

# Héctor Andrés Chang-Lara

[hector.chang@cimat.mx](mailto:hector.chang@cimat.mx)

<https://www.cimat.mx/~hector.chang/>

---

## Education

*PhD Mathematics.*

University of Texas at Austin, May 2013

*Regularity for Solutions of Nonlocal Fully Nonlinear Parabolic Equations and Free Boundaries on two Dimensional Cones.*

Advisor: Luis Caffarelli

*Master of Science*

University of New Mexico, May 2008

*Bachelor in Mathematics.*

Universidad Simón Bolívar, May 2007

## Research Interest

Analysis and regularity theory for elliptic and parabolic differential equations,  
Integro-differential equations,  
Free boundary problems,  
Analysis and connections with stochastic models and optimal control.

## Positions Held

*Investigador Titular "A" (tenured)*

Área de Matemáticas Básicas del CIMAT Guanajuato, Spring 2018 - present

*Ritt Assistant Professor*

Columbia University, Fall 2013 - Fall 2017

Supervisor: Ovidiu Savin

## Fellowships and Grants

*Sistema Nacional de Investigadores CONACYT*

Investigador Nacional Nivel I, 2019 - 2021

Investigador Nacional Nivel I, 2021 - 2025

*Proyectos de Ciencia Básica CONACYT (CB2017-2018)*

Análisis y Aplicaciones de Problemas de Frontera Libre Mediante Ecuaciones Integro-diferenciales, 2020 - 2023

## Publications

### 1. Regularity Theory for Elliptic Equations

1. H. A. Chang-Lara, G. Dávila.  
*Regularity for Solutions of Non Local, Non Symmetric Equations*  
Annales de l'I.H.P. Analyse non linéaire, 29 (2012) no. 6, pp. 833-859.  
Citations: 23 (MathSciNet), 37 (Google Scholar)
2. H. A. Chang-Lara, G. Dávila.  
*Regularity for Solutions of Non Local Parabolic Equations*  
Calc. Var. Partial Differential Equations 49 (2014), no. 1-2, 139-172.  
Citations: 56 (MathSciNet), 97 (Google Scholar)
3. H. A. Chang-Lara, G. Dávila.  
*Regularity for Solutions of Nonlocal Parabolic Equations II*  
J. Differential Equations 256 (2014), no. 1, 130-156.  
Citations: 26 (MathSciNet), 42 (Google Scholar)
4. H. A. Chang-Lara, D. Kriventsov  
*Further Time Regularity for Fully Non-linear Parabolic Equations*  
Math. Res. Lett. 22 (2015), no. 6, 1749-1766.  
Citations: 2 (MathSciNet), 4 (Google Scholar)
5. H. A. Chang-Lara, G. Dávila.  
*Hölder Estimates for Non-local Parabolic Equations with Critical Drift*  
J. Differential Equations 260 (2016), no. 5, 4237-4284.  
Citations: 13 (MathSciNet), 25 (Google Scholar)
6. H. A. Chang-Lara, G. Dávila.  
 *$C^{\sigma+\alpha}$  Estimates for Concave, Non-local Parabolic Equations with Critical Drift*  
J. Integral Equations Appl. 28 (2016), no. 3, 373-394.  
Citations: 10 (MathSciNet), 11 (Google Scholar)
7. H. A. Chang-Lara, D. Kriventsov  
*Further Time Regularity for Non-Local, Fully Non-Linear Parabolic Equations.*  
Comm. Pure Appl. Math. 70 (2017), no. 5, 950-977.  
Citations: 13 (MathSciNet), 20 (Google Scholar)
8. H. A. Chang-Lara, A. Saldaña  
*Classical solutions to integral equations with zero order kernels.*  
**Submitted.**

### 2. Analysis of Free Boundary Problems

1. M. Allen, H. A. Chang-Lara  
*Free Boundaries on Two Dimensional Cones*  
J. of Geometric Analysis (2015), no. 3, 1547-1575.  
Citations: 2 (MathSciNet), 8 (Google Scholar)
2. H. A. Chang-Lara, O. Savin  
*Boundary Regularity for the Free Boundary in the One-phase Problem*  
New Developments in the Analysis of Nonlocal Operators  
Contemporary Mathematics, 723. Amer. Math. Soc. (2019), 149-165.  
Citations: 4 (MathSciNet), 11 (Google Scholar)

