Curriculum Vitae

Name: **SARA GUADALUPE CRUZ Y CRUZ**

Update: **October 2020**

CURRICULUM VITAE

A. PERSONAL DATA

Name: Sara Guadalupe Cruz y Cruz
E-mail: sgcruzc@ipn.mx
sara.cruzycruz@gmail.com

Personal Links:
ORCID: https://orcid.org/0000-0002-7133-0803
Researcher ID: http://www.researcherid.com/rid/L-3842-2014
Mendeley: https://www.mendeley.com/profiles/sara-cruz-y-cruz
Google Scholar: https://scholar.google.com.mx/citations?user=ayQw-VMAAAAJ&hl=es
Scopus: https://www.scopus.com/authid/detail.uri?authorId=57142605900
https://www.scopus.com/authid/detail.uri?authorId=22233570300
ResearchGate: https://www.researchgate.net/profile/Sara_Cruz_Y_Cruz
Quantum Fest: http://eventos.fis.cinvestav.mx/quantumfest/
Red Tecnologías Cuánticas: http://redtc.nucleares.unam.mx/users/21
Bar Quantum Group: https://www.fis.cinvestav.mx/~orosas/bar.html

B. AFFILIATION

Current Position:

Permanent Tenured Professor Level A (Profesor Titular A)
Colegio de Profesores de la Sección de Estudios de Posgrado e Investigación,
Unidad Profesional Interdisciplinaria en Ingeniería y Tecnologías Avanzadas del Instituto Politécnico Nacional (UPIITA-IPN)

From: January 2007 up to date

Address:
SEPI, UPIITA-IPN,
Av. Instituto Politécnico Nacional No. 2580,
Col. La Laguna Ticomán, Gustavo A. Madero
CP 07340 Ciudad de México, Mexico
Phone: (+52) 57296000 Ext. 56918

C. EDUCATION

C.1 Dr. in Sci. by Departamento de Física, Centro de Investigación y de Estudios Avanzados (Cinvestav)

- Date: September 6th, 2005
- Ph. D. Thesis: Esquemas Cuánticos de Floquet: Espectros y Operaciones (in Spanish)
- Supervisor: Bogdan Mielnik

C.2 M. Sci. by Departamento de Física, Centro de Investigación y de Estudios Avanzados (Cinvestav)

- Date: May 15th, 1998
- M. Sci. Thesis: El Algoritmo Angular en los Espectros Cuánticos (in Spanish)
- Supervisor: Bogdan Mielnik

D. ACADEMIC POSITIONS

D.1 Assistant Professor, Departamento de Física, Cinvestav, Mexico, from February 1st to May 19th, 2000

D.2 Assistant Professor, Departamento de Física, Cinvestav, Mexico from August 28th to December 15th, 2000

D.3 Temporary Assistant Professor Level B, UPIITA-IPN, Mexico, from February 1st, 2002 to July 15th 2003

D.4 Permanent Assistant Professor Level B, UPIITA-IPN, Mexico, from July 16th, 2003 to April 30th, 2005

D.5 Permanent Assistant Professor Level C, UPIITA-IPN, Mexico from May 1st, 2005 to December 31st, 2006

D.6 Permanent Tenured Professor Level A, UPIITA-IPN, Mexico from January 1st 2007 up to date

D.7 Postdoctoral Fellow at Theoretical, Atomic and Optical Physics Department, Valladolid University, Valladolid, Spain, from October 1st, 2006 to July 31st, 2007

D.8 Postdoctoral Fellow at Departamento de Física, Cinvestav, Mexico, from August 1st, 2007 to July 31st 2008

E. HONORARY NOMINATIONS AND AWARDS

E.1 "Premio Arturo Rosenblueth 2005" Arturo Rosenblueth Award to the best Ph. D. Thesis in Natural and Exact Sciences in 2005, awarded by the Center for Research and Advanced Studies (Cinvestav) Mexico

E.2 "National Researcher SNI Nomination" Level: Applicant (Sistema Nacional de Investigadores, CONACyT, Mexico), from January 1st, 2007 to December 31st 2009

E.3 "National Researcher SNI Nomination" Level 1, from January 1st 2010 to December 31st, 2012

E.4 "National Researcher SNI Nomination" Level 1, from January 1st, 2013 to December 31st, 2016

E.5 "National Researcher SNI Nomination" Level 1, from January 1st, 2017 to December 31st, 2020

F. SHORT TERM VISITS IN FOREIGN INSTITUTIONS

F.1 Theoretical Physics Institute, Warsaw University, Poland, from June 1st to July 15th, 2000

F.2 Theoretical, Atomic and Optical Physics Department, Valladolid University, Spain, from October 1st to December 31st, 2006

F.3 Theoretical, Atomic and Optical Physics Department, Valladolid University, Spain, from march 1st to July 31st, 2007

F.4 Theoretical, Atomic and Optical Physics Department, Valladolid University, Spain, from March 16th to April 15th, 2009

F.5 Theoretical, Atomic and Optical Physics Department, Valladolid University, Spain, from June 25th to July 27th, 2017

F.6 Engineering and Computation Technologies Department. Murcia University, Spain, from July 17th to 21st July, 2017

F.7 Theoretical, Atomic and Optical Physics Department, Valladolid University, Spain, from July 4th to July 25th, 2018

G. RESEARCH ACTIVITIES

G.1 RESEARCH AREAS

Fundamentals of Quantum Mechanics, Time-depedent quantum systems, Floquet Theory, Quantum Control Theory, Semiclassical description of light-matter interaction, Supersymmetric Quantum Mechanics, Coherent States, Classical Optics Analogues of Quantum Systems, Quantum Optics.

