

National Institute of Physics College of Science University of the Philippines Diliman Quezon City 1101 Philippines

Annual Report for 2018



Instrumentation Physics Laboratory

Prepared and Submitted by:

Johnrob Y. Bantang, PhD Coordinator, IPL

with input from: Anthony Paul N. Fox IPL URA (2019)

Table of Contents

I.	Executive Summary	2
II.	Technical Report	6
III.	Photos, ISI/SCI Publications	16

NIP Management

Research Accomplishments of the NIP IPL Research Group January 1, 2018 - December 31, 2018

Prepared and Submitted by:

Johnrob Y. Bantang, PhD Coordinator, IPL Anthony Paul N. Fox IPL URA (2019)

Vision: A research program, founded upon a strong physics core, that promotes a scientific culture and unites researchers from various disciplines in developing sensible and effective solutions to the complex challenges facing the Philippines and the Region.

Mission: Our mission is to sustain production of PhD physics graduates; to conduct evidence-based studies on existing complex challenges that leads to sensible solutions; to communicate in a timely manner research finding to stakeholders; and engage in collaborative multidisciplinary research.

I. Executive Summary

A. Activities of the Research Group

IPL had organizational meetings in every first Monday on or after the start of the academic classes in UP Diliman followed by General Cleaning per subgroup. Several DOST-SEI scholars were also accepted as summer intern by June 2018. Most members participated in the year's SPP Congress on June 2018 at the Citystate Asturias Hotel in Puerto Princesa City (Palawan). June-July is also marked by service to Philippine Science Highschool system as IPL participated in accepting Summer School Internship Program (SSIP).

IPL has accepted only 8 new undergraduate students as an effect of the implementation of the K-12 program. The whole year is capped by year-ender and Christmas party of the laboratory.

1. Organization

As of December 2018, IPL has a total of 81 members. The membership status is broken down as follows. The distribution of the types of student members in IPL is shown in Figure I-1.

- a. PhD Staff Members (6) Staff members are composed of all PhD members of the laboratory, typically having faculty position in the Institute.
- b. Student Members (75) This is composed of all students that has passed the application process of IPL, either via the undergraduate route or graduate route (lateral entry). Some sort of affiliate membership exists since 2016 due to the project staff members associated with projects whose program or project leads are members of the PhD Staff.

The growth of IPL has also been monitored over many years covering almost one decade long time. Figure I-2 shows the variation of population size since the year 1999. The plot shows a peak in the number of student members. This increase is marked by an increase in the number of staff members. The increase in the membership of IPL is marked by the increase in the number of mentors (PhD staff members) and mentors-in-training (graduate



Figure I-1: Distribution of the types of members in IPL as of December 2018. Junior refers to BS3 students, senior students are those BS4, MS1 or PhD1/ PhD2. BS5, MS2 and PhD3 and higher are labeled graduating.

students). The mentors-in-training essentially co-advises undergraduate students with becoming co-authors in journals and conferences. Hence the capacity of IPL to mentor changes over time over the availability of some mentors to meet with their students. The through between 2011 and 2015 indicates years when most IPL PhD staff members were occupied by administrative tasks in the University (e.g. Prof. Saloma's deanship, associate deanship of Prof. Tapang, deputy directorship at NIP of Prof. Lim) or in the national level (e.g. Prof. Monterola becoming SPP vice and president, Dr. Bantang and Dr. Batac becoming SPP Secretary General).



Figure I-2: Student membership distribution over almost one decade since 1999. The capacity of IPL to mentor effectively is marked by the variation of a healthy proportionality of PhD staff, graduate students and undergraduates.



Figure I-3: Distribution of the degrees obtained by IPL members as of December 2018 at different semesters and terms. The previous semesters were included for comparison. No member of IPL is under the MSE program.

2. Mentoring

Figure I-3 shows a total of 23 students graduated with IPL in the year 2018 and distributed based on the degree obtained. The sizes of graduating classes in the previous semesters are shown for comparison. Previous number of graduations during the midyear is cumulated to the first semester number of graduates for 2015.

B. Research Highlights

Publications. Figure I-4 shows the sustained positive trend in the total number of publications by IPL over the years. Since 1995, the overall trend of about nine(9) authored ISI/SCI paper per year shows the expected 200th article in the year 2016 having reached a total of 194 papers in SCI/ISI journals.



Figure I-4: Trend in the number of publications made by IPL over the years since 1993 given the available data coming from Scopus, Google Scholar, and Web of Science.

Figure I-5 shows the types of publications were made by IPL for the year 2016. There were three ISI papers published.

Projects. IPL projects come from both within and without the Institute. Table I-1 shows a summary of the research and fundings IPL has. It is assumed that most of the NIP funding are grants that go directly to faculty honoraria. Bulk of the funding comes from without as it is used for capital outlay, personnel services and other equipment grants.



Figure I-5: A pie graph summarizing the authored publications of IPL members for 2018. Majority of the publications are national.

Type of funding	Number of projects		Amount
NIP	6	₽	409,200.00
non-NIP	3	₽	34,013,349.20
Totals	9	₽	34,422,549.20

Table I-1: Summary of IPL Projects

Major Equipment. N/A

Extension work. Under direct supervision of Prof. Giovanni A. Tapang and Assoc. Prof. Johnrob Y. Bantang, IPL was able to host a total of four(4) students in a science internship program (SIP) together with the Philippine Science High School System (4 students).

Other Accomplishments. Notable positions were occupied by IPL members such as Prof. Saloma being a continuing Editor-In-Chief of the Philippine Science Journal.

