

National Institute of Physics

Management Team

**Terminal Report for the Structure and Dynamics Research Program**

Period covered: 01 January 2021 to 31 December 2021

Prepared by:

Ronald S. Banzon, PhD

Program Coordinator

Structure and Dynamics Research Program

Submitted: 28 January 2022

**Contents**

1 Executive Summary	2
2 Technical Report	3
3 Appendices	8

## 1 Executive Summary

### 1.1 Activities of the Research Program

#### 1.1.1 Organization

	Count	Page
Regular Members	3	p. 3
Student Members	20	p. 3
PhD – 4		
MS – 4		
BS – 12		
Apprentices	9	p. 3
Total	<b>32</b>	

#### 1.1.2 Mentoring

Degree Program	Sem 2 AY 20–21 (p. 4)	Midyear 2021(p. 5)	Sem 1 AY 20–21 (p. 4)	Total
BS Physics	1	0	0	1
BS Applied Physics	5	0	2	7
MS Physics	0	2	2	4
PhD Physics	1	0	0	1
Total	7	2	4	13

### 1.2 Research Highlights

	Count	Page
International peer-reviewed articles	1	p. 5
International conference presentations	0	p. 5
Local conference papers	3	p. 5
Other invited lectures/talks	2	p. 6
NIP funded projects	3	p. 6
Non-NIP funded projects	0	p. 6
Outbound travel abroad	0	p. 6
Inbound visiting researchers	0	p. 6

### 1.3 Extension Work Highlights

	Count	Page
Extension work activities	4	p. 7
Research interns and trainees	0	p. 7

### 1.4 Challenges Encountered

	Count	Page
Challenges	1	p. 7

### 1.5 Awards, Accreditations, and Positions of Responsibilities Held

	Count	Page
National awards and positions held	2	p. 7

## 2 Technical Report

### 2.1 Activities of the Research Program

2020-2021 saw seven undergraduate students graduated and completed their theses. Four MS students defended their thesis. While the single PhD student did successfully defend her dissertation. Current regular membership in SanD (faculty and students) is now 30. There was an international peer-reviewed article and 3 local conference peer-reviewed papers.

The COVID-19 pandemic is a challenge that continues to question the means by which we are able to deliver educational targets.

#### 2.1.1 Organization

##### Regular Members (3)

- 1) Villagonzalo, Cristine – Professor
- 2) Banzon, Ronald – Associate Professor
- 3) Paraan, Francis – Professor

##### PhD Student Members (4)

- 1) Villegas, Vladimir D8
- 2) dela Rosa, Rafael – D6, University Research Associate 1 (URA 1)
- 3) Itable, Gene Moses – D6
- 4) Acosta, Geronimo Allan Jerome – D5

##### MS Student Members (4)

- 1) Guinid, Jammy Rey – M6
- 2) Masbate, Julius – M6
- 3) Elegado, Christopher Patrick – M3 [leave]
- 4) Urbano, Kryss – M2

##### BS Student Members (12)

- 1) Daquioag, Alyana – B4
- 2) Dela Cruz, Leon Sergio – B4
- 3) Deleon, Monica Cecilia – B7
- 4) De Guzman, Tristan – B7
- 5) Espalmado, Faye – B4
- 6) Estrada, John Benedick – B6
- 7) Herman, Gene Michael – B4
- 8) Ordonio, Andrei Espencer – B4
- 9) Rangel, Jerico – B4
- 10) Sacres, Kobe Brian – B5
- 11) Sorupia, Sven – B4
- 12) Suico, Samuel – B4

##### Apprentices (9)

- 1) Brongcano, Mark – B3
- 2) Carig, Jami Joyce – B3

- 3) Gamboa, Jose Antonio – B3
- 4) Glorioso, Mico – B3
- 5) Hizon, Zachary – B3
- 6) Legara, Allen – B3
- 7) Malalad , Joshue Diondre – B3
- 8) Rances, Joseph Garrett – B3
- 9) Ricaña, Mary June – B3

### 2.1.2 Mentoring

#### Graduated Sem 1 AY 2020–2021

##### BS Applied Physics (Instrumentation) (2)

- 1) Gomez, Jacob (Graduated as of Sem2 AY 2019-20)  
BS Thesis: Classification and characterization of the resulting fragments of two colliding dust clusters  
Adviser: Francis Paraan
- 2) Calpatura, Jairus Carlo F.  
BS Thesis: Intrinsic Property Dependence of the Thermoelectric Figure of Merit in Solid State Materials  
Adviser: Cristine Villagonzalo

##### MS Physics (2)

- 1) Ayang-ang, Cleofe Denneille Padin (Graduated Sem2 AY 2019-20)  
MS Thesis: Critical Schmidt Gap in a Variable-Range Kitaev Chain  
Adviser: Francis Paraan
- 2) Esperanza, Robertson  
MS Thesis: One-Dimensional Hubbard Chain with Ising-Like Nearest-Neighbor Interaction: Clarifying the Ground State and its Entanglement Content  
Adviser: Francis Paraan