G.2 RESEARCH PROJECTS

G.2.1 (2008-2010)

Vectores de Gamow y Regularización de Singularidades con Aplicaciones en Física (Gamow Vectors and Singularity Regularization with Physical Applications).
Grant number: CONACyT 24233-50766-F
Funder: CONACyT, Mexico
Level of involving: Participant
Responsible: Oscar Rosas-Ortiz Cinvestav, Mexico

G.2.2 (Jan-Dec 2009)

Generación de un Modelo Matemático de las Señales Electrogastrográficas Bipolares a partir de Registros Multicanal I (Generation of a Mathematical Model for the Bipolar Electrogastrographic Signals from Multichannel Data I).
Grant number: Project SIP 20091321
Funder: Instituto Politécnico Nacional, Mexico
Level of involving: Responsible

G.2.3 (Jan-Dec 2010)

Generación de un Modelo Matemático de las Señales Electrogastrográficas Bipolares a partir de Registros Multicanal II (Generation of a Mathematical Model for the Bipolar Electrogastrographic Signals from Multichannel Data II).
Grant number: SIP 20100516
Funder: Instituto Politécnico Nacional, Mexico
Level of involving: Responsible

G.2.4 (Jan-Dec 2011)

Métodos numéricos y algebraicos para el análisis de sistemas con masa dependiente de la posición I (Numerical and algebraic methods for the analysis of position-dependent mass systems I).

Grant number: SIP 20113705

Funder: Instituto Politécnico Nacional, Mexico

Level of involving: Responsible

G.2.5 (Jan-Dec 2012)

Métodos numéricos y algebraicos para el análisis de sistemas con masa dependiente de la posición II (Numerical and algebraic methods for the analysis of position-dependent mass systems II).

Grant number: SIP 20120451

Funder: Instituto Politécnico Nacional, Mexico

Level of involving: Responsible

G.2.6 (Jan-Dec 2013)

Método de factorización y sistemas con masa dependiente de la posición (Factorization method and position-dependent mass systems).

Grant number: SIP 20130067

Funder: Instituto Politécnico Nacional, Mexico

Level of involving: Responsible

G.2.7 (Jan-Dec 2014)

Distribuciones de Wigner y estados coherentes para sistemas ópticos y mecánicos (Wigner distributions and coherent states for optical and mechanical systems).

Grant number: SIP 20140767

Funder: Instituto Politécnico Nacional, Mexico

Level of involving: Responsible

G.2.8 (Jan-Dec 2015)

Método de factorización y estados coherentes para modos electromagnéticos paraxiales y sistemas mecánicos I (Factorization method and coherent states for paraxial electromagnetic modes and mechanical systems I).

Grant number: SIP 20150200
Funder: Instituto Politécnico Nacional, Mexico
Level of involving: Responsible

G.2.9 (Jan-Dec 2016)

Método de factorización y estados coherentes para modos electromagnéticos paraxiales y sistemas mecánicos II (Factorization method and coherent states for paraxial electromagnetic modes and mechanical systems II).
Grant number: SIP 20160527
Funder: Instituto Politécnico Nacional, Mexico
Level of involving: Responsible

G.2.10 (2015-2018)

Nuevos retos en sistemas dinámicos supersimétricos y superintegrables (New challenges in superintegrable and supersymmetric dynamical systems).
Grant number: MTM2014-57129-C2-1-P
Funder: Ministerio de Economía y Competitividad, Spain
Level of involving: Participant
Co-responsibles: Luis Miguel Nieto, Javier Negro, Valladolid Univerisity, Spain

G.2.11 2016

Estudio del control cuántico de luz no clásica y la generación de fotones entrelazados (A survey of quantum control of non-classical light and the generation of entangled photons).
Grant number: Insignia Project 2016 for Laboratory Equipment
Funder: Instituto Politécnico Nacional, Mexico
Level of involving: Responsible

G.2.12 (Jan-Dec 2017)

Análogo electromagnético de la ecuación de Schrödinger: óptica ondulatoria paraxial y estados coherentes generalizados I (Electromagnetic analogue of the Schrödinger equation: paraxial wave optics and generalized coherent states I).
Grant number: SIP 20170233
Funder: Instituto Politécnico Nacional, Mexico
Level of involving: Responsible

G.2.13 (Jan-Dec 2018)

Análogo electromagnético de la ecuación de Schrödinger: óptica ondulatoria paraxial y estados coherentes generalizados II (Electromagnetic analogue of the Schrödinger equation: paraxial wave optics and generalized coherent states II).
Grant number: SIP 20180377
Funder: Instituto Politécnico Nacional, Mexico
Level of involving: Responsible

G.2.14 (2016-2018)

Modelización matemática del grafeno y de otros materiales: defectos, propiedades electrónicas, fotónicas y aplicaciones (Mathematical models of graphene and other materials: defects, photonic and electromagnetic properties and applications).
Grant Number: VA057U16
Funder: Conserjería de Eduación, Junta de Castilla y León, Spain
Level of involving: Participant
Responsible: Luis Miguel Nieto, Valladolid Univeristy, Spain

G.2.15 (Jan-Dec 2019)

Método de factorización y potenciales cuánticos para el diseño espectral y análisis de dispositivos y materiales ópticos (Factorization method and quantum potentials for the spectral design of optical media and optical devices).
Grant number: SIP 20195981
Funder: Instituto Politécnico Nacional, Mexico
Level of involving: Responsible

G.2.16 (2019-2021)

Optical potentials: Theory and applications in quantum physics
Grant number: A1-S-24569
Funder: CONACyT, Mexico
Level of involving: Participant
Responsible: Oscar Rosas-Ortiz Cinvestav, Mexico

G.2.17 (Jan-Dec 2020)

Método de factorización y potenciales cuánticos para el diseño espectral y análisis de dispositivos y materiales ópticos (Factorization method and quantum potentials for the spectral design of optical media and optical devices).