II. Technical Report

A. Activities of the Research Group

1. Organization

- (a) Staff Members (6 PhD):
 - Prof. Caesar A. Saloma (Editor-In-Chief of Phil. J. Sci.);
 - Prof. Maricor N. Soriano;
 - Prof. Giovanni A. Tapang (Assoc. Dean for Research Innovation Dissemination and Enterprise);
 - Prof. May T. Lim (current institute Dep. Director for Academic Affairs);
 - Assoc. Prof. Johnrob Y. Bantang (Lab Coordinator, Physics 10 and NIP IT coordinator)
 - Asst. Prof. Rene C. Batac (until July 2018)

(b) Active Adjunct Researchers (4):

- Prof. Cynthia Palmes-Saloma (NIMBB, UPD)
- Dr. Ranzivelle Marianne Roxas-Villanueva (UP Los Baños)
- Dr. Atchong Hillario (IPL Projects)
- Dr. Marissa G. Pastor (University of San Carlos)
- Dr. Rene C. Batac (from August 2018, with De La Salle University, Taft Ave. Manila)

(c) IPL only accepts apprenticeship for the graduate students (lateral entry).

(d) The list of regular student members is shown in *Table II-1a, next page*.

Table II-1a. List of Student Members	las of Dec	2017)	(03)
Table II-Ta: LIST OF Student Members	(as of Dec	2017)	(93)

Un	Undergraduate students (BS3, 8)								
1	Bautista, Chris	B3							
2	Anila, Jemima	B3							
3	Vera Cruz, Jireh	B3							
4	Vargas, Kyngzer	B3							
5	Bagasala, Maria Tisha C.	B3							
6	Arorong, Michelle	B3							
7	Pangilinan, Michelle	B3							
8	Rayco, Sarakiel M.	B3							
Un	dergraduate students (B	S4, 20))						
1	Cusi, Adrielle Theresa	B4	8	Hernandez, Daniella	B4	15	Banaag, Matthew Joseph R.	B4	
2	Rigonan, Alec Kevin	B4	9	Mateo, Emil Joseph	B4	16	Mawis, Paolo Rafael	B4	
3	Advincula, Andrea Rica	B4	10	Reyes, Eric Joshua Vincent	B4	17	Bagood, Rafael Alberto	B4	
4	Diaz, Charles Jason	B4	11	Bartilad, Kelvin	B4	18	Principe, Rene Jr.	B4	
5	Fernan, Charles Louie C.	B4	12	Bailador, Kenneth	B4	19	Jalandoni, Rian Fritz D.	B4	
6	Baylon, Creo	B4	13	Leo, Kenneth	B4	20	Lahoz, Samantha Ruth C.	B4	

:			1		1		;				
7	De Castro, Crizzia Mielle	B4	14	Tan, Lou Josef	B4						
Une	Undergraduate students (BS5, 26)										
1	Janer, Ciara D.O.	B5	10	Cervantes, Kristen Joyce	B5	19	Mangsat, Crystal Jill	B6			
2	Redelosa, Cyd Kristoff	B5	11	Menorca, Maria Loraine	B5	20	Sta Ana, Phillip John	B6			
3	Arjonillo, Hannah Christina	B5	12	Narag, Mark Jeremy	B5	21	Rebong, Raymond Luke	B6			
4	Roque, Jamika Ann	B5	13	Villamayor, Merimae S.	B5	22	Del Rosario, Ronilo	B6			
5	Derecho, Jejomar	B5	14	Juan, Rhei Joven	B5	23	Perit, Charmaine	B6			
6	Asuncion, John Adrian Y.	B5	15	Crisostomo Richmond L.	B5	24	Vistal, Jona	B6			
7	Algodon, John Paul Emmanuel	B5	16	Saavedra, Sheenly Anne P.	B5	25	Guial, Kit Laurence	B6			
8	Mabajen, Joseph Roel	B5	17	Vergara, Stephanie Anne	B5	26	Ramos, Reinier Xander A.	B6			
9	Velez Joshua	B5	18	Naces, Carl Jesse	B6						
Gra	duate Students (MS, 15	5)									
1	Fenis, Ivan	M1	6	Cabatit, Cephas Olivier V.	M2	11	Cirunay, Michelle	M2			
2	Abuel, Joshua Neal H.	M1	7	Zoluaga, Jan Parvin	M2	12	Medrana, Micholo	M2			
3	Darilag, Rafael Christopher	M1	8	Hilado, Jeremy	M2	13	Romero, Roland Albert	M2			
4	Cubero, Jayson	M2	9	Santiago, Joshua	M2	14	Galarion, Wilbur	M2			
5	Fox, Anthony	M2	10	Rubio, Louie	M2	15	Urog, Krister Jazz P.	M3			
Gra	duate Students (PhD, 9)									
1	Valgomera, Christian	P1	6	Improso, Wynn Dunn	P3						
2	Balingit, Chester	P1	7	Sison, Gabriel Dominik	P4						
3	Aguilar, Ritz Ann	P2	8	Pedemonte, Gerold	P6						
4	Dailisan, Damian	P2	9	Pulido, Maria Teresa	P6			-			
5	Abella, Alfred	P2									

(e) A summary of membership is shown in *Table II-1b* below.

Table II-1b: Summary of IPL membership status.

Member Type	Degree	Count
PhD Staff		6
Student members	B3	8
	B4	20
	B5 and above	17
	M1	3
	M2 and above	12
	P1	2
	P2	3

Member Type	Degree	Count
	P3 and above	0
Adjunct Researchers		4
Apprenticeship		0
	тс)TAL: 75

2. Mentoring

a. List of graduates since January 2018 (as of December 2018)

