CURRICULUM VITAE

**Carlos Larriba-Andaluz**

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**EDUCATION:**

**Universidad Politécnica de Madrid, Aeronautical Engineering, Bachelor of Science, 2005**

**Universidad Politécnica de Madrid**, Aeronautical Engineering: Aeronaves y Vehículos

Espaciales (Aeroplanes and Spaceships), **Master of Science, 2005**

**Yale University**, Mechanical Engineering, **Master of Science and Master of Philosophy**, 2009

**Yale University, Mechanical Engineering, Ph.D., 2010**

**PROFESSIONAL EXPERIENCE:**

(8)2015-Present Faculty, Tenure Track Assistant Professor, Mechanical Engineering, **IUPUI**

(10)2013-2015(7) Postdoctoral Associate, Mechanical Engineering, **University of Minnesota**

(5)2013-(10)2013 Postdoctoral Associate, Chemistry**, Indiana University.**

(4)2011-2013(4) Postdoctoral Associate, Mechanical Engineering, **University of Minnesota**.

2010-2011(4) Postdoctoral Associate, Mechanical Engineering, **Yale University**.

2007-2010 Graduate Student, Mechanical Engineering, **Yale University Ph.D.**

2006-2007 Visiting Assistant in Research (Jan 2006), Mechanical Engineering, **Yale University**.

2005-2006 Employee, **Iberia** Airlines-Aircraft Line Maintenance: Engines General Electric CF-86, Trent 500; Airbus A320, A340

**RESEARCH INTERESTS (Abridged précis)**

The broad spectra of my field of study could be englobed under a single concept: ***Nanoengineering and Nanomanufacturing***. Among multiple fields, my main focus is steered towards electrosprays of ionic liquids under vacuum (used in ***clean electrical propulsion for satellites***), dielectric electrosprays by means of ***charge injection atomization*** (for efficient production and ***control of fuel drop generation and combustion***), ***Ion Mobility Spectrometry (IMS) coupled with Mass Spectrometry (MS)*** for the ***characterization of polymers, nanoparticles and large biomolecules*** and ***plasma reactors and plasma modeling*** for the nucleation and collection of silane ions and nanoparticles.

In ***IMS-MS***, current projects include structural characterization of liquid and solid polymers, proteins, asphaltenes, biomolecules and Room Temperature Ionic Liquids. Bulk properties are then determined through experimental and theoretical mobility inferences. Most notably, I have put together a system consisting a flat parallel plate ***Differential Mobility Analyzer*** (DMA) (Resolution >60) together with a QSTAR XL Mass Spectrometer. The third built so far and one of the best characterization IMS-MS systems in the world.

In the field of coaxial electrospray, I strive to develop a novel technique for the production of monodispersed sized dielectric droplets in the submicron range. My most recent projects involve the generation of 0.3-10nm silver nanoparticles of controlled size and distribution for the characterization of condensation and evaporation rates of metal particles using a tandem DMA system and ***micro plasma generation of Nickel nanoparticles***.

Theoretically and numerically I have developed a ***suite of algorithms***, initially freely available and used by several university departments at the moment, ***to calculate heat, mass and momentum transfer in the free molecular regime for all atom models using the Kinetic Theory of Gases*** including the possibility of diffuse reemission, polarization and vdw potentials or even gas diatomic molecules. My work also revolves around the study of surface bulk properties, such as surface tension or viscosity, finding new theoretical approaches based on interphase and statistical thermodynamics.

In 2013 I joined High Temperature Plasma Lab at the University of Minnesota to improve the Aerosol-Plasma numerical model under the guidance of Professor Steven Girshick. My main tasks include ***developing a 2D axial symmetric, multichemistry, sectional Aerosol-Plasma model*** and the study of afterglow and pulsing plasmas for ion and ***Silane nanoparticle collection***. Other objectives include the study of dust formation from fusion edge plasma, ***microplasma jets and nanoparticle-nanoparticle and ion-nanoparticle (OML)*** ***interactions*** in a plasma.