Grant number: SIP 20200818
Funder: Instituto Politécnico Nacional, Mexico
Level of involving: Responsible

H. SCIENTIFIC PUBLICATIONS

H.1 SCIENTIFIC PUBLICATIONS IN INDEXED JOURNALS

H.1.1 Sara Cruz y Cruz and Bogdan Mielnik, "The parity phenomenon of the Floquet spectra", *Phys. Lett.* A **352** (2006) 36-40.
https://doi.org/10.1016/j.physleta.2005.11.042

H.1.2 Sara Cruz y Cruz and Bogdan Mielnik, "Quantum control with periodic sequences of non resonant pulses", *Rev. Mex. Fis.* S **53**(4) (2007) 37-41
WOSUID: SCIELO:S0035-001X2007001000008

H.1.3 Sara Cruz y Cruz, Javier Negro and Luis Miguel Nieto, "Classical and quantum position-dependent mass harmonic oscillators", *Phys. Lett.* A **360** (2007) 400-406
https://doi.org/10.1016/j.physleta.2007.05.040

H.1.4 Sara Cruz y Cruz, Şengül Kuru and Javier Negro, "Classical motion and coherent states for the Pöschl-Teller potentials", *Phys. Lett.* A **372** (2008) 1391-1405
https://doi.org/10.1016/j.physleta.2007.10.010

H.1.5 Sara Cruz y Cruz and Oscar Rosas-Ortiz, "Position-dependent mass oscillators and coherent states" *J. Phys. A: Math. Theor.* **42** (2009) 185205
https://doi.org/10.1088/1751-8113/42/18/185205

H.1.6 Sara Cruz y Cruz and Oscar Rosas-Ortiz, "SU(1,1) coherent states for the position-dependent mass singular oscillator", *Int. J. Theor. Phys.* **50** (2011) 2201-2210
https://link.springer.com/article/10.1007%2Fs10773-011-0728-8

H.1.7 Sara Cruz y Cruz and Oscar Rosas-Ortiz, "Dynamical equations, invariants and spectrum generating algebras for classical systems with position-dependent mass", *SIGMA* **9** (2013) 004 21 pages
http://www.emis.de/journals/SIGMA/2013/004/

H.1.8 Sara Cruz y Cruz and Oscar Rosas-Ortiz, "Leaky modes of waveguides as a classical optics analogue of quantum resonances", *Adv. Math. Phys.* **2014** (2014) 281472 10 pages
http://dx.doi.org/10.1155/2015/281472

H.1.9 Oscar Rosas-Ortiz, Sara Cruz y Cruz and Marco Enríquez, "SU(1,1) and SU(2) Approaches to the Radial Oscillator: Generalized Coherent States and Squeezing of Variances" *Ann. Phys.* **373** (2016) 346-373
https://doi.org/10.1016/j.aop.2016.07.001

H.1.10 Sara Cruz y Cruz and Zulema Gress, "Group approach to the paraxial propagation of Hermite-Gaussian modes in a parabolic medium" *Ann. Phys.* **383** (2017) 257-277
https://doi.org/10.1016/j.aop.2017.05.020

H.1.11 Kevin Zelaya, Oscar Rosas-Ortiz, Zurika Blanco-Garcia and Sara Cruz y Cruz, "Completeness and Nonclassicality of Coherent States for Generalized Oscillator Algebras" *Adv. Math. Phys.* **2017** (2017) ID7168592
https://doi.org/10.1155/2017/7168592

H.1.12 Sara Cruz y Cruz and Carlos Santiago-Cruz, "Position dependent mass Scarf Hamiltonians generated via the Riccati equation" *Math. Meth. Appl. Sci.* **42** (2019) 4909
https://onlinelibrary.wiley.com/doi/abs/10.1002/mma.5068

H.1.13 Damián Jacinto-Méndez, Mario Villada-Balbuena, Sara Cruz y Cruz and Mauricio D. Carbajal-Tinoco, "Static structure of sodium polystyrene sulfonate solutions obtained through a coarse-grained model" *Mol. Phys.* **116**, (2018) 2244-2253
https://doi.org/10.1080/00268976.2018.1471225

H.1.14 Marco Enríquez and Sara Cruz y Cruz "Exactly solvable one qubit driving fields generated via nonlinear equations" *Symmetry* **10** (2018) 567
https://doi.org/10.3390/sym10110567

H.1.15 Sara Cruz y Cruz, Rubén Razo, Oscar Rosas-Ortiz and Kevin Zelaya "Coherent states for exactly solvable time-dependent oscillators generated by Darboux transformations" *Phys. Scrip.* **95** 044009
https://iopscience.iop.org/article/10.1088/1402-4896/ab6525

H.1.16 Oscar Rosas-Ortiz and Sara Cruz y Cruz 2020 "Superpositions of bright and dark solitons supporting the creation of balanced gain and loss optical potentials" *Math. Meth. Appl. Sci.* (2020) 1-12 (Early Access)
https://doi.org/10.1002/mma.6666

H.2 PEER REVIEWED SCIENTIFIC PUBLICATIONS

H.2.1 Sara Cruz y Cruz, "Time of events: an applicability limit for the Floquet schemes", in O. Rosas-Ortiz et. al. (Eds.), *AIP Conference Proceedings* **809** (2006) 106-108.
https://doi.org/10.1063/1.2160976

H.2.2 Sara Cruz y Cruz and Bogdan Mielnik, "Time continuity and the positivity problem of the Floquet Hamiltonian", in O. Miranda et. al. (Eds.), *AIP Conference Proceedings* **885** (2007) 26-29
https://doi.org/10.1063/1.2563171

H.2.3 Sara Cruz y Cruz, Javier Negro and Luis Miguel Nieto, "On position-dependent mass harmonic oscillators", *J. Phys.: Conf. Ser.* **128** (2008) 012053
https://doi.org/10.1088/1742-6596/128/1/012053

