MS Physics of NIP.

Clearly, the aforementioned problems are solved by improving the ability of NIP and IPL to attract more PhD faculty applicants from all over the world, and by developing a tenable PhD degree program in applied physics. More PhD faculty and PhD graduates would enhance the research productivity of IPL as measured in terms of peer-reviewed publications and technical presentations.

E. Awards or Accreditations Received / Positions of Responsibility Held (e.g., as SPP officer, journal editorship, etc) and Other Accomplishments

1. Dr. Tapang
   Dean, College of Science, UP Diliman (start: Sept. 2019)
2. Dr. Bantang
   Director, Computational Science Research Center, College of Science, UP Diliman
3. Dr. Lim
   Deputy Director for Research and Extension, NIP
4. Dr. Saloma
   Editor-in-Chief, Philippine Journal of Science
5. Dr. Tapang
   President, Samahang Pisika ng Pilipinas (January - December 2019)
6. Dr. Bantang
   Senior Councilor, Samahang Pisika ng Pilipinas (January 2019 - December 2020)

III.   Photos, ISI/SCI publications and other Appendices
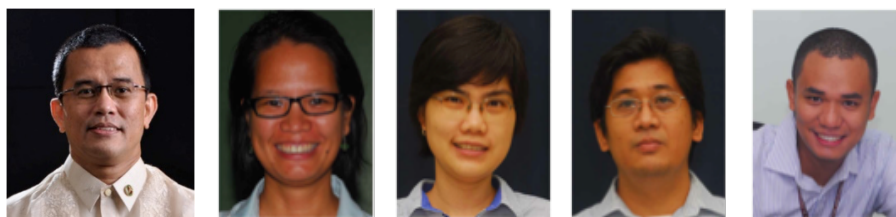
Figure 1. IPL Faculty (left to right): Prof. Caesar Saloma, Prof. Maricor Soriano, Prof. May Lim, Prof. Giovanni Tapang, Dr Johnrob Bantang.

Figure 2. IPL graduates with faculty at the IPL 2019 Graduation Party on 27 May 2019.

Figure 3. Members of IPL present during the general cleaning on 17 August 2019.

Figure 4. IPL Staff with new BS3 student-members at the Welcome Party on 14 October 2019.

Vehicular traffic modeling with greedy lane-changing and inordinate waiting

Damian N. Dailisan, May T. Lim [*]

National Institute of Physics, University of the Philippines Diliman, 1101 Quezon City, Philippines

HIGHLIGHTS

- A modified NaSch traffic model is proposed with the addition of lane changing.
- The fraction of vehicles that change lanes move faster than those that do not.
- Increasing the fraction of lane changers has diminishing returns in the speed difference of vehicles.
- Phase transitions due to the value of slowdown probability are coupled with density.
- Slowdown transition is different from the density phase transition.

ARTICLE INFO

ABSTRACT

Lane changing and vehicular slowdowns are known to impact traffic flow. Using a modified Nagel–Schreckenberg cellular automata model for two vehicle types: blocking (e.g. cars) and non-blocking (e.g. motorcycles), we determined the thresholds at which the interplay of lane changing, random and non-random slowdowns strongly impact vehicle speeds. Lane changing improves speed with diminishing returns as vehicles opt to change lanes. At the same time, lane changing is detrimental to the overall speed when lane straddling occurs. Increasing random slowdowns beyond a critical value (in the case of motorcycles, slowdown values of $p_{slow} \approx [0.2, 0.3, 0.4]$ for densities $\rho = [0.20, 0.15, 0.10]$ respectively) can force crossover from free flowing traffic into a state where interactions between vehicles reduce the average speed.

© 2019 Elsevier B.V. All rights reserved.

1. Introduction

High traffic density is prevalent in urban centers, where "rush hour" traffic volume is slowly becoming the norm. Solutions to the challenge of increasing throughput despite increasing volume include real-time traffic navigation (e.g. Waze, Google Traffic) to find roads with lower occupancy, as well as optimization of sharing assignments in the nascent ride-sharing transportation network (e.g. Uber, Lyft, Grab).

The introduction of apps for ride hailing has led to a decrease in waiting time for passengers [1,2] but has also introduced the unintended consequence of parked transport providers, waiting to be hailed. In cities where public transportation vehicles are privately owned, there is an additional incentive to prolong the waiting period (by waiting for price surges, or declining longer trips) to maximize profits from riders. The low cost and prevalence of on-street parking together with the increased number of vehicles due to these ride-sharing solutions ironically contribute to congestion [3].