Table II-2a: List of graduates for the 2nd Semester of AY 2017-18

Program	Student Name	Thesis Title	Defense Date	Adviser(s)
BS Applied Physics	Antonio Miguel V. Cruz	Dynamics of an SIS-like Audience Applause Model	May 7	Johnrob Y. Bantang
BS Applied Physics	Clyde H. Huang	Characterizing Competition in the Wholesale Electricity Spot Market	May 7	May T. Lim
BS Applied Physics	Rey Audie S. Escosio	Response of Single and Connected Hodgkin-Huxley Neurons to a Sinusoidal Input	May 7	Johnrob Y. Bantang
BS Applied Physics	Ivan M. Fenis	Real-Time Estimation of Vehicular Traffic Speed	May 7	May T. Lim
BS Physics	Marie Gabrielle M. De Luna	Light Filtering for Brightfield Microscopy using a Liquid Crystal Tunable Filter	May 7	Giovanni A. Tapang
BS Physics	Gilbert Michael G. Chua	Influence Structure Analysis of Stock Markets through Time Series and Network Methods	May 8	Giovanni A. Tapang
BS Physics	Lloyd Gabriel T. Rizada	Creating a Time-Resolved Index of Commuter Comfort using Information from a MEMS Device	May 8	May T. Lim
BS Applied Physics	John Lawrence M. Euste	Characterization and Analysis of Culture and Cultural Dynamics	May 8	Caesar A. Saloma
BS Applied Physics	Dionessa C. Biton	Experiments and Simulations on Slowly- Driven Granular Media	May 8	Rene C. Batac Johnrob Y. Bantang
BS Applied Physics	David Bryan C. Lao	Electrical Impedance Tomography: Instrumentation and Resolution Analysis	May 8	Giovanni A. Tapang
BS Applied Physics	Alfiero K. Orden II	Characterizing Area and Population Distributions in Urban Systems Using Multi-layered Voronoi Diagrams and Levy	May 9	Rene C. Batac

Program	Student Name	Thesis Title	Defense Date	Adviser(s)
BS Applied Physics	Derick B. Canceran	Scheduling the NBA Regular Season Using Simulated Annealing with Local Search	May 10	Caesar A. Saloma
BS Applied Physics	Elijah Justin M. Medina	Quantifying Degree of Interaction Between Word Co-occurrence Networks	May 10	Johnrob Y. Bantang
BS Applied Physics	Jasmine Michelle T. Abella	Structural and Temporal Analysis of the Co-authorship MNetworks of Small and Young Scientific Communities: The Case of the University of the Philippines Diliman	May 10	Rene C. Batac
BS Applied Physics	Camille D. Perlada	Quantifying Analaysis and Rule-based Models of the Spatial Spreading of Urban Structure	May 11	Rene C. Batac
BS Applied Physics	John Kenneth V. Rubio	Comparing Dynamical Properties of Epidemics on Complex Networks of Homogoneous and Inhomogeneous Agents	May 11	Johnrob Y. Bantang
MS Physics	Karol Giuseppe A. Jubilo	Accurate Color Correction of Underwater Images Panoramas using Reference Images	May 18	Maricor N. Soriano
MS Physics	Adrian Chester M. Balingit	Sampling Effects of Measuring the Structure of Temporal Networks	May 18	May T. Lim

Table II-2b: List of graduates for Midyear 2018

Program	Student Name	Thesis Title	Defense Date	Adviser(s)

Table II-2c: List of graduates for the 1st Semester of AY 2018-19

Program	Student Name	Thesis Title	Defense Date	Adviser(s)
BS Applied Physics	Carl Jesse R. Naces	Comparison of Shadow Rugosity Versus Chain-Type Rugosity Values from 3D Coral Reef Models	Dec 3	Maricor N. Soriano
BS Physics	Ronilo J. Del Rosario	Location Analysis of Jollibee and Mcdonald's Stores in Metro Manila	Dec 3	Caesar A. Saloma
BS Applied Physics	Jana Paula N. Datu	Gait-Model-Based Pedestrian Dead Reckoning using Smartphone Inertial and Magnetic Sensors	Dec 3	Maricor N. Soriano
BS Physics	Phillip John M. Sta Ana	Facial Recognition using Principal Component Analysis and Neural Networks	Dec 3	Caesar A. Saloma

Program	Student Name	Thesis Title	Defense Date	Adviser(s)
BS Applied Physics	Crystal Jill R. Mangsat	Edge Detection of Digital Images of Painting using K-Means Clustering and Crisp Boundary Detection	Dec 3	Maricor N. Soriano

b. Summary counts of graduates in 2018. Entries with zero count is not shown (e.g. MSE programs). Zero entries are removed for clarity.

Table II-3: Summary counts of graduates in 2018

Course	2017-18 sem 2	Mid 2018	2018-19 sem 1	Total
BS Physics	3		2	5
BS ApPhysics	13		3	16
MS Physics	2			2
PhD Physics				
TOTAL COUNTS:	18		5	23

B. Research Highlights

1. ISI/SCI Journal publications (5, non-ISI: 2)

- 1. Lee Jr, Henry V., Leo Mendel D. Rosario, Roy B. Tumlos, Henry J. Ramos, Luis Ma T. Bo-ot, and **Maricor N. Soriano**. "Excitation of O (1S) auroral green line from ambient air in a microwave-induced plasma jet at atmospheric pressure." Japanese Journal of Applied Physics 57(6): 066102 (2018) DOI: 10.7567/JJAP.57.066102.
- 2. N Tse, **M Soriano**, AM Labrador, and RA Balarbar (2018) Decision making, materiality and digitisation: Esteban Villanueva's Basi Revolt Paintings of Ilocos, AICCM Bulletin, 39:1, 42-54, DOI: 10.1080/10344233.2018.1543146
- Alagao M.A., Go M.A., Soriano M., Tapang G. (2018) Characterization of the Performance of a 7-Mirror Segmented Reflecting Telescope via the Angular Spectrum Method. In: Ribeiro P., Raposo M. (eds) Optics, Photonics and Laser Technology. Springer Series in Optical Sciences, vol 218. Springer, Cham. https://doi.org/10.1007/978-3-319-98548-0_7
- 4. JAF Balista and **CA Saloma**. Modified inelastic bouncing ball model of the Brazil nut effect and its reverse. Granular Matter (2018) 20:47. https://doi.org/10.1007/s10035-018-0821-2
- 5. G Sison, P Pasion, **G Tapang**, "Detected Communities and Structure in the NGO Co-funding Networks of PDAF Releases from 2007-2009", Philippine Journal of Science 147 (3), 383-392

2. Conference proceedings (international) (2)

- M Soriano. Making sense of the sea on a shoestring: A review of cost-effective tools for coral reef visualization. AIP Conference Proceedings 1871, 060002 (2017); https://doi.org/ 10.1063/1.4996531.
- A Yumang, E Dimaunahan, J Dela Cruz, G Talisic, G Sampedro, M Soriano, "Real-time Plasmodium Falciparum Parasitemia using Natural Neighbor Interpolation", 2018 IEEE 10th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM)