3. H. A. Chang-Lara, N. Guillen, R. Schwab  
*Some Free Boundary Problems Recast as Nonlocal Parabolic Equations*  
Nonlinear Anal. 189 (2019), 11538, 60 pp.  
Citations: 4 (MathSciNet), 10 (Google Scholar)
4. H. A. Chang-Lara, E. Pimentel  
*Non-convex Hamilton-Jacobi Equations with Gradient Constraints*  
Nonlinear Anal. 210 - Special Issue: Free Boundary Problems (2021), 112362, 17 pp.
5. H. A. Chang-Lara, M. Santos  
*Hölder Regularity for Non-variational Porous Media Type Equations*  
J. Differential Equations 360 (2023), 347372.

### 3. Analysis of Stochastic Models

1. F. Baccelli, H. A. Chang-Lara, S. Foss  
*Shape Theorems for Poisson Hail on a Bivariate Ground*  
Adv. in Appl. Probab. 48 (2016), no. 2, 525-543.  
Citations: 1 (MathSciNet), 3 (Google Scholar)

## Invited Talks

### 1. 2023

1. *A transmission problem for first and second order operators*  
ICMC's Summer Meeting on Differential Equations and  
13th Americas Conference on Differential Equations and Nonlinear Analysis.  
Sao Carlos, Brazil, February 2023.

### 2. 2022

1. *Introducción a las soluciones viscosas: Browniano vs. eikonal.*  
Cibercoloquio Latinoamericano de Matemáticas. February 2022.
2. *A Non-variational Approach for the Porous Medium Equation.*  
SIAM Conference on Analysis of PDE. Berlin, March 2022.
3. *Browniano vs. Eikonal.*  
13th Minimeeting on Differential Geometry. September 2022.

### 3. 2021

1. *A Non-variational Approach for the Porous Medium Equation*  
Congreso Latinoamericano de Matemáticos, Montevideo, September 2021.
2. *Obstacle Type Problems with Gradient Constraints*  
Mathematical Congress of the Americas. Buenos Aires, July 2021.
3. *Non-convex Hamilton-Jacobi Equations with Gradient Constraints*  
VIII Congreso de Matemática Aplicada, Computacional e Industrial.  
Buenos Aires, May 2021.

#### 4. 2020

1. *Eikonal vs. Brownian*  
Rio de Janeiro Webinars on Analysis of PDE, November 2020.

#### 5. 2019

1. *Boundary Regularity for the Free Boundary in the One-phase Problem*  
Swedish Summer PDEs. Stockholm, August 2019.
2. *Regularidad en el borde de la frontera libre en el problema de una fase*  
VII Taller de Geometría y Sistemas Dinámicos. Hermosillo, April 2019.
3. *Some Free Boundary Problems Recast as Nonlocal Parabolic Equations*  
AMS Sectional Meeting, Interactions between Geometric Measure Theory, PDE, and Harmonic Analysis. University of Hawaii, March 2019.

#### 6. 2018

1. *Regularidad en el Borde de la Frontera Libre en el Problema de una Fase*  
51 Congreso Nacional de la Sociedad Matemática Mexicana. Villahermosa, October 2018.
2. *Further Time Regularity for Parabolic Equations*  
BUC-XV: Function spaces meet materials science: recent developments in spectral theory and scattering. CIMAT-Guanajuato, September 2018.
3. *From the Free Boundary Condition for Hele-Shaw to the Fractional Parabolic Equation*  
AMS Sectional Meeting, Analysis at the intersection of Geometric Measure Theory and Partial Differential Equations. Portland, April 2018.