Recently(2015), I have started a tenure-track at the Purdue University School of Engineering and Technology in Inidianapolis where I will resume my previous activities as a PI specially focusing in **IMS-MS**.

**PUBLICATIONS IN REFEREED JOURNALS AND BOOKS:**

**2016 -ACCEPTED** Izabella Czerwinska, Johann Far, **Larriba C., “**Structural Analysis of monometallic ruthnium-arene complexes usin ion mobility mass spectrometry, collision induced dissociation, and density functional theory.” Dalton Transactions,

**2015 -Submitted Larriba, C.**, Hogan, C., Fernandez de la Mora, J. “On the Projection Area Algorithm and the averaging misconception.”

**2015 -IN PROGRESS Larriba C.,** Steven Girshick. **“**Numerical Modeling of a Pulsed Argon-Silane RF Plasma with Biased Substrate for High-Velocity Deposition of Nanoparticles” Journal of Physics D: Applied Physics.

**2015 -ACCEPTED “**Analysis of Heterogeneous Water Vapor Uptake by Metal Iodide Cluster Ions via Differential Mobility Analysis-Mass Spectrometry (DMA-MS)” Derek Oberreit,Vivek K. Rawat, Carlos Larriba-Andaluz, Hui Ouyang, Peter H. McMurry, Christopher J. Hogan, Submitted to Journal of Chemical Physics

**2015 -ACCEPTED** Anne Maißer1, Jikku M. Thomas1, Carlos Larriba-Andaluz, Siqin He and Christopher J. Hogan  **“**The Mass-Mobility Distributions of Ions Produced by a Po-210 Source in Air” Journal of Aerosol Science JAEROSCI-D-15-00089R1

**2015 -** Hui Ouyang, Siqin He, **Larriba C.** and Christopher J. Hogan Jr. “IMS-MS and IMS-IMS Investigation of Structure and Stability of Dimethylamine-Sulfuric acid Nanoclusters”. J. Phys. Chem. A, 119 (2015), 2026–2036

**2015 -Larriba C.,** Hogan C. Clemmer,D.E. “Gas molecule scattering & ion mobility measurements for organic macro-ions in He *versus* N2 environments” Phys. Chem. Chem. Phys.,17 (2015), 15019-15029

2014 **-**Iain D. G. Campuzano, **Larriba C.**, Dhanashri Bagal and Paul D. Schnier, **“**Ion Mobility and Native Mass Spectrometry Measurements ofthe Humanised IgGk NIST Monoclonal Antibody Standard” Symposium Series Chapter, ACS BOOKS (Book Chapter)

2014 **-**Ajay Kumar, Seungkoo Kang, **Larriba C.,** Hui Ouyang, Christopher J Hogan2 and R Mohan Sankaran1 “Ligand-free Ni nanocluster formation at atmospheric pressure via rapid quenching in a microplasma process”, Nanotechnology 25 [(2014) 385601](tel:%282014%29%20385601)

2014 **- Larriba C.,** Hogan C. “On Collision Cross Section Calculations for Polyatomic Ions Considering Rotating Diatomic/Linear Gas Molecules” The Journal of Chemical Physics No. A14.08.0283

2013 **- Larriba C.,** Fernández de la Mora J., Clemmer, D.E. “Electrospray Ionization Mechanisms for Large Polyethylene Glycol Chains studied through Tandem Ion Mobility Spectrometry” Journal of the American Society for Mass Spectrometry, Volume 25, Issue 8 (2014), Page 1332-1345

2013 **-** Hui Ouyang, **Larriba C.**, Derek R. Oberreit, & Christopher J. Hogan Jr.“The Collision Cross Sections of Iodide Salt Cluster Ions in Air via Differential Mobility Analysis-Mass Spectrometry “ Journal of the American Society for Mass Spectrometry, Volume 24, Issue 12 (2013), Page 1833-47

2013 **-** Ranganathan Gopalakrishnan, Mark J. Meredith, **Larriba C.** and Christopher J. Hogan Jr.\* “Brownian Dynamics Determination of the Bipolar Steady State Charge Distribution on Spheres and Non-spheres in the Transition Regime” Journal of Aerosol Science, Volume 63, September 2013, Pages 126–145

2012 **-Larriba C.,** Hogan C. “Free Molecular Collision Cross Section Calculation Methods for Nanoparticles and Complex Ions with Energy Accommodation” Journal of Computational Physics, 251, 344 (2013).