3. Conference attendance (international) (2)

- B Decena, P Hilario, G Tapang, "Three Dimensional Wavefront Engineering Using a Phase-only Spatial Light Modulator for Microwave Metamaterials", TENCON 2018-2018 IEEE Region 10 Conference, 0287-0290
- 2. W Improso, P Hilario, G Tapang, "Spurious transmission in liquid crystal tunable filter operation in microscopy", Conference on Lasers and Electro-Optics/Pacific Rim, Th3K. 5

1. Conference papers (local) (49)

Papers presented during the 36th SPP Physics Congress (6-9 June 2018, Puerto Princesa City, Philippines)

- 1. A. Fox, G. Tapang, C. Saloma, "Origin of interferogram asymmetry in optical-feedback semiconductor laser Michelson interferometer", Proceedings of the Samahang Pisika ng Pilipinas.
- 2. J. Santiago, G. Tapang, C. Saloma, "Parallel computation of GS algorithm and its robustness to rounding-off error and noise", Proceedings of the Samahang Pisika ng Pilipinas.
- 3. R. Romero, G. Tapang, C. Saloma, "Robustness of compressive Fourier-domain sampling against rounding-off errors and noise", Proceedings of the Samahang Pisika ng Pilipinas.
- 4. D. Canceran, C. Saloma, "Towards a more efficient scheduling of regular NBA games", Proceedings of the Samahang Pisika ng Pilipinas
- 5. H. Arjonillo, C.Saloma, "Preserving photon detection and average power in random scattering media and curvature correction in vectorized particle Monte Carlo simulation of focused Gaussian beam", Proceedings of the Samahang Pisika ng Pilipinas
- 6. J. Euste, C. Saloma, "Spatio-temporal dynamics of cross-cultural variations", Proceedings of the Samahang Pisika ng Pilipinas
- 7. A. Cusi, G. Tapang, C. Saloma, "Probe particle collisions and measurement accuracy of diffusion coefficient via Brownian motion", Proceedings of the Samahang Pisika ng Pilipinas
- 8. C. Saloma, "Measuring the performance of the Philippine scientific enterprise system", Proceedings of the Samahang Pisika ng Pilipinas
- 9. M Medrano, M Soriano, F Paraan, "Computational fluid dynamics analysis of lift on the Teardrop 2.0 for different angles of attack", Proceedings of Samahang Pisika ng Pilipinas
- 10. A Advincula, A Abella, M Soriano, "Pendant drop tensiometry of milk-water solutions", Proceedings of Samahang Pisika ng Pilipinas
- 11. M Narag, M Soriano, "Identifying the painter using background texture features and neural networks", Proceedings of Samahang Pisika ng Pilipinas
- 12. R Aguilar, M Soriano, "Negative-index metamaterials: Waveguide applications", Proceedings of Samahang Pisika ng Pilipinas
- 13. C Redelosa, M Lim, "Centrality measurement of traffic analysis zones using Uber Movement data", Proceedings of the Samahang Pisika ng Pilipinas
- 14. L Rizada, A Balingit, M Lim, "Feasibility of a time-resolved index of commuter comfort", Proceedings of the Samahang Pisika ng Pilipinas
- 15. D Dailisan, L Rubio, M Osorio, C David, M Lim, "Degree distributions of Origin-Destination matrices generated from school and barangay population data", Proceedings of the Samahang Pisika ng Pilipinas
- 16. L Rubio, D Dailisan, M Osorio, C David, M Lim, "Quantifying public high school accessibility in the Philippines", Proceedings of the Samahang Pisika ng Pilipinas
- 17. I Fenis, M Lim, "Camera tilt calibration by optical flow for vehicular traffic speed estimation", Proceedings of the Samahang Pisika ng Pilipinas
- 18. J Derecho, M Lim, "Trends in the spread of global news in the English language", Proceedings of the Samahang Pisika ng Pilipinas
- 19. M Menorca, M Lim, "Proximity analysis between researchers and networking venues", Proceedings of the Samahang Pisika ng Pilipinas
- 20. J Mabajen, M Lim, "Price discovery algorithm for free-form PHILGEPS dataset", Proceedings of the Samahang Pisika ng Pilipinas