H.2.4 Oscar Rosas-Ortiz, Nicolás Fernández-García and Sara Cruz y Cruz, "A primer on resonances in quantum mechanics", in L. M. Montaño Zetina et. al. (Eds.), *AIP Conference Proceedings* **1077** (2008) 31-58
https://doi.org/10.1063/1.3040259

H.2.5 Sara Cruz y Cruz and Julieta Medina, "Simulation of non-resonant quantum protocols for a single qubit", in *AIP Conference Proceedings* **1287**: Proceedings of the Advanced Summer School in Physics 2009, 64-73
https://doi.org/10.1063/1.3507425

H.2.6 Sara Cruz y Cruz, "Factorization method and the position-dependent mass problem", Trends in Mathematics, Geometric Methods in Physics, XXX workshop on geometrical methods in Physics, Białowieża, Poland 2011, Birkhäuser Publishing pp 229-237
https://doi.org/10.1007/978-3-0348-0448-6_18

H.2.7 Oscar Rosas-Ortiz, Sara Cruz y Cruz and Nicolás Fernández García, "Negative time delay for wave reflection from a one-dimensional semi-harmonic well", Trends in Mathematics, Geometric Methods in Physics, XXX workshop on geometrical methods in Physics, Białowieża, Poland 2011, Birkhäuser Publishing pp 275-281
https://doi.org/10.1007/978-3-0348-0448-6_22

H.2.8 Sara Cruz y Cruz and Carlos Santiago-Cruz, "Bounded motion for classical systems with position-dependent mass", *J. Phys.: Conf. Ser.* **538** (2014) 012006
https://doi.org/10.1088/1742-6596/538/1/012006

H.2.9 Sara Cruz y Cruz and Rubén Razo, "Wave propagation in the presence of a dielectric slab: the paraxial approximation", *J. Phys. Conf.: Ser.* **624** (2015) 012018
https://doi.org/10.1088/1742-6596/624/1/012018

H.2.10 Sara Cruz y Cruz and Bogdan Mielnik, "Noninertial quantization: truth or illusion?", *J. Phys.: Conf. Ser.* **698** (2016) 012002
https://doi.org/10.1088/1742-6596/698/1/012002

H.2.11 Sara Cruz y Cruz, Nidia Escamilla and Víctor Velázquez, "Generation of sources of light with well defined orbital angular momentum", *J. Phys. Conf.: Ser.* **698** (2016) 012016
https://doi.org/10.1088/1742-6596/698/1/012016

H.2.12 Marco Enríquez and Sara Cruz y Cruz, "Disentangling the Time-Evolution Operator of a Single Qubit", *J. Phys. Conf. Ser.* **839** (2017) 012015
https://doi.org/10.1088/1742-6596/839/1/012015

H.2.13 Zulema Gress and Sara Cruz y Cruz, "A Note on the Off-Axis Gaussian Beams Propagation in Parabolic Media", *J. Phys.: Conf. Ser.* **839** (2017) 012024
https://doi.org/10.1088/1742-6596/839/1/012024

H.2.14 Rubén Razo and Sara Cruz y Cruz, "New confining optical media generated by Darboux transformations", *J. Phys. Conf. Ser.* **1194** (2019) 012091
https://doi.org/10.1088/1742-6596/1194/1/012091

H.2.15 Zulema Gress and Sara Cruz y Cruz, "Hermite Coherent States for Quadratic Refractive Index Optical Media" in Ş Kuru *et al* Eds. *Integrability, Supersymmetry and Coherent States*, CRM Series in Mathematical Physics, Springer Nature Switzerland AG 2019

H.2.16 Erick Barrios-Barocio, Víctor Velázquez and Sara Cruz y Cruz, "Design and Construction of Homodyne Detectors for the Study of Quantum Optical States", *J. Phys. Conf. Ser.* **1540** (2020) 012030
doi:10.1088/1742-6596/1540/1/012030

H.3 EDITED BOOKS

H.3.1 Sara Cruz y Cruz, Francisco Delgado and Oscar Rosas-Ortiz (Eds.)
Quantum Fest 2015. *Journal of Physics: Conference Series* **698** 2016
http://iopscience.iop.org/issue/1742-6596/698/1

H.3.2 Sara Cruz y Cruz (Ed.)
Quantum Fest 2016: International Conference on Quantum Phenomena, Quantum Control and Quantum Optics. *Journal of Physics: Conference Series* **839** 2017 http://iopscience.iop.org/issue/1742-6596/839/1

H.3.2 Sara Cruz y Cruz, Nicolás Fernández, Claudia Quintana and Oscar Rosas-Ortiz (Ed.)
Quantum Fest 2019: International Conference on Quantum Phenomena, Quantum Control and Quantum Optics. *Journal of Physics: Conference Series* **1540** 2020 https://iopscience.iop.org/issue/1742-6596/1540/1

H.4 POPULAR SCIENCE

H.4.1 Sara Cruz y Cruz, Nicolás Fernández-García y Oscar Rosas-Ortiz, "Diagramas de Bianchi para Susy", *Ciencia Ergo Sum*, **13** (3) (Noviembre 2006-Febrero 2007) 319-331

H.4.2 Sara Cruz y Cruz y Oscar Rosas-Ortiz, "Estados coherentes y gatos de Schrödinger", *Cinvestav,* **27** (Enero-Marzo 2008) 30-37

H.4.3 Sara Cruz y Cruz, "Un paseo por el mundo cuántico", *Avance y Perspectiva*, **1**(4), Juio-Agosto 2016, pp 19-21

H.4.4 Sara Cruz y Cruz y Rubén Razo, "De la equivalencia formal entre las leyes dinámicas de la óptica clásica y los sistemas mecánicos. *Boletín UPIITA*, **54**, Mayo 2016

H.5 SOFTWARE COPY RIGHTS

H.5.1 S. G. Cruz y Cruz, L. I. Garay Jiménez y A. Vázquez Jiménez, GuiModFibGas Implementación de un modelo matemático de las células gástricas interactivo con el usuario a través de interfase gráfica (in Spanish).