#### Graduated Sem 2 AY 2020–2021

##### BS Physics (1)

- 1) Maddumba, Marc Leney D.  
BS Thesis: Investigating COVID-19 vaccination effectiveness in Metro Manila using SIR epidemic model  
Adviser: Ronald Banzon

##### BS Applied Physics (Instrumentation) (4)

- 1) Dimacali, Raphael Angelo  
BS Thesis: Generating images of numbers from text with a generative adversarial network  
Adviser: Francis Paraan
- 2) Edora, Maria Alena A.  
cum laude  
BS Thesis: Quantifying the performance of a sparse autoencoder in detecting network anomalies  
Adviser: Francis Paraan

## 3) Ganding, Jersey Diane A.

cum laude

BS Thesis: Critical behavior and cluster geometry in an ising model with changing lattice dimensionality

Adviser: Ronald Banzon

## 4) Ramos, Aaron Paul D.

BS Thesis: Schmidt gap in the 1D Ising model with Dzyaloshinsky-Moriya interaction

Adviser: Francis Paraan

## BS Applied Physics (Materials Physics) (1)

## 1) Rodriguez, Tim Jeff M.

BS Thesis: Characterizing localized surface plasmon resonance of a metallic nanoparticle in media

Adviser: Cristine Villagonzalo

## PhD Physics (0PhDsem2)

## 1) Sombillo, Neris

PhD Dissertation: Nonrefocusing Nuclear Magnetic Resonance Quantum Information Processing

Co-Adviser: Ronald Banzon Co-Adviser: Cristine Villagonzalo

**Graduated MY AY 2021**

## MS Physics (2)

## 1) Mangada, Mykhal Gideon Lim

MS Thesis: Image classification with tensor network-based machine learning algorithm

Adviser: Francis Paraan

## 2) Tan, Apolinario Miguel Isagan

MS Thesis: Quantum Fisher information and entanglement in an XY dimer

Adviser: Francis Paraan

**2.2 Research Highlights****2.2.1 International peer-reviewed articles (1)**

- 1) Sombillo, NI, RS Banzon & C Villagonzalo. Optimal fixed-point quantum search in an interacting Ising spin system. Quantum Inf Process 20, 90 (2021), DOI: /10.1007/s11128-021-03023-1

**2.2.2 International conference presentations (0)****2.2.3 Local peer-reviewed conference papers (3)**

- 1) R.S. dela Rosa, AMI Tan & F.N.C. Paraan. "Entanglement detection via quantum Fisher information in an XY dimer" in Proceedings of the 39th Samahang Pisika ng Pilipinas Physics Conference, SPP-2021-PA-05 (Philippines 2021)
- 2) KAM Feri & CD Villagonzalo. "Specific heat behavior in finite-sized Lipkin-Meshkov-Glick spin system" in Proceedings of the 39th Samahang Pisika ng Pilipinas Physics Conference, SPP-2021-1F-05 (Philippines 2021)

- 3) VPVillegas & CD Villagonzalo. "Canonical ensemble profile of a Fermi-Hubbard model treated as a double qubit chain" in Proceedings of the 39th Samahang Pisika ng Pilipinas Physics Conference, SPP-2021-2B-03 (Philippines 2021)

#### **2.2.4 Local conference presentations (0)**

##### **2.2.5 NIP funded projects (3)**

- (a) Project Leader: Banzon, Ronald S.  
Project Title: Diversity for population characterization of different initial conditions  
Period: 01 January 2021–31 December 2021
- (b) Project Leader: Paraan, Francis Norman C.  
Project Title: Analysis of the classical and quantum information in condensed matter and other complex systems  
Period: 01 January 2021–31 December 2021
- (c) Project Leader: Villagonzalo, Cristine DLR.  
Project Title: Thermodynamics in a quantum machine of spin 1/2 particles  
Period: 01 January 2021–31 December 2021

##### **2.2.6 Non-NIP funded projects (0)**

##### **2.2.7 Other invited lectures/talks (0)**

##### **2.2.8 Outbound travel abroad (0)**

##### **2.2.9 Inbound visiting researchers (0)**

## **2.3 Extension Work Highlights**

### **2.3.1 Extension Work Activities<sup>1</sup> (4)**

- (a) Name: Francis Paraan  
Extension work: Samahang Pisika ng Pilipinas Councilor, Proceedings of the SPP Editor-in-Chief, SPP Webmaster 2021  
Organization: Samahang Pisika ng Pilipinas
- (b) Name: Francis Paraan  
Extension work: Referee  
Organization: American Physical Society Physical Review Journals
- (c) Name: Cristine Villagonzalo  
Position: Physics Division (Division IX) Chair and Vice President of the Governing Board  
Organization: National Research Council of the Philippines
- (d) Name: Cristine Villagonzalo  
Position: Referee  
Organization: Elsevier, Springer & World Scientific Publishing

### **2.3.2 Research Interns and Trainees (0)**

## **2.4 Challenges Encountered**

- (a) Current health protocols prevented face-to-face classes. The continuing health crisis modified the implementation of classes that continued to execute in asynchronous mode.