- 21. A De Jesus, D Bruzon, G tapang, "Dimerization of polyanthracene in polymethylmethacrylate for reversible light-induced surface modification", Proceedings of the Samahang Pisika ng Pilipinas
- 22. B Decena, P Hilario, G Tapang, "Parallel optical stereolithography using wavefront engineered light", Proceedings of the Samahang Pisika ng Pilipinas
- 23. C Valgomera, D Bruzon, G Tapang, "Characterization of an automated thermometric microfluidic titrator", Proceedings of the Samahang Pisika ng Pilipinas
- 24. A Veloria, G Perez, G Tapang, "Spatio-temporal validation of interpolated rainfall measurements from Philippine synoptic stations", Proceedings of the Samahang Pisika ng Pilipinas
- 25. R Romero, G Tapang, "Paramecium crowd localization using galvanotaxis controlled by 16-bit electrode set-up", Proceedings of the Samahang Pisika ng Pilipinas
- 26. D Lao, G Tapang, "Developing an electrical impedance tomographic system", Proceedings of the Samahang Pisika ng Pilipinas
- 27. K Cervantes, G Tapang, "Effect of source rate variation on the total information within an Erdos-Renyi random network", Proceedings of the Samahang Pisika ng Pilipinas
- 28. W Improso, P Hilario, G Tapang, "Characterization of liquid crystal tunable filter spectral response with diverging incident light", Proceedings of the Samahang Pisika ng Pilipinas
- 29. G Chua, G Sison, G Tapang, "Stock market network influence structure analysis with time series and network methods", Proceedings of the Samahang Pisika ng Pilipinas
- 30. S Saavedra, J Bantang, "Recurrence dynamics of Internet access user activity", Proceedings of the Samahang Pisika ng Pilipinas
- 31. S Lahoz, J Bantang, "Hysteresis in coupled pair of Wilson-Cowan neuronal populations", Proceedings of the Samahang Pisika ng Pilipinas
- 32. M Banaag, J Bantang, "Dynamics of an elastic particle in a horizontally oscillating onedimension box with a non-frictionless floor", Proceedings of the Samahang Pisika ng Pilipinas
- 33. D Biton, J Bantang, "Granular thermometer from a simulation of two interacting granular systems", Proceedings of the Samahang Pisika ng Pilipinas
- 34. R Ramos, J Bantang, "Proposed cellular automaton model for a neuronal patch with a thresholded linear activation function", Proceedings of the Samahang Pisika ng Pilipinas
- 35. C Cabatit, J Bantang, "Mean-field approach to human settlement patterns using the Radiation Model", Proceedings of the Samahang Pisika ng Pilipinas
- 36. J Rubio, J Bantang, "Time delay in disease transmission via interactions of heterogeneous agents in Watts-Strogatz networks", Proceedings of the Samahang Pisika ng Pilipinas
- 37. R Escosio, J Bantang, "Stability, periodicity, and mode-locking behaviors in a Hodgkin-Huxley neuron", Proceedings of the Samahang Pisika ng Pilipinas
- 38. K Urog, J Bantang, "Network robustness on bursty loads", Proceedings of the Samahang Pisika ng Pilipinas
- 39. R Crisostomo, J Bantang, "Simulation and characterization of tree branching morphologies based on real tree images", Proceedings of the Samahang Pisika ng Pilipinas
- 40. E Medina, J Bantang, "Interaction of word co-occurrence networks through identical words", Proceedings of the Samahang Pisika ng Pilipinas
- 41. J Abella, R Batac, "Social network analysis of the co-authorship network of the University of the Philippines Diliman from 1996 to 2016", Proceedings of the Samahang Pisika ng Pilipinas
- 42. D Biton, C Janer, R Batac, "Statistical properties of avalanche in sandpile with targeted triggering and in granular pile set-up for earthquake modeling", Proceedings of the Samahang Pisika ng Pilipinas
- 43. C Janer, R Batac, "Quasi-static regimes in a continuously-rotated and slowly-grown granular setup", Proceedings of the Samahang Pisika ng Pilipinas
- 44. C Perlada, R Batac, "A quantitative analysis and growth model of urban spatial structures", Proceedings of the Samahang Pisika ng Pilipinas
- 45. M Cirunay, R Batac, "Scaling of urban properties for Philippine cities", Proceedings of the Samahang Pisika ng Pilipinas
- 46. A Orden, R Batac, "Characterizing spatial distributions of urban systems using Voronoi diagrams and Lévy flights", Proceedings of the Samahang Pisika ng Pilipinas
- 47. M Villamayor, R Batac, "Emergence of cooperator dominance in an iterated prisoner's dilemma games with punishing agents and dynamic strategies", Proceedings of the Samahang Pisika ng Pilipinas
- 48. J Asuncion, R Batac, "Universal statistics of fire sizes for different targeting schemes in a forest fire model", Proceedings of the Samahang Pisika ng Pilipinas

49. M Cirunay, R Batac, "Statistical signatures of the spatial imprints of road network growth", Proceedings of the Samahang Pisika ng Pilipinas

Project Leader	Title	Am	ount
Saloma, Caesar A.			
Soriano, Maricor N.	Sketch Filtering Using Convolutional Neural Networks	₽	105,600.00
Lim, May T.	Investigations of Vehicular Traffic	₽	105,600.00
Tapang, Giovanni A.	Effect of Oblique Illumination in Liquid Crystal Tunable Filter	₱	105,600.00
Bantang, Johnrob Y.	Spatial and Temporal Properties of Biological System	₱	92,400.00
	TOTAL :	₽	409,200.00

4. NIP Funded Projects, Jan-Dec 2017 (6)

5. Other Funded Project (non-NIP) (10)

Project Leader	Title / Awarding agency	Period/ Phase No.	Am	ount
Maricor Soriano	Philippine Coral Reef and Mangrove Remote Sensing (Project PHILCOMARS Air under CARE-CADRES Program) / DENR	Jan 2017 - Jan 2018	₱	5,700,000.00
Maricor Soriano	Coral Reef Visualization and Assessment – ARRAS Visualization (Program CORVA 1b under CARE-CADRES Program) / DENR	Jan 2017 - Jan 2018	₱	8,000,000.00
Giovanni Tapang	STAMP - Standards and Testing Automated Modular Platform / DOST PCIEERD	2016-2018	₽	20,313,349.20
TOTAL (3 projects	5):		₽	34,013,349.20

6. Major equipment upgrade/acquired (0)



7. Research travels abroad (0)

Name	Purpose	Place	Dates	Mode of Exchange

8. Visiting researchers (0)

Name of visitor	Purpose/duration	Contact person	Mode of Exchange
Marissa G. Pastor	Meeting for possible collaboration / 1 week	Johnrob Y. Bantang	Collaboration

C. Extension Work Highlights

1. Extension work activities (0)

Description / Duration	Beneficiary	NIP Personnel	Remarks
N/A			

2. Research interns and OJT's trained in 2017 (4)

Name	Beneficiary	Program / Duration	NIP Personnel	Remarks
Laspoñas, Dancel John	PSHS-CRC	IPL / 13Jun—03Jul	G Tapang	
Ruiz, Reysonn Joss Leigh B.	PSHS-CMC	IPL / 13Jun—03Jul	G Tapang	
Dehayco, Kim	PSHS-EVC	IPL / 13Jun—03Jul	G Tapang	
Dominong, Denierom Kate D.	PSHS-CVC	IPL / 13Jun—03Jul	J Bantang	

D. Main Challenges Encountered and Proposed Solutions

Challenge encountered	Proposed solution
Delays in drafting of terminal / annual report	Drafting by the URA already employed by beginning of the 2019.

E. Awards or Accreditations Received / Positions of Responsibility Held and Other Accomplishments

1. National (1)

Name	Accomplishment	Date / Place
Caesar A. Saloma	Editor-in-Chief of the Philippines Journal of Science	2012 - present

2. International (0)

3.