H.5.2 S. G. Cruz y Cruz, L. I. Garay Jiménez y A. Vázquez Jiménez, ModFibGastrica Implementación de un modelo matemático de las células gástricas (in Spanish).

I. SCIENTIFIC CONFERENCES & SYMPOSIA

I.1 ORGANIZING COMMITTEES OF SCIENTIFIC CONFERENCES

I.1.1 Quantum Fest 2013
UPIITA, Instituto Politécnico Nacional, México D.F., Mexico
October 23-25, 2013
CHAIRMAN
http://eventos.fis.cinvestav.mx/quantumfest/qf2013.html

I.1.2 Quantum Fest 2014
Physics Department, Cinvestav, México D.F., Mexico
October 29-31, 2014
CHAIRMAN
http://eventos.fis.cinvestav.mx/quantumfest/index14.html

I.1.3 Quantum Fest 2015
Tecnológico de Monterrey Campus Edo. de México, Mexico
October 19-23 2015
CHAIRMAN
http://eventos.fis.cinvestav.mx/quantumfest/index15.html

I.1.4 Quantum Fest 2016: International Conference on Quantum Phenomena, Quantum Control and Quantum Optics
UPIITA, Instituto Politécnico Nacional, Ciudad de México, Mexico
October 17-21, 2016
CHAIRMAN
http://eventos.fis.cinvestav.mx/quantumfest/

I.1.5 Quantum Fest 2019: International Conference on Quantum Phenomena, Quantum Control and Quantum Optics
UPIITA, Instituto Politécnico Nacional, Ciudad de México, Mexico
October 28-Nov 1, 2019
http://eventos.fis.cinvestav.mx/quantumfest/

I.2 PARTICIPATION IN SCIENTIFIC CONFERENCES & SYMPOSIA

I.2.1 INSTITUTIONAL

I.2.1.1 8a Semana de Investigación UPIITA, México D.F., Mexico, Aptil 21-25, 2014.
Invited Talk: Método de factorización y sistemas con masa dependiente de la posición

I.2.1.2 9a Semana de Investigación UPIITA, México D.F., Mexico, May 2015.
Invited Talk: Analogías entre la óptica paraxial y los sistemas mecánicos: teoría y aplicaciones

I.2.1.3 10a Semana de Investigación UPIITA, México D.F., Mexico May 2016.
Invited Talk: Electromagnetic modes of waveguides as a classical optics analogue of quantum states

I.2.1.4 11a Semana de Investigación UPIITA, Ciudad de México, Mexico, May 2018.
Invited Talk: Análogo electromagnético de la ecuación de Schrödinger: óptica ondulatoria paraxial y estados coherentes generalizados.

I.2.1.5 12a Semana de Investigación UPIITA, Ciudad de México, Mexico, May 2019.
Invited Talk: Método de factorización y potenciales cuánticos para el diseño espectral y análisis de dispositivos y materiales ópticos.

I.2.2 NATIONAL

I.2.2.1 IV Encuentro Regional de Investigación y Enseñanza de la Física, Puebla, Mexico, May 24-27, 1994
Contribution Talk: "Funcionamiento y Construcción de un Pequeño Telescopio Newtoniano".

I.2.2.2 Advanced Summer School in Physics 2005, Cinvestav, México D.F., Mexico, July 11-22, 2005
Contribution Talk: "Quantum Jumps and Quasienergy Spectra".

I.2.2.3 VI Taller de la División de Gravitación y Física Matemática de la Sociedad Mexicana de Física (SMF), Metepec, Pue., Mexico, November 20-25, 2005
Contribution Talk: "Control Cuántico Mediante Secuencias Periódicas de Pulsos No Resonantes".

I.2.2.4 Advanced Summer School in Physics 2006, Cinvestav, México D.F., Mexico, July 10-14, 2006
Contribution Talk: "Illusions of Quantum Theory in Rotating Frames".

I.2.2.5 VII Taller de la División de Gravitación y Física Matemática de la SMF, Universidad Autónoma de Nuevo León, Monterrey, Nuevo León, Mexico, November 26-30, 2007
Contribution Talk: "El oscilador armónico con masa dependiente de la posición: aspectos clásico y cuántico".

I.2.2.6 II Reunión Anual de la División de Información Cuántica de la SMF, INAOE, Tonantzintla, Puebla, Mexico, May 19-21, 2009
Contribution Talk: "Osciladores con masa dependiente de la posición y estados coherentes".

I.2.2.7 Advanced Summer School in Physics 2009, Cinvestav, México D. F., Mexico, July 27-31, 2009.
Contribution Talk: "Quantum control with periodic sequences of non-resonant pulses"

I.2.2.8 III Reunión Anual de la División de Información Cuántica de la SMF, Instituto de Física, Universidad Autónoma de San Luis Potosí, San Luis Potosí, Mexico, May 29-April 1, 2010
Contribution Talk: "Illusions of quantum theory in rotating frames".

I.2.2.9 Quantum Fest 2010, Cinvestav, México D. F. Mexico. December 8th, 2010
Contribution Talk: "Simulación de procesos de control cuántico para un qubit".

I.2.2.10 VIII Encuentro Xalapeño de Física, Facultad de Física e Inteligencia Artificial, Universidad Veracruzana, Xalapa Veracruz, Mexico, May 4-6, 2011
Invited Talk: "Procesos de Control Cuántico Resonante y no Resonante para un Qubit".

I.2.2.11 Quantum Fest 2011, Cinvestav, México D. F. Mexico. November 24-25, 2011
Contribution Talk: "Classical and quantum position-dependent mass systems".

