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Joseph N. E. Lucero

Curriculum Vitae

"No one undertakes research with the intention of winning a prize. It is the joy of discovering something no one knew before."

- Stephen Hawking

Education

Ph.D. in Chemistry, 2021 – Present

Stanford University,
Stanford, California, USA,
Topic: Non-idealities in Li-ion Batteries – Electrochemical Modeling & State Estimation
Advisor: [Dr. Simona Onori](#).

M.Sc. in Physics, 2019 – 2021

Simon Fraser University,
Burnaby, British Columbia, Canada,
Thesis: "Stochastic Thermodynamics of Gaussian Information Engines"
Advisor: [Dr. David A. Sivak](#).
GPA – 4.15/4.33

B.Sc. (Hons. with Distinction) in Physics – Biological Physics, 2014 – 2019

Simon Fraser University,
Burnaby, British Columbia, Canada,
Thesis: "Energy & Information Transduction In Strongly-Coupled Systems"
Advisor: [Dr. David A. Sivak](#).
CGPA – 3.93/4.33; UDGPA – 4.00/4.33

Employment History

Data Analysis Ph.D. Intern (Transportation Analytics), Summer 2024

Oak Ridge National Lab – National Transportation Research Center,
Oak Ridge, Tennessee, USA,
Intern Hosts: [Dr. Vivek A. Sujan](#).

Hardware Engineering Ph.D. Intern (Battery Modeling), Summer 2023

Google – Platforms Infrastructure Engineering,
Sunnyvale, California, USA,
Intern Hosts: [Dr. Vijay Boovaragavan](#), [Mr. Vivek Khaire](#).
○ Electrochemical-thermal physics-based battery modeling
○ Battery degradation modeling using Gaussian Processes

Peer-Reviewed Publications

JNE Lucero, VA Sujan, S Onori

"An experimentally validated electro-thermal EV battery pack model incorporating cycle-life aging and cell-to-cell variation."

IEEE Trans. Transp. Electrifi., 1-1. (2024)

V. Peppas, RM Thomson, SA Enger, GP Fonseca, C Lee, **JNE Lucero**, F Mourtada, FA Siebert, J Vijande, P Papagiannis.

"A MC-based anthropomorphic test case for commissioning model-based dose calculation in interstitial breast 192-Ir HDR brachytherapy"

Med. Phys., 1-13. (2023)

TK Saha, **JNE Lucero**, J Ehrich, DA Sivak, and J Bechhoefer.

"Bayesian information engine that optimally exploits noisy measurements."

Phys. Rev. Lett. **129**, 130601. (2022) [Editor's Suggestion](#). [Physics synopsis](#).

JNE Lucero, J Ehrich, J Bechhoefer, and DA Sivak.
“Maximal fluctuation exploitation in Gaussian information engines.”
Phys. Rev. E, **104**, 044122. (2021).
TK Saha, **JNE Lucero**, J Ehrich, DA Sivak, and J Bechhoefer.
“Maximizing power and velocity of an information ratchet.”
Proc. Natl. Acad. Sci. USA, **118**(20), e2023356118. (2021).
[SFU News Press Release](#). [PNAS Commentary](#).
E Lathouwers, **JNE Lucero**, and DA Sivak.
“Nonequilibrium response of stochastic strongly-coupled rotary motors.”
J. Phys. Chem. Lett., **11**, 5273-5378. (2020). [SFU News Press Release](#).
JNE Lucero, A Mehdizadeh, and DA Sivak.
“Optimal control of rotary motors.”
Phys. Rev. E., **99**, 012119. (2019).

Manuscripts

JNE Lucero, L. Xu, S. Onori.
“Comparing Mass-Preserving Numerical Methods for the Lithium-Ion Battery Single Particle Model.” (*In review*).
JNE Lucero, Y. Gao, S. Onori.
“Thermodynamically-Consistent Dynamics Corrections to the Single Particle Model of Lithium-Ion Batteries.” (*In preparation*).
JNE Lucero, C Chen, A Huang, B Sheldan, DA Sivak, and M Thomson.
“Physically optimizing inference.” (*In preparation*).