Name	Accomplishment	Date / Place
N/A		
Other acc	omplishments (0)	
Name	Accomplishment	Date / Place

III. Photos, ISI/SCI Publications

A. Photos



IPL Principal Investigators and PhD Staff members (L to R): Prof. Caesar A. Saloma, Prof. Maricor N. Soriano, Prof. May T. Lim, Prof. Giovanni A. Tapang, Assoc. Prof. Johnrob Y. Bantang, Asst. Prof. Rene C. Batac. [photos: courtesy of Dr. Val Almoro, NIP Administration]



IPL Participants during the Samahang Pisika ng Pilipinas Physics Congress held at Palawan, Pwerto Princesa (08 June 2018 Laboratory Dinner). Dr. Jacq Romero-Amor joined as alumna of IPL. [photo credits to Dr. Atchong Hilario]



A simple lunch with SIP 2018 participants from the PSHS Grade 11 students and their student supervisors after the Closing Program (03 July 2018)

Β. **ISI/SCI** Publications

Listing of front-page copies of ISI/SCI Publications

1. Lee Jr, Henry V., Leo Mendel D. Rosario, Roy B. Tumlos, Henry J. Ramos, Luis Ma T. Bo-ot, and Maricor N. Soriano. "Excitation of O (1S) auroral green line from ambient air in a microwaveinduced plasma jet at atmospheric pressure." Japanese Journal of Applied Physics 57(6): 066102 (2018) DOI: 10.7567/JJAP.57.066102.

> Japanese Journal of Applied Physics 57, 066102 (2018) https://doi.org/10.7567/JJAP.57.066102



Excitation of O(1S) auroral green line from ambient air in a microwave-induced plasma jet at atmospheric pressure

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Strong emission from the auroral green line $O(^{1}S) \rightarrow O(^{1}D)$ at 557.7 nm was observed in the afterglow of an atmospheric-pressure 2.45 GHz microwave-induced plasma jet. The device used Ar as the working gas for the plasma, and a surrounding N2 gas flow to stabilize the discharge The characteristic line-shape of the peak at 557.7 nm indicated that the emission was from the O(1S)N₂ excimer. Vibrational temperatures of NO and N2, estimated based on the emission spectra of the afterglow, were compared against the intensity of the green line and the concentration of N_2 gas flowing in the system. The data points yielding the most intense green lines fall at vibrational temperatures of around 2000 K for both NO and N₂. It was observed that the amount of N₂ gas flowing in the system positively contributed to the intensity of the green line. Using fluid simulation, the O2 concentration in the afterglow was estimated to be in the range of 1-5.5%. © 2018 The Japan Society of Applied Physics

1. Introduction

The auroral green line at 557.7 nm was first observed in 1868 by Anders Jonas Ångström. Its source had been a puzzle for more than 50 years, until it was eventually confirmed to be from transitions between metastable states of oxygen $O(^{1}S) \rightarrow O(^{1}D).^{1}$ Presently, the green line is now an established reference as observatories use 557 nm filters in acquiring auroral data. In the study of auroral physics, experiments have been done to create artificial auroral emissions in the upper atmosphere by pumping it with radio waves.^{2,3)} In these experiments, typical emission lines investigated are from $O(^{1}D)$ at 630 nm, $O(^{1}S)$ at 557.7 nm, and N_{2}^{+} at 427.8 nm.

There are also vacuum experiments that simulate planetary auroral behavior (e.g., Planeterrella under 1-10 Pa).4 ever, the high quenching rates from these small-scale experiments have prevented emissions from O(1D) and O(1S).4) Alternatively, some researches have reported artificially generated green line at atmospheric pressure. For example, Dondes et al. generated the 557.7 nm emission by directly exciting oxygen atoms with polonium-210 alpha radiation.7 Kozlov et al. detected the green line from the emission of the ON2 excimer in a dielectric barrier discharge (DBD) using mixtures of N2/O2.8) Similarly, Pointu et al. also reported the appearance of the green line from a flowing afterglow setup at atmospheric pressure.9) However, the relative intensity of the green lines from aforementioned studies appear to be relatively weak compared to the rest of the reported emission spectrum, where the emission from NO and N2 were much higher than that from $O(^{1}S)$.^{8,9)} Among the experiments published in literature, Gherardi et al. reported one of the strongest green lines from a N2 DBD enclosed in vacuum with a starting base pressure of 0.1 Pa and working pressure of up to 1 atm.¹⁰⁾ The work by Panousis et al. on a DBD flowing afterglow showed a relatively strong emission from the O(1S)N2 excimer as well as photos of the yellow-green afterglow.

Previous studies have shown that an O2 deficient environment is crucial for sustaining the $O(^1S)$ line. $^{8,9,11-13)}$ This requirement is especially true for pressures above 10 Torr.12) This is why auroras are typically observed in altitudes where heavy molecules (such as O₂) are scarce and lighter atoms (such as O) are more abundant. In contrast, an open atmospheric-pressure environment makes it difficult to sustain the auroral oxygen lines, because of the relatively high pressure that causes high collision rates and of the abundance of O2 that strongly quenches the $O(^{1}S)$ atoms.