I.2.2.12 Quantum Fest 2013, UPIITA, México D. F. Mexico, October 23-25, 2013
Contribution Talk: Dynamical equations and spectrum generating algebras for position-dependent mass systems

I.2.2.13 Quantum Fest 2014, Cinvestav, México D. F., Mexico, October 29-31, 2014
Contribution Talk: Paraxial wave optics and generalized coherent states

I.2.2.14 Advanced Summer School in Physics, Cinvestav, Mexico City., Mexico, 22-26th July, 2019
Contribution Talk: Electromagnetic modes as optical analogues of quantum states

I.2.3 INTERNATIONAL

I.2.3.1 XXII Workshop on Geometric Methods in Physics, Białowieża, Poland, June 29-July 5, 2003
Contribution Talk: "Quantum Jumps and Quasienegy Spectra".

I.2.3.2 XXV International Colloquium on Group Theoretical Methods in Physics, Cocoyoc, Mexico, 2-6 August, 2004

I.2.3.3 5th International Symposium on Quantum Theory and Symmetries, Valladolid Univeristy, Valladolid, Spain. July 22-28, 2007
Contribution Talk: "Classical and quantum position-dependent mass harmonic oscillators".

I.2.3.4 Recent Developments in Time-Asymmetric Quantum Mechanics, Quantization and Related Topics, Valladolid University, Valladolid, Spain, 14-16 July, 2010
Contribution Talk: "Position-dependent Mass Systems and Coherent States"

I.2.3.5 XXX Workshop on Geometric Methods in Physics, Institute of Mathematics, Białystok, Białowieża, Poland. July, 2011
Contribution Talk: "Position-dependent mass systems and coherent states".

I.2.3.6 International Symposium Symmetries in Science, Bregenz, Austria, July 21-26, 2013
Plenary Talk: "Dynamical equations, invariants and spectrum-generating algebras of mechanical systems with position-dependent mass".

I.2.3.7 Latin American School of Physics, México D. F., Mexico, July 22-August 2, 2013
Contribution Talk: Dynamical equations and spectrum generating algebras for position-dependent mass systems

I.2.3.8 Quantum Theory and Symmetries 8, México D.F. , México, August 5-9, 2013
Contribution Talk: Dynamical equations and spectrum generating algebras for position-dependent mass systems

I.2.3.9 International conference on quantum control, exact or perturbative, linear or nonlinear, México D. F., Mexico October 22-24, 2014
Contribution Talk: Time continuity and the positivity problem of the Floquet Hamiltonian

I.2.3.10 Waves in Science and Engineering, Cinvestav, U. Querétaro, Querétaro, Mexico, August 22-26, 2016
Invited Talk: Paraxial wave optics and generalized coherent states

I.2.3.11 Quantum Fest 2016, UPIITA, Ciudad de México, Mexico, October 17-21, 2016
Contribution Talk: Group approach to the paraxial propagation of Hermite-Gaussian modes in a parabolic medium

I.2.3.12 6th International Workshop on New Challenges in Quantum Mechanics: Integrability and Supersymmetry, Valladolid, Spain, June 27-30, 2017
Contribution Talk: Group approach to the propagation of Hermite-Gaussian modes in a parabolic medium

I.2.3.13 32th International Colloquium on Group Theoretical Methods in Physics, Czech Technical University in Prague, Czech Republic July 9-13, 2018
Contribution Talk: Group approach to the propagation of paraxial modes in a parabolic medium

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J TEACHING

J.1 TAUGHT COURSES & LECTURES

J.1 **High School Level:**
More than 500 school hours of courses on Basic Mathematics, including: Algebra, Trigonometry and Calculus

J.2 **Bachelor Level**:
More than 3500 school hours of courses on Basic Mathematics, including: Linear Algebra, Real Analysis, Vector Calculus, Ordinary Differential Equations and Complex Variable Calculus

J.3 **Bachelor Level**:
More than 1500 school hours of courses on Physics, including: Classical Mechanics, Electrostatic and Magnetostatics, Electromagnetic Theory, Modern Physics and Classical Optics

J.4 **Pre-Master Level**:
More than 500 school hours of courses on Advanced Mathematics and Physics

J.5 **Master Level**:
More then 700 school hours of courses on Advanced Mathematics, including: Real Analysis and Mathematical Methods for Physics and Engineering

J.6 **Master Level**:
More than 900 school hours of courses on Physics, including: Electromagnetics, Electrodynamics, Classical Mechanics, Quantum Mechanics and Quantum Optics

J.7 **Ph. D. Level**:
More then 500 school hours of courses on Mathematics, including: Group Theory and Functional Analysis

J.8 **Ph. D. Level**:
More that 900 school hours of courses on Physics, including: Spectral Problems in Quantum Mechanics, Quantum Optics, Quantum Mechanics and Optical Information Processing

J.9 **Teacher Training Lectures**:
Lecture: New Findings and Applications of Quantum Mechanics (8 hours)
Lecture: Introduction to Quantum Information and Simulations (8 hours)

J.2 SUPERVISED THESIS

J.2.1 Ph.D THESIS

J.2.1.1 COMPLETED THESIS

J.2.1.1.1 Zulema Gress Mendoza
Descripción algebraica de procesos de propagación de modos ópticos paraxiales (in Spanish)
Completed on July 5th, 2018
Related papers:

- Sara Cruz y Cruz and Zulema Gress, "Group approach to the paraxial propagation of Hermite-Gaussian modes in a parabolic medium" *Ann. Phys.* **383** (2017) 257-277 https://doi.org/10.1016/j.aop.2017.05.020
- Zulema Gress and Sara Cruz y Cruz, "A Note on the Off-Axis Gaussian Beams Propagation in Parabolic Media", *J. Phys.: Conf. Ser.* **839** (2017) 012024 https://doi.org/10.1088/1742-6596/839/1/012024

J.2.1.1.2 Damián Jacinto Méndez
Estudio de la conformación estructural de polielectrolitos hidrofóbicos (in Spanish)
Codirector: Mauricio Carbajal, Depto. de Física, Cinvestav
Completed on September 21st, 2018
Related paper:

- Damián Jacinto-Méndez, Mario Villada-Balbuena, Sara Cruz y Cruz and Mauricio D. Carbajal-Tinoco, "Static structure of sodium polystyrene sulfonate solutions obtained through a coarse-grained model" *Mol. Phys.* **116**, 2244-2253 https://doi.org/10.1080/00268976.2018.1471225

J.2.1.1.3 Rubén Razo Chávez

Electromagnetic propagation in spectraly designed open waveguides
Completed on January 16th, 2020
Related paper:

- Sara Cruz y Cruz and Rubén Razo, "Wave propagation in the presence of a dielectric slab: the paraxial approximation", *J. Phys.: Conf. Ser.* **624** (2015) 012018 https://doi.org/10.1088/1742-6596/624/1/012018
- Rubén Razo and Sara Cruz y Cruz, "New confining optical media generated by Darboux transformations", *J. Phys. Conf. Ser.* **1194** 012091 https://doi.org/10.1088/1742-6596/1194/1/012091
- Sara Cruz y Cruz, Rubén Razo, Oscar Rosas-Ortiz and Kevin Zelaya "Coherent states for exactly solvable time-dependent oscillators generated by Darboux transformations" *Phys. Scrip.* **In press**
https://iopscience.iop.org/article/10.1088/1402-4896/ab6525

J.2.1.2 THESIS IN PROGRESS

J.2.1.2.1 Nidia Escamilla Bojorges

Transmisión de informacón es espacio libre usando luz con momento angular orbital (in Spanish)
Related paper:

- Sara Cruz y Cruz, Nidia Escamilla and Víctor Velázquez, "Generation of sources of light with well defined orbital angular momentum", *J. Phys.: Conf. Ser.* **698** (2016) 012016 https://doi.org/10.1088/1742-6596/698/1/012016

J.2.1.2.2 Carlos Santiago Cruz

Supersymmetric partners and coherent states for position-dependent mass systems
Related papers:

- Sara Cruz y Cruz and Carlos Santiago-Cruz, "Position dependent mass Scarf Hamiltonians generated via the Riccati equation" *Math. Meth. Appl. Sci.* **42** (2019) 4909 https://doi.org/10.1002/mma.5068
- Sara Cruz y Cruz and Carlos Santiago-Cruz, "Bounded motion for classical systems with position-dependent mass", *J. Phys.: Conf. Ser.* **538** (2014) 012006 https://doi.org/10.1088/1742-6596/538/1/012006

– Carlos Santiago-Cruz, "Isospectral Trigonometric Pöschl-Teller Potentials with Position Dependent Mass Generated by Supersymmetry" *J. Phys.: Conf. Ser.* **698** (2016) 012028 https://doi.org/10.1088/1742-6596/698/1/012028

J.2.1.2.3 Erick Barrios Barocio
Diseño y construcción de un detector homodino para aplicaciones en óptica cuántica (in Spanish)

J.2.1.2.4 Iván Alejandro Bocanegra Garay
Complex potentials in quantum mechanics and optical devices based on gain- and loss materials

J.2.1.2.5 María del Carmen Blázquez Villalobos
Spectrum generating algebras for non-Hermitian Hamiltonians with real spectras

J.2.2 MASTER THESIS

J.2.2.1 COMPLETED THESIS

J.2.2.1.1 Nidia Escamilla Bojorges
Producción de luz con momento angular orbital a partir de fuentes clásicas y cuánticas (in Spanish)
Completed: July 11st, 2012

J.2.2.1.2 Zulema Gress Mendoza
Análisis de la correlación espacial de luz estructurada (in Spanish)
Completed: January 17th, 2014

J.2.2.1.3 Carlos Santiago Cruz
Análisis de la dinámica de sistemas con masa dependiente de la posición usando el método de factorización (in Spanish)
Completed: February 15, 2015

J.2.2.1.4 Rubén Razo Chávez
Resonancias en mecánica cuántica y su análogo electromagnético (in Spanish)
Completed: March 23th, 2015

J.2.2.1.5 Iván Alejandro Bocanegra Garay
Spectral description of open optical devices with axial symmetry
Completed: January 22nd, 2018

J.2.2.1.6 Emmanuel Pérez Jaramillo
Simulación óptica de las oscilaciones de Rabi atómicas mediante una guía de ondas curvilínea multimodal (in Spanish)
Completed: August 3rd, 2018

J.2.2.1.7 María del Carmen Blázquez Villalobos
Non-Hermitian Sacrf II Hamiltonians generated by nonlinear equations
Completed: January 17th, 2020

J.2.2.1.8 Gerardo Jose Suarez Rodriguez
Detection of semitransparent objects using quantum interrogation
Completed: October 2th, 2020

J.2.2.2 THESIS IN PROGRESS

J.2.2.2.1 Gerardo Jiménez Trejo
Orbital angular momentum in single photons

J.2.2.2.2 Miguel Alejandro Mendoza Armendáriz
Periodic modulated self-confining optical media

J.2.2.2.3 Pranjal Agarwal
Off-Axis Hermite-Gaussian modes in parabolic media

K. MEMBER OF EVALUATING COMMITTEES

K.1 Member of the Evaluating Committee for the Discharge of Researchers at the Instituto Politécnico Nacional from 2010

K.2 Member of the Evaluating Jury for the Research and Technological Development Award 2014, Instituto Politécnico Nacional, Mexico

K.3 Member of the Evaluating Committee for the Discharge of Researchers at the Instituto Politécnico Nacional from 2017

K.4 Member of the Evaluating Committee for the Discharge of Researchers at the Instituto Politécnico Nacional from 2019

K.5 Panelist in the Selection Committee of Fulbright García-Robles Fellowships awarded by the Comisón México-Estados Unidos para el Intercambio Educativo y Cultural (COMEXUS), April 2019

K.6 Panelist in the Selection Committee of Fulbright García-Robles Fellowships awarded by the Comisón México-Estados Unidos para el Intercambio Educativo y Cultural (COMEXUS), April 2020

L. ACTIVITIES ORIENTED TO THE CREATION, PROMOTION AND CONSOLIDATION OF POSTGRADUATE TRAINING PROGRAMMES

L.1 Participation in the design, submission, launching and quality certification by the Mexican Council of Science and Technology (CONACyT, Mexico) of the Master Training Programme: Master in Advanced Technology, Curriculum 2007, implanted at UPIITA, Instituto Politécnico Nacional, Mexico.