2012 **-Larriba C.,** Hogan C. “Momentum Transfer Collision Cross Sections and Ion Mobilities in Diatomic Gases: Measurement vs. Prediction with Non-Specular Scattering Models” Journal of Physical Chemistry A  [http://dx.doi.org/10.1021/jp312432z](http://dx.doi.org/10.1021/jp312432z" \t "_blank), 117, 3887 (2013).

**2012** -Christopher J. Hogan Jr., **Larriba C.**, Rafael Borrajo and Juan Fernández de la Mora.”The Mobility-Size Relationship for Multiply Charged Ionic Liquid Nanodrops: Potential Mobility Standards” International Journal of Mass Spectrometry. (Awaiting submission)

2012 -Chonglin Zhang, Thaseem Thajudeen, **Larriba C.**, Thomas E. Schwartzentruberand Christopher J. Hogan Jr.”The Scalar Friction Factor for Non-spherical Particles and Aggregates Across the Entire Knudsen Number Range from Dimensional Analysis and Direct Simulation Monte Carlo (DSMC)”. Aerosol Science and Technology 46(10): 1065-1078

**2012** -**Larriba, C.,** Fernandez de la Mora, J. “The analysis of injected non dilute clusters and ions of Ionic Liquids in Charge Injection Atomization of dielectric liquids” Physics of Fluids (Ready for Submission)

2011 -**Larriba, C.**, Fernandez de la Mora, J. “Production of monodispersed submicron sized droplets of dielectric liquids by injection of charges from highly conducting liquids” Physics of Fluids 23, 102003.

2011 -**Larriba, C.**, Fernandez de la Mora, J. “The Gas Phase Structure of Coulombically Stretched Polyethylene Glycol Ions” Journal of Physical Chemistry B 116(1): 593-598 <http://dx.doi.org/10.1021/jp2092972>.

2011 -**Larriba, C.**, Hogan, C. et al. “The Mobility-Volume Relationship below 3.0 nm examined by Tandem Mobility-Mass Measurement” Journal of Aerosol Science and Technology 45(4): 453-467

2010 -**Larriba, C.,** Fernandez de la Mora, J. , “Electrospraying insulating liquids via charged nanodrop injection from the Taylor cone of an ionic liquid” Physics of Fluids 22, 072002.

2010 -**Larriba, C.,** “Production of ions & particles via simple and compound electrosprays in vacuum, gases or liquids (polar and non-polar)”. Ph.D. Thesis, Yale University.

2008 -**Larriba, C.**, Y. Yoshida, et al. "Correlation between surface tension and void fraction in ionic liquids" Journal of Physical Chemistry B 112(39): 12401-12407.

2008 -**Larriba, C.** et al. “Ionic Liquids IV, not just solvents anymore”, (Book) ACS chapter 21.

2007 -Yoshida, Y., O. Baba, **Larriba, C.** "Imidazolium-based ionic liquids formed with dicyanamide anion: Influence of cationic structure on ionic conductivity." Journal of Physical Chemistry B 111(42): 12204-12210.

2007 -**Larriba, C.**, Castro, S. et al. "Monoenergetic source of kilodalton ions from Taylor cones of ionic liquids." Journal of Applied Physics 101(8): 1-6.

2007 -Castro, S., **Larriba, C.** et al. "Effect of liquid properties on electrosprays from externally wetted ionic liquid ion sources." Journal of Applied Physics 102 (9): 1-6.