In this study, a highly visible auroral green line emission was produced from ambient air using a typical microwaveinduced plasma jet operating at atmospheric pressure. Optical emission spectroscopy was used to study the dynamics of the green afterglow. The spectral line shape indicates that the green emission comes from not only O(1S) atoms but are actually from O(1S)N2 excimers. The rovibrational temperatures of the afterglow are estimated by using a basic statistical model of the possible molecular energy transitions to simulate the emission spectrum. Knowing the rovibrational temperatures and gas concentrations, suitable conditions for generating the green line were established. The mechanisms behind the formation and destruction of the green line were studied by analyzing the changes in the emission spectra intensities against varying operational parameters

2. Methodology

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2.1 Experimental setup

A diagram of the microwave atmospheric plasma jet (MAPJ) is shown in Fig. 1. The MAPJ is powered by a microwave generator (IBF Electronic PGEN2450-3-4KW2AIW) capable of 300W up to 3kW of continuous microwave output. Starting from the magnetron head, the microwaves are propagated through the following components: microwave isolator with a circulating water load, dual directional coupler, H-bend, three-stub tuner, water-cooled surfaguide-type waveguide holding a quartz tube, until finally terminating with an adjustable sliding short.14) All the microwave components, except the directional coupler, were manufactured by IBF Electronic. The MAPJ has already been used in material science and food technology applications.15-18)

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 N Tse, M Soriano, AM Labrador, and RA Balarbar (2018) Decision making, materiality and digitisation: Esteban Villanueva's Basi Revolt Paintings of Ilocos, AICCM Bulletin, 39:1, 42-54, DOI: 10.1080/10344233.2018.1543146

DECISION MAKING, MATERIALITY AND DIGITISATION: ESTEBAN VILLANUEVA'S BASI REVOLT PAINTINGS OF ILOCOS

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Esteban Villanueva's fourteen 1821 paintings, the Basi Revolt Paintings of Ilocos, are valued for their representation of the conflict between the Spanish colonial administration and Filipino Ilocano insurgents. As pictorial documents representing the emergence of secular artistic practice in the Philippines, they possess significant social and historical narratives of national independence and the Ilocano's strength of character. Damage, previous restorations and the effects of tropical climates have not been kind to the Basi Revolt paintings and their visual reading is complex. This paper reports on the technical and materials analysis of the paintings, documentation, digitisation and image analysis as a conservation model to broaden perspectives on knowledge acquisition in conservation. Conservation decision making in the Philippines is an additional focus of the paper, with an examination of localised values, and the trajectory and life of the paintings to inform conservation actions and creative processes.

KEYWORDS: Philippines, painting practice, digitisation, decision making, conservation in tropical climates, authenticity

INTRODUCTION

Esteban Villanueva's (b. 1797–1878) fourteen 1821 paintings, the Basi Revolt Paintings of Ilocos Norte, have a significant past and biography, and one that has been described as a 'reckless fantasy' by Filipino historian Arnold Azurin (1998). They first belonged to the Esteban Villanueva's family, the purported artist, and were then donated to the Provincial Government of Vigan in the Philippines in the 1950s and displayed at the Burgos Museum also in Vigan (Ramirez 1969, p. 115). With the support of the Ayala Foundation, the Basi Revolt paintings were then displayed in Manila from 1975, returned to the Burgos Museum, and were later displayed at the Metropolitan Museum in 2011 and the National Museum in Manila from 2012 to 2014 (Flores 2014, p. 69). Now they are on permanent display at the newly inaugurated National Museum's Vigan museum complex in Ilocos Norte, where they are expected to remain.

The 200-year geographic trajectory of the *Basi Revolt paintings* is fragmented and so too is their analysis. In 1998, the paintings were a topic of an art historical conference and more recently, a contemporary art forum (Azurin 1998). Their numerous changes in ownership and environmental care have resulted in damage and degradation, leading to visual uncertainties and possible art historical misinterpretations. It could also be argued that given the accurate depiction of events, greater clarity could be achieved through their conservation to strengthen the social and historical evidence. In 2014, it was therefore timely to investigate the *Basi Revolt paintings* at the National Museum of the Philippines to clarify uncertainties, create knowledge and inform conservation actions.

TRADITIONAL PRINCIPLES OF MATERIAL AUTHENTICITY AND DECISION-MAKING FOR THE BASI REVOLT PAINTINGS

Using the traditional principles of conservation, a technical art history mode of enquiry was first considered. This followed an investigation of the single artist and paintings' historiography and materials characterisation, an approach synonymous with positivist views of conservation and a pathway of explanation, process and control to catergorise its material authenticity.

The 1821 artworks as early examples of secular painting practice in the Philippines are all signed by Esteban Villanueva. His baptism record is dated 6

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 Alagao M.A., Go M.A., Soriano M., Tapang G. (2018) Characterization of the Performance of a 7-Mirror Segmented Reflecting Telescope via the Angular Spectrum Method. In: Ribeiro P., Raposo M. (eds) Optics, Photonics and Laser Technology. Springer Series in Optical Sciences, vol 218. Springer, Cham. <u>https://doi.org/10.1007/978-3-319-98548-0_7</u>

Chapter 7 Characterization of the Performance of a 7-Mirror Segmented Reflecting Telescope via the Angular Spectrum Method



Mary Angelie Alagao, Mary Ann Go, Maricor Soriano and Giovanni Tapang

Abstract A segmented reflecting telescope made of seven 76 mm concave mirrors, each with a focal length of 300 mm, was characterized. Its performance was evaluated by computing the point spread function (PSF) and comparing it to an equivalent monolithic mirror. Aberrations were added and corrected using a phase retrieval technique called the Gerchberg-Saxton (GS) algorithm to obtain the correction phase that serves as the input to the spatial light modulator (SLM). Results revealed an improvement in the telescope angular resolution as a result of the implemented phase correction. It was also shown that the PSF varies depending on the orientation and number of mirrors added.

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137

M. A. Alagao (\boxtimes) · M. A. Go · M. Soriano · G. Tapang National Institute of Physics, University of the Philippines, Diliman,

 JAF Balista and CA Saloma. Modified inelastic bouncing ball model of the Brazil nut effect and its reverse. Granular Matter (2018) 20:47. <u>https://doi.org/10.1007/s10035-018-0821-2</u>