L.2 Participation in the design, submission, launching and quality certification by the Mexican Council of Science and Technology (CONACyT, Mexico) of the Ph. D Training Programme: Doctorate in Advanced Technology, Curriculum 2011, implanted at UPIITA, Instituto Politécnico Nacional, Mexico.

L.3 Academic Coordinator of the master programme: Master in Advanced Technology, UPIITA, Instituto Politécnico Nacional from February 5th, 2010 to February 4th 2013

L.4 Coordinator of the Process of Promotion and Quality Certification by the Mexican Council of Science and Technology (CONACyT, Mexico) of the master programme Master in Advanced Technology, UPIITA, Instituto Politécnico Nacional, Call 2011. In this evaluation the cited programme was promoted from the New Programme Level to the Programme under Development Level.

L.5 Coordinator of the Process of Promotion and Quality Certification by the Mexican Council of Science and Technology (CONACyT, Mexico) of the master programme Master in Advanced Technology, UPIITA, Instituto Politécnico Nacional, Call 2014. In this evaluation the cited programme was ratified as a Programme under Development.

L.6 Coordinator of the Process of Promotion and Quality Certification by the Mexican Council of Science and Technology (CONACyT, Mexico) of the Ph. D. programme Doctorate in Advanced Technology, UPIITA, Instituto Politécnico Nacional, Call 2016. In this evaluation the cited programme was promoted from the New Programme Level to the Programme under Development Level.

L.7 Coordinator of the Process of Promotion and Quality Certification by the Mexican Council of Science and Technology (CONACyT, Mexico) of the Ph. D. programme Doctorate in Advanced Technology, UPIITA, Instituto Politécnico Nacional, Call 2019. In this evaluation the cited programme was ratified as Programme under Development.

M. ACTIVITIES ORIENTED TO THE DEVELOPMENT AND CONSOLIDATION OF RESEARCH GROUPS

M.1 Coordinator of the establishment, equipment and launching of the Quantum Phenomena Laboratory at the Instituto Politécnico Nacional 2018. This is the first laboratory that develops experimental research activities in Classical and Quantum Optics and Quantum Phenomena at the National Polytechnic Institute, Mexico.

M.2 Head of the Quantum Phenomena Laboratory and supervisor of its research activities.

M.3 Representative of the Quantum Phenomena Research Group at the Master and Doctorate in Advanced Technology training programmes, UPIITA, Instituto Politécnico Nacional.

N. ADDITIONAL ACADEMIC-ADMINISTRATIVE ACTIVITIES

N.1 Participation as expositor in the Expo-Profesiográfica IPN from 2002, a program for the popularization of the Bachelor and Postgraduate Training Programmes taught at UPIITA, Instituto Politécnico Nacional, Mexico

N.2 Invited Editor of the Column "UPIITA: Nuevos Horizontes" , Revista *Conversus*, Instituto Politécnico Nacional from January 2008 to December 2010

N.3 Coeditor of the Special Issue: Información Cuántica, Revista *Cinvestav* **27** (Jan-March 2008)

N.4 Promotion of the activities of research and technological development at the Instituto Politécnico Nacional through:

- the organization of the extracurricular lecture series: Luz no Clásica: Tópicos Selectos (in Spanish). UPIITA, Instituto Politécnico Nacional, October 2009 and October 2011. Lecturers: Oscar Rosas-Ortiz (Cinvestav, Mexico) and Víctor Velázquez (UNAM, Mexico)
- the delivery of the workshop: Formación de grupos de investigación y elaboración de artículos científicos (in Spanish) in the 2o. Curso-Taller: Investigación, Desarrollo Tecnológico e Innovación. Escuela Superior de Turismo, Instituto Politécnico Nacional. November 2013

O. ADDITIONAL ADMINISTRATIVE TRAINING

O.1 Extracurricular course: Direccionamiento para la construcción de contenidos educativos digitales en modalidades alternativas mx10. Secretaría de Investigación y Posgrado, Instituto Politécnico Nacional. Registro SIP: AV-CPE-028-09, May 6-24 2013 (**Course for the design and construction of contents for the e-learning**)

O.2 Extracurricular course: Moderación en línea para modalidades educativas alternativas mx10. Secretaría de Investigación y Posgrado, Instituto Politécnico Nacional. Registro SIP: AV-CPE-029-09, from June 12th to August 5th, 2013 (**Course for the On-line moderation training in the e-learning**)

O.3 Diploma: Gestión de Calidad en Programas de Posgrado del IPN. Secretaría de Investigación y Posgrado, Instituto Politécnico Nacional. Registro SIP: AV-DIP-013-10, from May 21st to December 3rd, 2010 (**Diploma in Quality Management and Certification of Master and Ph. D. Training Programmes**)

P. COLABORATORS

Profr. Dr. Bogdan Mielnik[†]
Physics Department, Cinvestav
Ciudad de México, Mexico

Profr. Dr. Oscar Rosas-Ortiz
Physics Department, Cinvestav
Ciudad de México, Mexico

Profr. Dr. Javier Negro Vadillo
Theoretical, atomics and optics physics Department, Valladolid Univeristy
Valladolid, Spain

Profr. Dr. Luis Miguel Nieto Calzada
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Ciudad de México, Mexico