* Corresponding author.
E-mail address: may@nip.upd.edu.ph (M.T. Lim).

ACCEPTED MANUSCRIPT

Detection and visualization of water surface three-wave resonance via a synthetic Schlieren method

Chapter 1
Suppression of Zeroth-Order Diffraction in Phase-Only Spatial Light Modulator

Wynn Dunn Gil D. Improso, Giovanni A. Tapang and Caesar A. Saloma

Abstract A correction beam is created using a spatial light modulator (SLM) to suppress the zeroth-order diffraction (ZOD) that is produced by the unmodulated light coming from the dead areas of the said SLM. The correction beam is designed to interfere destructively with the undesirable ZOD that degrades the overall quality of the propagated SLM signal. Two possible techniques are developed and tested for correction-beam generation: aperture division and field addition. With a properly-calibrated SLM, ZOD suppression is demonstrated numerically and experimentally at sufficiently high area factor (AF) values where suitable matching is achieved between the correction beam and the ZOD profiles to result in a 39% reduction of the ZOD intensity via angular aperture division, 32% reduction via annular aperture division, and 24% reduction via vertical aperture division. At low AF values however, meaningful ZOD suppression is not obtained. With the field addition method, a ZOD reduction as high as 99% is gained numerically which was not realized experimentally using an SLM with a fill factor of 0.81 due to limitations posed by an iterative phase-recovery algorithm (ghost image) as well as unwanted signal contributions from the SLM anti-reflection coating, SLM surface variations, optical misalignment and aberrations.

1.1 Introduction

Manipulating the amplitude and phase of light had been extensively studied to achieve desired complex light distribution in different practical applications [1–6]. Controlling the amplitude or the phase, or both at the same time can be done as necessary.

W. D. G. D. Improso (✉) · G. A. Tapang · C. A. Saloma
National Institute of Physics, University of the Philippines, Diliman,
Quezon City, Philippines
e-mail: wimproso@nip.upd.edu.ph

G. A. Tapang
e-mail: gtapang@nip.upd.edu.ph

C. A. Saloma
e-mail: csaloma@nip.upd.edu.ph

Modeling the residential distribution of enrolled students to assess boundary-induced disparities in public school access

Louie John M. Rubio[1], Damian N. Dailisan[1], Maria Jeriesa P. Osorio[2], Clarissa C. David[2], May T. Lim[1]*

1 National Institute of Physics, University of the Philippines Diliman, Quezon City, Philippines, 2 College of Mass Communication, University of the Philippines Diliman, Quezon City, Philippines

* may@nip.upd.edu.ph

Abstract

Given school enrollments but in the absence of a student residence census, we present a gravity-like model to infer the residential distribution of enrolled students across various administrative units. Multi-scale analysis of the effects of aggregation across different administrative levels allows for the identification of administrative units with sub-optimally located schools and highlights the challenges in allocating resources. Using this method, we verify that the current scheme of free cross-enrollment across administrative boundaries is needed in achieving universal education in the Philippines.

Introduction

Achieving inclusive and quality education is part of the 2030 Agenda adopted at the United Nations Sustainable Summit in 2015 [1]. As with most Sustainable Development Goals (SDGs) targets, it uses index indicators [2, 3], such as the net enrollment rate (NER) or the fraction of enrolled students in a specific age group, to track progress. A downside of the NER is that it is prone to misestimation because of its dependence on population projections [4]. Furthermore, the averaging process masks factors that affect late school–entry such as poverty [5], perceptions on school readiness [5], and distance of schools [4].

Information-based initiatives [6] to reform the public school system in the Philippines range from an online volunteer-driven participatory monitoring school-level platform [7] to data collection using high-resolution surveys required by the Department of Education (DepEd) either at the school-level (EBEIS) or at the learner-level (LIS) [8]. The data collection process itself is usually quite involved and has to meet the challenges of data standardization and timely collection [6].

Accessibility models that incorporate spatial detail can range from the simple gravity-based model [9], similar to the one we use in this paper, to highly detailed models that include topography, land use plans [10], and navigation tools. To date, geospatial studies of Philippine schools have focused on understanding location-influenced factors. Linked to natural disasters and civil unrest are findings that: (a) the repeated use of school structures as

19