Granular Matter (2018) 20:47 https://doi.org/10.1007/s10035-018-0821-2

ORIGINAL PAPER



Modified inelastic bouncing ball model of the Brazil nut effect and its reverse

Junius André F. Balista^{1,2} · Caesar Saloma¹

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Abstract

We developed the modified inelastic bouncing ball model (mIBBM) to describe the emergence of the Brazil nut effect (BNE) and its reverse (RBNE) in a vertically-vibrated binary granular mixture. The mIBBM incorporates the container-to-grains force-transmission efficiency (transmissibility) T_r to quantify the dimensionless mean void lifetime $\omega \langle \delta t \rangle$ that acts as the segregation phase indicator where ω is the vibration angular frequency. The mixture is represented as two non-interacting inelastic balls, Ball A and Ball B. Each ball bounces with a time-of-flight τ_A (or τ_B) that depends on transmissibility T_{rA} (or T_{rB}) and the dimensionless container acceleration Γ , i.e., $\tau_A = \tau_A(\Gamma, T_{rA})$ and $\tau_B = \tau_B(\Gamma, T_{rB})$. The ball dynamics are described by the bifurcation diagrams of the dimensionless times-of-flight, $\omega \tau_A(\Gamma, T_{rA})$ and $\omega \tau_B(\Gamma, T_{rB})$. The probability-weighted difference $\omega \langle \delta t \rangle$ between branches of the two diagrams is computed and interpreted as follows: $\omega \langle \delta t \rangle > 0$ (occurrence of BNE), $\omega \langle \delta t \rangle < 0$ (RBNE) and $\omega \langle \delta t \rangle = 0$ (no segregation). Segregation phases are revealed as varying shifts and widths of $\omega \langle \delta t \rangle$ across the Γ axis. The phase boundaries in the $\omega \langle \delta t \rangle$ -versus- Γ diagram are sensitive to changes in T_{rA} , T_{rB} and $\Delta T_r =$ $(T_{rA} - T_{rB})$. The mIBBM explains why the BNE is a more likely than the RBNE and predicts a segregation phase sequence that is generally consistent with related experimental results taken over a limited ω -range. Additional experiments are needed to enable a more comprehensive and precise evaluation of the mIBBM.

Keywords Granular segregation · Brazil nut effect · Vibration · Bouncing ball · Bifurcation

1 Introduction

Mixtures of grains of different geometric and intrinsic properties tend to segregate when subjected to shear or vibration. A common configuration for shear-driven segregation is a granular mixture inside a rotating horizontal cylinder, known as the Oyama drum, in which radial and axial segregations are possible [1–3]. For vibration-driven segregation, which is the focus of this work, the confined granular mixture is placed on top of a vertically oscillating plate and the case where the larger grains rise to the top of the container is popularly known as the Brazil nut effect (BNE) [4–23] while the opposite where the smaller grains rise to the top is named the reverse Brazil nut effect (RBNE) [15–19].

While our understanding of granular segregation has improved over the years, there is still no comprehensive and definitive theory for the BNE/RBNE phenomenon. The difficulty arises from the dependence of the phenomenon on several factors such as the properties of the grains, the container, and the applied vibration. There is still no general consensus about the universal indicator of segregation although a number have been suggested, e.g., segregation coefficient [9], number of particles visible at the top surface [12], rise rate [14], etc. Several segregation models are available, each supported by experiments and simulations, but they still need to be reconciled with one another for consistency. Two of the more common [21, 22] are the void-filling (percolation) model [8] and the convection model [10], which are viewed by some as contradictory or competing (e.g., [23]) but resolving the issue is not central to the purpose of the present study.

Here, we present a new macroscopic model that relates the three segregation phases (BNE, RBNE, absence of seg-

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5. G Sison, P Pasion, **G Tapang**, "Detected Communities and Structure in the NGO Co-funding Networks of PDAF Releases from 2007-2009", Philippine Journal of Science 147 (3), 383-392

Philippine Journal of Science 147 (3): 383-392, September 2018 ISSN 0031 - 7683 Date Received: 03 Nov 2017

Detected Communities and Structure in the NGO Co-funding Networks of PDAF Releases from 2007-2009

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Using network theory, the researchers visualize and analyze relationships that can be found in the Priority Development Assistance Fund (PDAF) allocation from the released 2012 report of the Commission of Audit (COA). Strong community structure was seen in the legislator-legislator co-funding network and NGO-NGO co-funding network as indicated by the high values of modularity, 0.5 and 0.4 respectively. Also, communities in the legislator-legislator network do not correspond to parties but they do try to incorporate members of the ruling party.

Key words: complex systems, 89.75.-k, social systems 89.65.-s

INTRODUCTION

Various systems in nature are driven by mechanisms with non-trivial interactions. From language (Roxas & Tapang 2010) to politics (Zhang et al. 2008), these systems are highly complex with behaviors that are hard to predict. However, these systems are still of interest to us, so their analysis has driven the development of new methods. One possible method is to study the small-scale interactions between the individual elements along with their patterns and structure. The researchers want to see if these patterns and structures reflect real properties of the system. This is the basis of using network science to analyze systems.

A network is a simple way to represent a set of objects or nodes that have relationships with each other. These objects are called nodes or vertices, while call the relationship between them is called an edge (Barrat et al. 2008). Depending on the data set, edges could represent different kinds of relationships. In a social network, these could be friendship relations (Wang & Wellman 2010) or co-authorships in a congressional setting (Fowler 2006). Edges in networks can have values attached to them (weighted networks) or be set to have a uniform weight of one for unweighted networks (Barrat et al. 2008).

Network tools have been used in many applications to date. The researchers have analyzed different systems such as prose and poetry (Roxas & Tapang 2010), SMS messages (Cabatbat & Tapang 2013), translations (Cabatbat et al. 2014), poetic styles (Roxas-Villanueva et al. 2012) and bill co-authorships in the Philippine Congress (Sison 2013; Pasion 2017), among others.

Networks have been used to characterize political systems such as the United States Congress (Zhang et al. 2008) and the Philippine House of Representatives (Sison 2013; Pasion 2017). In such networks, nodes are the legislators themselves and links between them are either voting patterns or co-sponsorships of bills and resolutions (Sison 2013; Pasion 2017). These co-sponsorship networks can be used as proxies for effective political party affiliation of the legislators which can be derived from calculating partitions, also known as communities, which arise from their level of partisanship (Zhang et al. 2008).

On 14 Aug 2013, the Commission on Audit (COA) Special Audits Office Report No. 2012-03 (COA SAO 2013) on the priority development fund (PDAF) was released. The PDAF

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