Technical Skills

- Extensive experience in:
 - Scientific Python, Cython, & FORTRAN programming
 - MATLAB/Simulink
 - Data analysis and visualization
 - Utilization of computational clusters
 - OpenMP parallelization
- Experienced in shell (zsh and bash) scripting
- Proficient in C/C++ and Mathematica
- Experienced in modeling Li-ion energy storage systems using:
 - Equivalent-circuit models
 - Electrochemical continuum models (P2D, SPM(e))
 - Lumped-parameter thermal models
 - Machine-learning-based degradation models

PG Awards & Scholarships

NSERC PGS D
(2021 – 2024)
Value: \$63,000 CAD/3 years
Location of tenure: Stanford University – Dept. of Chemistry
NSERC CGS M
(2020 – 2021)
Value: \$17,500 CAD
Location of tenure: Simon Fraser University – Dept. of Physics
BC Graduate Scholarship
(2019 – 2020)
Value: \$15,000 CAD
Location of tenure: Simon Fraser University – Dept. of Physics

UG Research Experience

Undergraduate Research Assistant

(Spring 2015 - Summer 2019)

Location: Simon Fraser University – Dept. of Physics

Topic: Nonequilibrium Response of Rotary Mechanochemical Machines

Undergraduate Research Assistant

(Summer 2018)

Location: Carleton University – Dept. of Physics

Topic: Monte Carlo Simulations of GYN-Applicator Radiation Transport & Deposition

Undergraduate Research Assistant

(Summer 2017)

Location: Simon Fraser University – Dept. of Computer Science

Topic: Inferring Maximum Likelihood Phylogenies from MIRU-VNTR data

UG Awards & Scholarships

SFU Physics Charter Faculty Prize

(Summer 2019)

NSERC USRA in Computational Biophysics

(Summer 2019)

Value: \$4,500 CAD

PI: Dr. David A. Sivak

NSERC USRA in Computational Medical Physics

(Summer 2018)

Value: \$5,315 CAD

PI: Dr. Rowan M. Thomson

SFU Undergraduate Open Scholarship

(Summer 2016; Spring 2016, 2017, 2018; Fall 2015, 2016, 2017, 2018)

NSERC USRA in Computational Biology

(Summer 2017)

Value: \$4,500 CAD

PI: Dr. Leonid Chindelevitch

SFU President's Honor Roll

(Spring 2017, Spring 2019)

SFU Dean's Honour Roll

(Summer 2015; Fall 2015; Spring 2016, 2017, 2019)

SFU Academic Excellence Entrance Scholarship

(Fall 2014)

Offered Awards

FAST Doctoral Fellowship

(2021 - 2025)

Value: \$96,000 CAD/4 years

Location of tenure: University of Toronto – Dept. of Chemistry

QEII Graduate Scholarship in Science and Technology

(2021 - 2022)

Value: \$15,000 CAD

Location of tenure: York University – Dept. of Physics

Chair's Fellowship

(2021 - 2022)

Value: \$7,500 USD

Location of tenure: Northwestern University – Dept. of Chemistry

NSERC CGS M

(2019 - 2020)

Value: \$17,500 CAD

Location of tenure: Western University – Dept. of Chemistry

Presentations

A Comparative Study of Numerical Methods for Lithium-Ion Battery Electrochemical Modeling

(May 2024)

Electrochemical Society (ECS) – 243rd Meeting

An optimal dispatch framework supporting heavy-duty vehicle charging infrastructure incorporating photovoltaics and energy storage

(April 2024)

Society of Automotive Engineers (SAE) – World Congress

Maximizing fluctuation exploitation in a simple information ratchet

(March 2021)

American Physical Society March Meeting – Virtual

Optimal Control of Rotary Motors

(August 2018)

Canadian Undergraduate Physics Conference – University of Alberta

Posters

Revolutionizing Heavy-Duty Commercial Vehicle Mobility: Using Photovoltaics and Energy Storage to Support Charging Infrastructure

(May 2024)

