

**Theoretical Physics Group**  
National Institute of Physics  
2013 Accomplishment Report

Eric A. Galapon Group

***ISI Publication***

K. Martinez & E.A. Galapon, Exactification of the Poincare asymptotic expansion of the Hankel integral: spectacularly accurate asymptotic expansions and non-asymptotic scales, Proc. Roy. Soc. A 20130529, Dec 2013 (online), Feb 2014 (print).

***SPP 2013***

R.S. Vitancol & E.A. Galapon, An N-qubit Master Equation and Two-qubit Entanglement Dynamics in Spin-Chain and Bosonic Environments, SPP 2013, Cebu.

D. Sombillo & E.A. Galapon, Expectation value of CTOA-operator for double barrier potential, SPP 2013, Cebu.

J. Bunao & E.A Galapon, A dense domain for  $T_{-3,-3}$  in  $L_2(-\infty, \infty)$ , SPP 2013, Cebu.

M. Flores & Galapon, Bipartite entanglement dynamics of 2 and 3 qubit systems in a single mode reservoir with two excitations, SPP 2013, Cebu.

P. Blancas & E.A. Galapon, Quantum cloaking of a hard sphere by introducing it a potential coating, SPP 2013, Cebu.

V. Villegas & E.A. Galapon, Entanglement generation and enhancement in a two qubit system by local perturbation, SPP 2013, Cebu.

***Projects***

“An Investigation of the Universality of Exponential Superluminality in Quantum Tunneling”, funded by DOST and managed by NRCP, September 2012-September 2014.

“N-qubit bipartite entanglement dynamics with emphasis on entanglement preservation”, funded by Outright Research Grant, February 2013-January 2014 (Project No. 121218 PNSE).

“Quantum traversal time across multiple potential barriers and the generalized Hartman effect”, funded by System Grant March 2013-Feb 2014.

*Students*

PhD Physics

Marvin Flores  
Joseph Bunao  
Robert Vitancol  
Herbert Domingo

MS Physics

Philip Blancas  
Reseith John Fajardo  
John Paul Besagas

BS Physics

Vladimir Villegas  
Art Dumigpe  
Christian Tica

## **Contributions to Theory Annual Report Esguerra/Yanga/Magpantay (January to December 2013)**

### **Publications in ISI indexed journals:**

1. K.H. Villegas, D.M. Yanga, J.P. Esguerra, Tunneling of Holes in Spin Polaron Theory, J. Supercond Nov Magn (published online 6 July 2013) DOI 10.1007/s10948-013-2290-5
2. D.L. Dy, J.P. Esguerra, First-passage characteristics of biased diffusion in a planar wedge, PHYSICAL REVIEW E 88, 012121 (2013)
3. J.A. Magpantay, Microscopic irreversibility and the H-theorem, Int. J. Mod. Phys. B, 27, 1250205 (2013)

### **Papers Presented in the 31st SPP Physics Congress, University of San Carlos, Talamban Campus, Cebu City, 23-25 October 2013**

1. J. Cosme, FN Paraan, JP Esguerra, Thomas-Fermi Approach on the Particle Density of a Tonks-Girardeau Gas in Harmonic Confinement with Multiple Delta Perturbations
2. J.Tare, J.P. Esguerra, Space-fractional Schrodinger equation for a quadrupolar triple Dirac-delta potential
3. MA Fudolig, JP Esguerra, Elephant Walk with Single-Step Memory Lapse
4. D Caneso, KH Villegas, JP Esguerra, Evolution of the Magnetization Probability of a Frustrated Antiferromagnet in a Hexagonal-triangular lattice in Discrete Glauber Dynamics
5. N. Lamsen, JP Esguerra, Rapdity Distribution of a Tracer Particle in 1D Maxwell-Juttner Gas
6. J Vance, JP Esguerra, Brownian motion with viscous and quadratic friction
7. MM Nayga, JP Esguerra, Levy Path-Integral Approach to the fractional Schrodinger equation with delta-perturbed infinite square well
8. M Aydinan, JP Esguerra, Two-dimensional persistent random walk with linearly increasing step size
9. L. Lorenzo, JP Esguerra, Pulse-propagation in an exponentially graded spring-mass system

### **Students who graduated:**

Jayson Cosme, MS Physics, Summer 2013

Thesis: Ground State Properties of Tonks-Girardeau Gas in Harmonic Oscillator Potential with Multiple delta-Perturbations

Deborah Anne Lumantas, BS Applied Physics, 2nd Semester 2012-2013

Stellar Structure Calculations Using Piecewise Linear Emulators

Awards/Recognitions: 1) magna cum laude; 2) Most Outstanding BS Applied Physics Graduate

Ephraim Jabneel Eisma, BS Physics, 2nd Semester 2012-2013  
 Solutions to Persistent Random Walks with Probability of Rest in D dimensions  
 Awards/Recognitions: 1. cum laude, 2. Most Outstanding BS Physics Graduate

Miguel Antonio Fudolig, BS Physics, 2nd Semester 2012-2013  
 Apparent Superluminal Motion of Objects Moving at Relativistic Speeds  
 Awards/Recognitions: cum laude

**Ongoing Student Advisees as of December 2013**

**Verification needed:** Cilicia Uzziel Perez, Course: MA Physics, Adviser: Jose Magpantay

Bhazel Anne Rara Pelicano	PhD Physics	Jose Perico Esguerra
Mikaela Irene Fudolig	PhD Physics	Jose Perico Esguerra
Diandrew Lexter Dy	PhD Physics	Jose Perico Esguerra
Kristian Hausser Villegas	PhD Physics	Jose Perico Esguerra/Danil Yanga
Niel Caidic	MS Physics	Jose Perico Esguerra
Leodegario U Lorenzo II	MS Physics	Jose Perico Esguerra
Kendrick Agapito	MS Physics	Jose Perico Esguerra
Diane Caneso	MS Physics	Jose Perico Esguerra
Jeffrey Tare	MS Physics	Jose Perico Esguerra
Pecier Paul Decierdo	MS Physics	Jose Perico Esguerra
Miguel Antonio Fudolig	MS Physics	Jose Perico Esguerra
Wilar Tan	MS Physics	Jose Perico Esguerra
Jan Tristram Acuna	BS Physics	Jose Perico Esguerra
Mary Madelynn Nayga	BS Physics	Jose Perico Esguerra
James Vance	BS Physics	Jose Perico Esguerra
Noel Lamsen	BS Physics	Jose Perico Esguerra
Alan Presbitero	BS Physics	Jose Perico Esguerra
Macliing Aydinan	BS Physics	Jose Perico Esguerra
Derrick John Junio	BS Physics	Jose Perico Esguerra
Gabriel Dizon	BS Physics	Jose Perico Esguerra

**Research Grants:**

Jose Perico H. Esguerra  
 Title: Pulse propagation in an exponentially graded spring-mass system  
 NIP Research Grant  
 Duration: 1 January 2013 to 31 December 2013