2007 -Garoz, D., C. Bueno, **Larriba, C.** "Taylor cones of ionic liquids from capillary tubes as sources of pure ions: The role of surface tension and electrical conductivity." Journal of Applied Physics 102(6): 064913 1-10.

**AWARDS and HONORS:**

-SEPI Scholarship.- Progama de Becas Fundacion SEPI para Universitarios Iberia 2005 (2005)

-Ministerio de Educacion y Ciencia Scholarship.- Computer hardware and software technician (2005)

-Yale University Scholarship: Graduate Student Scholarship (2007-2008)

-Beca Fundacion Areces: XXIII Convocatoria de Becas para Ampliación de Estudios en el Extranjero en Ciencias de la Vida y de la Materia (2010(8)-2012(9).

-MSI (Minnesota SuperComputing Institute) Poster Award ($1000) (2014)

**PROFESSIONAL AFFILIATIONS:**

# AAAR (American Association for Aerosol Research)

ACS (American Chemical Society)

ASMS (American Society for Mass Spectrometry)

AIAA (American Institue of Aeronautics and Astronautics)

ISIMS (International Society of Ion Mobility Spectrometry)

**PARTICIPATION IN EDUCATION AT IUPUI:**

*Graduate Level Courses*

-ME 510: Gas Dynamics (Teacher)

**PARTICIPATION IN EDUCATION AT YALE:**

*Graduate Level Courses (Teaching Assistant)*

-ENAS 500: Mathematical Methods I (TA Lvl 3)

*Undergraduate Level Courses (Teaching Assistant)*:

-ENAS 194: Ordinary and Partial Differential Equations (TA Lvl 4)

**PARTICIPATION IN EDUCATION AT U. OF MINNESOTA:**

-Co-advised Master Thesis: Santiago Ruiz Valdepenas: 2011-2012 University of Minnesota: “**Evaporation kinetics of singly charged silver nanoclusters in a tandem DMA system”**

*Graduate Level Courses*

-Lecturer in Molecular Gas Dynamics

**PUBLISHED ABSTRACTS, PAPERS PRESENTED AT MEETINGS, POSTERS AND INVITED LECTURES (since 2006):**

***Meeting Participation:***

2006 AIAA Meeting, Sacramento, CA: AIAA-2006-4639.  “Taylor cones of ionic liquids from capillary tubes as sources of pure ions for electrical propulsion” D. Garoz, C. Bueno, Larriba C., S. Castro, and J. Fernandez de la Mora (Oral presentation, presented paper)

2007 387 WE-Heraeus-Seminar, Physikzentrum Bad Honnef, Germany, 5–7 March 2007

Larriba C., de la Mora, Juan “Charge injection into dielectric liquids from electrosprays of highly conducting liquids”; “Ion emissions from capillary sources in pure and mixed regimes. (Poster and Oral Presentation).

2007 30th New England Fluids Workshop, New Haven, CT March 2007: Larriba C., Fernandez de la Mora, Juan “Charge injection into dielectric liquids from electrosprays of highly conducting liquids” (Oral Presentation: “SoundBite”)

2007 ACS Symposium Series No. 975, American Chemical Society,2007, 308-319. “Chapter 21. Taylor cones of ionic liquids as ion sources: The role of electrical conductivity and surface tension,” C. Larriba, D. Garoz, C. Bueno, I. Romero-Sanz, S. Castro, J. Fernandez de la Mora, Y. Yoshida, G. Saito, R. Hagiwara, K. Matsumoto, J. Wilkes; in “Ionic Liquids IV: Not Just Solvents Anymore,” Robin D. Rogers, Joan F. Brennecke and Kenneth R. Seddon, eds., (Oral Presentation)

2008 236th National Meeting of the American-Chemical-Society, Aug 17-21, 2008 Philadelphia, PA “ [I&EC 38-Correlation between surface tension and void fraction: Ionic liquids](http://apps.isiknowledge.com/full_record.do?product=UA&search_mode=GeneralSearch&qid=9&SID=3BjmHln@gM@BLEeGhIG&page=1&doc=1&colname=WOS)” Larriba, C., Fernandez de la Mora, Yoshida, Y. (Oral Presentation)