#### 7. 2011-2017

1. Rocky Mountain Partial Differential Equations  
Provo, May 2017.
2. AMS Sectional Meeting, Qualitative and Quantitative Properties of Solutions to PDE.  
New York, May 2017.
3. AMS Fall Central Sectional Meeting.  
Minnesota, October 2016.
4. 11th AIMS Conference on Dynamical Systems Differential Equations and Applications.  
Orlando, July 2016.
5. 3rd Conference on Nonlocal Operators and Partial Differential Equations.  
Poland, June 2016.
6. Math Finance and Partial Differential Equations Conference.  
Rutgers University, November 2013.
7. 9th AIMS Conference on Dynamical Systems Differential Equations and Applications.  
Orlando, July 2012.
8. SIAM Conference on Analysis of Partial Differential Equations (PD11).  
San Diego, November 2011.

8. **Seminar talks:** CIMAT Guanajuato, SEDNOL IMUNAM - Ciudad de México, IIMAS, IMUNAM Querétaro, CCM-UNAM Morelia, Universidad de Colima, CUCEI, UADY, Universidad Juárez del Estado de Durango, UAM-Azcapotzalco, Universidad Simón Bolívar, University of Texas in Austin, Columbia University, Princeton University, Massachusetts Institute of Technology, University of California Los Angeles, University of New Mexico, University of Washington, University of Pennsylvania, Rutgers University, McGill University, Purdue University, Michigan State University, Brigham Young University.
- 

## Supervision and Theses Directions

1. *Post-doctoral supervision:* Makson Santos.  
Submitted paper: *Hölder Regularity for Non-variational Porous Media Type Equations*.  
Paper in preparation: *Free Boundary Regularity for Non-variational Porous Media Type Equations*.  
CIMAT. Guanajuato, 2020-2021.
2. *Master Student:* Emanuel Rivera.  
 *$L^1$  Optimal Transport Theory and Minimal Flow Problems*.  
CIMAT. Guanajuato, 2021.
3. *Master Student:* Diego Castro.  
*Schwarz Method and Balayage*.  
CIMAT. Guanajuato, 2021.
4. *Summer Project Mentorship:* Iancarlo Ariel Espinoza - DEMAT, UG  
Based on: Alan Turin, the Chemical Basis of Morphogenesis.  
XXX Verano de la investigación Científica de la Academia Mexicana de Ciencias, 2020.
5. *Summer Project Mentorship:* Leslie Quincosa - DEMAT, UG  
Control óptimo aplicado a modelos epidemiológicos.  
Estancias de Investigación de Verano, CIMAT 2021.
6. *Summer Project Mentorship:* Karlo Jair Guevara - DEMAT, UG  
Control óptimo aplicado a modelos epidemiológicos.  
Estancias de Investigación de Verano, CIMAT 2021.
7. *Summer Project Mentorship:* Kapioma Villarreal - DEMAT, UG  
Divisible Sandpiles.  
Estancias de Investigación de Verano, CIMAT 2021.
8. *Summer Project Mentorship:* Enrique Galicia Pineda - UNAM  
Modelación y análisis de pilas de arena.  
Estancias de Investigación de Verano, CIMAT 2021.
9. *Summer Project Mentorship:* Josué Juárez - U. Veracruzana  
(Colaboration with Jesús Núñez Zimbrón, CIMAT-Gto)  
Flujos gradientes y la Ecuación de Fokker-Planck  
Estancias de Investigación de Verano, CIMAT 2021.

10. *Summer Project Mentorship*: Alberto Isaac Estrella - UNAM  
Introducción a las soluciones viscosas  
Estancias de Investigación de Verano, CIMAT 2022.
  11. *Summer Project Mentorship*: Jesús Emmanuel Román Acosta - FCFM-UANL  
Introducción al estudio de ecuaciones diferenciales parciales elípticas  
Estancias de Investigación de Verano, CIMAT 2022.
- 