## **2.5 Awards, Accreditations, and Positions of Responsibilities Held**

### **2.5.1 National awards and positions held (2)**

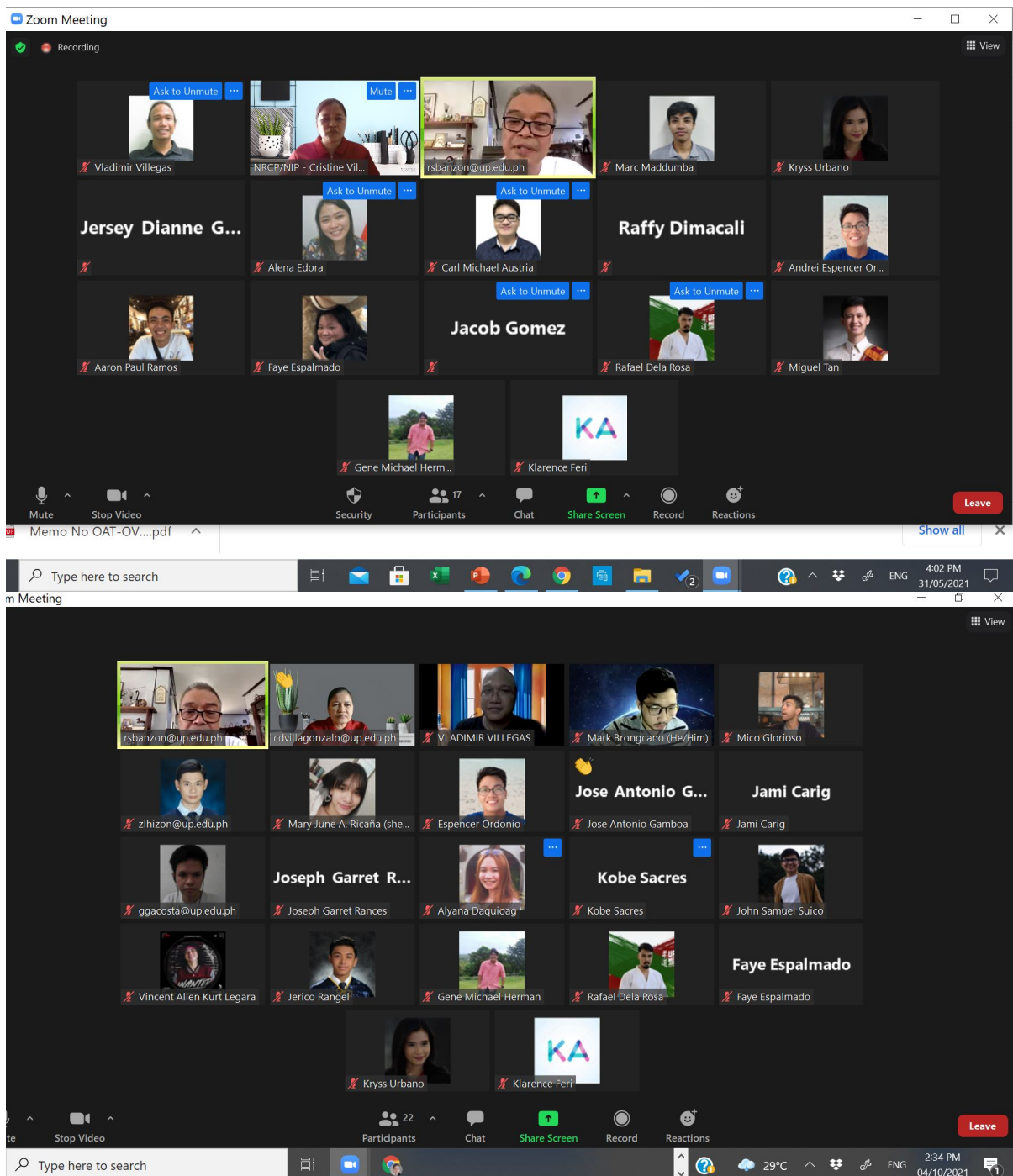
- (a) Name: Francis Paraan  
Award: 2020 Outstanding Young Scientist  
Organization: National Academy of Science and Technology
- (b) Name: Cristine Villagonzalo  
Position: Deputy Director for Academic Affairs  
Organization: National Institute of Physics

---

<sup>1</sup>From the 2003 UP Diliman Faculty Manual 2003 Section 4.3.4: Extension includes services utilizing expertise and talent related to one's discipline, outside instruction and research, such as nondegree training, seminars, workshops, conferences, review classes [except UP College Admission Test (UPCAT)], advisory/technical/information services, exhibits, performances, consultancies (without professional fee), networking, advocacy, and volunteer/community work.

### 3 Appendices

#### 3.1 Photographs



SanD seminar (31 May and 4 October 2021).