2008 AAAR 27th Annual Conference, 20-24 October 2008 Rosen Shingle Creek, Orlando, “Charge injection into dielectric liquids from electrosprays of highly conducting liquids”. Larriba, C (Oral Presentation)

2009 AAAR 28th Annual Conference, 26-30 October 2009 Minneapolis, MN, Larriba C. Fernandez de la Mora Juan et al., “[Electrospraying Insulating Liquids Via Charged Nanodrop Injection from the Taylor Cone of an Ionic Liquid”](http://aaarabstracts.com/AAAR/viewabstract.php?paper=1247&cf=1); “[Measuring the Surface Tension of Single Molecule Polymer Nanodrops” (Oral Presentation and Poster)](http://aaarabstracts.com/AAAR/viewabstract.php?paper=1329&cf=1)

2010 58th ASMS Conference on Mass Spectrometry; “Automated deconvolution of complex two-dimensional Mass-Mobility spectra of multiply charged globular ions into their associated mass-charge distributions”Juan Fernandez Garcia; Alejandro Casado; Carlos Larriba Andaluz; Chris Hogan; Juan Fernandez de la Mora; “Electrospray IMS-MS analysis of large Polymers”: escaping from the crowded fully-stretched into the globular region Carlos Larriba Andaluz; Juan Fernandez Garcia; Chris Hogan; Juan Fernandez De La Mora (Poster & Poster)

2010 IAC International Conference, Helsinki Aug.29th-Sept.3rd 2010. “Advances in experimental methods to characterize suspended nanoparticles” de la Mora, Juan Fernández; Larriba, Carlos; Fernández-García, Juan; Hogan, Chris; Attoui, Michel; (**Plenary Lecture**)

2011 59th ASMS Conference on Mass Spectrometry; “Gas Phase Structures of Polyethylene Glycol Ions studied via Ion Mobility and Mass Spectrometry” Larriba, Carlos; de la Mora, Juan. (Poster and Workshop presentation)

2012 60th ASMS Conference on Mass Spectrometry; “Calculating the Drag and Electrical Mobility in Air of a charged vibrational molecule in the free molecular regime Kn>>>1” Larriba, Carlos, Hogan, Christopher.

2012 EAC 2012, 2nd-7th September 2012, Granada, Spain, Larriba C. and Hogan C. “Structural determination of charged nanoparticles in a polarizable gas”

2012 AAAR 31st Annual Conference, 10-12 October 2012 Minneapolis, MN, Larriba C. et al.

“Structural determination in a Polarizable Gas”; Larriba C. et al.“ Tandem DMA Measurement of the Evaporation of Sub 5nm Metal Nanoparticles” (Oral Presentation and Poster)

2013 61st ASMS 2013 Conference on Mass Spectrometry; “Ion Mobility-Mass Spectrometry of Iodide Salt Cluster Ions in Air and Comparison to Density Functional Theory Predictions; Hogan C., Ouyang H, Larriba C et al.; “The inability of Hard Sphere Specular Scattering to predict Ion Mobility in diatomic gases in the 5-100kDa range” Larriba C., Hogan C. (2 posters)

2013 246th ACS Fall Meeting Indianapolis, September 8th-12th “ Novel Interfaced approach to mobility calculations with diffuse scattering and Maxwell rotational distributions for diatomic gases in the free molecular regime” Larriba C., Hogan C. (**Invited Speaker**)