## Teaching

1. *CIMAT/DEMAT (2018-present)*: [Multivariable Calculus](#), [Ordinary Differential Equations](#), [Partial Differential Equations](#), [Measure Theory](#), [Partial Differential Equations](#), [Classical Mechanics](#), [Analytical Modeling](#), [Hamilton-Jacobi Theory](#), [Analytic Geometry \(highschool\)](#).
2. *Columbia University (2013-2017)*: Single and Multivariable Calculus, Ordinary Differential Equations, Linear Algebra, Real Analysis.
3. **Workshops**:
  1. *Problemas de Control óptimo*  
XI Summer School. Universidade Federal de Sergipe 2022.
  2. *Ecuaciones Diferenciales Parciales Elípticas*  
EMALCA. Universidad Juárez Autónoma de Tabasco 2021
  3. *Elliptic Regularity for some Degenerate Equations*  
Learning seminar, CMUC. Coimbra, 16 de julio del 2021
  4. *Problemas de Control óptimo*  
Escuela de Verano del CIMAT-Guanajuato 2021.
  5. *Introducción al Cálculo de Variaciones*  
XVI Taller de Soluciones de Problemas de Cálculo.  
CIMAT-Guanajuato 2019
  6. *Redes Eléctricas*  
Taller de Ciencia para Jóvenes.  
CIMAT-Guanajuato 2019.
  7. *Introducción a la Teoría Potencial*  
Escuela de Verano  
CIMAT-Guanajuato 2019.

## Professional Service

1. *Academic Committee Member for the Applied Mathematics Masters Program:*  
CIMAT Guanajuato, 2021-present.
2. *Organizer for the [CIMAT-DEMAT Colloquium](#)*  
CIMAT Guanajuato, 2022-present.
3. *Organizer of the session: [Elliptic Equations](#)*  
V Encuentro Conjunto de la Real Sociedad Matemática Española y la Sociedad Matemática Mexicana.  
CIMAT Guanajuato, June 2021.
4. *Organizer of the session: [Differential Equations](#)*  
Congreso Nacional Virtual de la Sociedad Matemática Mexicana.  
Sociedad Matemática Mexicana, October 2020.
5. *Organizer of the session: [Variational Methods and Elliptic PDEs](#)*  
12th Americas Conference on Differential Equations and Nonlinear Analysis.  
CIMAT Guanajuato, December 2019.
6. *Organizer: [Taller de Ecuaciones Diferenciales y Cálculo de Variaciones](#)*  
Special Guest: Connor Mooney (UC Irvine)  
CIMAT Guanajuato, May 2019.
7. *Organizer: [Modelos Multiescalas: Teoría y Aplicaciones](#)*  
Special Guests: Christina Frederick (NJIT), Jessica Lin (McGill).  
CIMAT Guanajuato, December 2018
8. *Organizer [Partial Differential Equations Seminar](#).*  
CIMAT Guanajuato, Fall 2018  
CIMAT Guanajuato, Fall 2020 (joint with IMUNAM-Mexico City).
9. *Examining committee:* Connor Mooney (Columbia 2015), Claudia Acosta Díaz (CIMAT 2018), Jurgen Alfredo Julio Batalla (CIMAT 2019), José Hermenegildo Ramírez (CIMAT), Santiago Arenas (CIMAT), Camilo González (CIMAT), Pedro Salazar (CIMAT), Arturo Arellano (CIMAT 2020 (undergraduate) and 2021 (MS)).
10. *Analysis and Differential Equations Qualifying Exam Committee*  
CIMAT Guanajuato, 2018 - present.
11. *Reviewer:* Estancias postdoctorales en el extranjero 2019 (CONACYT), Ciencia de Frontera 2019 (CONACYT), Projects for Initiation in Research 2020 (FONDECYT).
12. *Peer-reviewer:* Inventiones, Archive for Rational Mechanics and Analysis, Journal of Differential Equations, Journal of Functional Analysis, Analysis & PDE, Calculus of Variations and PDEs, International Mathematical Research Notices, Nonlinear Analysis, Potential Theory and Applications, SIAM Journal on Mathematical Analysis, AMS Mathematical Reviews, Memorias de la Sociedad Matemática Mexicana.

## Outreach

1. *Venezuela Team Leader at the XXXV Iberoamerican Mathematical Olympiad*  
Costa Rica. October 2021.
2. *Venezuela Team Leader at the XXXIV Iberoamerican Mathematical Olympiad*  
Peru. November 2020.
3. *Observer for Venezuela at the 61th International Mathematical Olympiad*  
St. Petersburg. September 2020.
4. *Venezuela Team Leader at the XXXIV Iberoamerican Mathematical Olympiad*  
Guanajuato. September 2019.