2013 AAAR 32nd Annual Conference, September 30th to October 4th Portland, OR “Calculations and Measurements of the Collision Cross Sections of Sub-2.0 nm Metal Iodide Clusters in Air”. Hui Ouyang, Carlos Larriba-Andaluz, Derek Oberreit, Christopher Hogan Jr.; “Diffuse Vs. Specular Algorithms to Explain Electrical Mobility in Diatomic Gases.” Carlos Larriba-Andaluz, Christopher Hogan Jr.; “Formation of 1.0-10 nm Ni Clusters in an Atmospheric Pressure DC Microplasma.” R. Mohan Sankaran, Ajay Kumar, Seungkoo Kang, Carlos Larriba-Andaluz, Hui Ouyang, Christopher Hogan Jr., ; “The Mass and Mobility Distributions of Ions Generated by a 10mCi Po-210 Alpha Particle Source as Measured by Differential Mobility Analysis-Mass Spectrometry”. Mark Meredith, Carlos Larriba-Andaluz, Hui Ouyang, Ranganathan Gopalakrishnan, Derek Oberreit, Christopher Hogan (4 talks)

2014 Washington University in St Louis (February 2014), Lecture: “Nanoparticle and cluster analysis through Ion Mobility-Mass Spectrometry (IMS-MS)”, Larriba, C.,(**Invited Speaker**)

2014 Massachusets Institute of Technology (MIT) (May 2014), Lecture: “Nanoparticle and cluster analysis through Ion Mobility-Mass Spectrometry (IMS-MS)”, Larriba, C., (**Invited Speaker**)

2014 PSC May 2014 5th Annual Meeting (University of Maryland, College Park) “1D Nanodusty Pulsed Plasma Model for the Study and Control of Particle Generation and Growth”. Carlos Larriba-Andaluz and Steven L. Girshick (Poster and Talk).

2014 GEC 2014 July-August 2014 “Argon-Silane Plasma Particle Generation, Control and Growth using a 1D Nanodusty Pulsed Chemistry Model” Steven L. Girshick and Carlos Larriba-Andaluz

2014 AAAR 33rd Annual Conference, October 20-24, 2014, Orlando, FL, 1D Nanodusty Pulsed Plasma Sectional Chemistry Model for the Study and Control of Particle Generation and Growth.  Carlos Larriba-Andaluz, Steven Girshick, University of Minnesota (Oral presentation)

2014 7th International Conference on the Physics of Dusty Plasmas (ICPDP 2014) 3-7th March, 2014, New Delhi, India. “ Dynamics of a Pulsed RF Argon-Silane Dusty Plasma” Pulkit Agarwal, Carlos Larriba, David H. Porter and Steven L. Girshick. (**Invited Speaker**)

2014 67th Annual Gaseous Electronics Conference, Nov. 2-7, 2014 “Numerical Modeling of a Pulsed Argon-Silane RF Plasma with Biased Substrate for High-Velocity Deposition of Nanoparticles”, Steven Girshick and Carlos Larriba-Andaluz (Talk)

2014 IUPUI “Revolutionary nanoparticle and cluster analysis through Ion Mobility Spectrometry-Mass Spectrometry (IMS-MS)”,Larriba C. November 21st, (**Invited Speaker**)

2015 ISPC “Numerical Modeling of Controlled Deposition of Silicon Nanoparticles Using a Pulsed RF Argon-Silane Plasma” Larriba C., Girshick, S. (Talk)

2015 PSC “Controlled Deposition of Silicon Nanoparticles Using a 1D Pulsed RF Argon-Silane Plasma Model” Larriba C., Girshick, S. (2 talks)

2015 GEC 68th Annual Gaseous Electronics Conference/9th International Conference on Reactive Plasmas/33rd Symposium on Plasma Processing. “Controlled Fluxes of Silicon Nanoparticles By Extraction from a Pulsed RF Plasma” Steven Girshick, Carlos Larriba (talk)

2015 ASMS 63rd ASMS Conference “Protein Structure Collapse in the Gas-phase Revealed by Ion Mobility and Molecular Dynamics” Iain Campuzano, Morgan Lawrentz, Carlos Larriba (Poster)

2015 ISIMS 24th International Conference July 26th-30th  “Novel Efficient Parallelized Algorithms to Calculate Ion Mobilities from All Atom Models” Carlos Larriba (talk)

2015 AAAR (Session Chair, 2 talks, 1 workshop)