Stanford Energy Research Showcase – Stanford University

Revolutionizing Heavy-Duty Commercial Vehicle Mobility: Battery and Infrastructure-Informed Electrification Roadmaps

(January 2024)

Stanford-CEC Energy Innovation Summit – Stanford University

Development of comprehensive battery models for application-infrastructure co-optimization in Heavy-Duty Commercial-Vehicle Electrification

(April 2023)

Battery Research Center Launch – Stanford University/SLAC

Performance Limits of a Gaussian Information Engine

(February 2021)

Annual Physics Department Poster Competition – Simon Fraser University

Thermodynamics of Information-Driven Feedback

(February 2020)

Annual Physics Department Poster Competition – Simon Fraser University

Optimal Fluctuation Exploitation in Information Ratchets

(August 2019)

Physics Summer Student Poster Competition – Simon Fraser University

Modelling of GYN-applicators in egs_brachy

(August 2018)

Canadian Undergraduate Physics Conference – University of Alberta

Inferring Maximum Likelihood Phylogenies from MIRU-VNTR Data

(Top Undergraduate Poster Prize)

(August 2017)

Symposium on Mathematics and Computation – Simon Fraser University

Optimal Driving of a Nonequilibrium Mechanochemical Motor

(Top Poster Prize)

(August 2016)

Physics Summer Student Research Day – Simon Fraser University

Optimal Driving of Rotatory Mechanochemical Motors

(April 2016)

Annual Physics Department Poster Competition – Simon Fraser University

Conferences Attended

Frontiers in Biophysics

(June 2016, 2017, 2019, 2021, 2022)

Simon Fraser University/University of British Columbia

Workshop on Stochastic Thermodynamics

(2021, 2022)

Santa Fe Institute (Virtual)

Canadian Association of Physicists Congress

(June 2019)

Simon Fraser University

Undergraduate Research Opportunities Conference

(September 2017)

University of Waterloo

Class Projects

(Math Models in Biology) **Pattern formation in simple reaction-diffusion systems**

(Jan 2022 - Mar 2022)

Instructor: Dr. **Alison Marsden**

(Machine Learning for Chemistry) **Machine learning aided prediction of mini-protein stability**

(Sept 2021 - Dec 2021)

Instructor: Dr. **Grant M. Rotskoff**

(Numerical PDEs) **Pseudospectral Solutions to 2D Advection-Diffusion Equations**

(Sept 2019 - Dec 2019)

Supervised by: Dr. **Ralf Wittenberg**

(Control Theory) **Robust Control and Emergent Oscillations**

(Jan 2019 - Apr 2019)

Instructor: Dr. **John Bechhoefer**

(Machine Learning) **Making Trustworthy Classifiers**

(Oct 2018 - Dec 2018)

Instructor: Dr. **Greg Mori**

(Biophysics Laboratory) **Saccharomyces Cerevisiae and Statistical Indicators of Population Health**

(Oct 2017 - Dec 2017)

Supervised by: Dr. **Nancy R. Forde** and Dr. **David Lee**

(Computational Biology) **Nuclear and Mitochondrial Genes Shed Light on the Evolution of Salmon**

with **Aniket Mane**, **Alice Yue**, and **Zahra Zohrevand**

(Nov 2016 - Dec 2016)

Supervised by: Dr. **Leonid Chindelevitch** and Dr. **Bernard Crespi**

PG Courses

- Energy Storage and Conversion
- Engineering Optimization
- Machine Learning
- Electrochemical Energy Storage Systems
- Numerical PDEs

UG Courses

- Control Theory
- Mathematical Physics
- Quantum Mechanics
- Electromagnetic Theory
- Molecular Biology & Physiology
- Computational Physics
- Classical Mechanics
- Intro. to Particle Physics
- Computational Biology
- Protein Structure & Function

Mentoring Experience

Brad Friesen

(Sept 2019 - April 2020)

"Optimal Driving of a Semi-Classical Electron Junction"

Shakul Pathak
(May 2019 - July 2019)
"Optimal Driving of a Flashing Rotary Brownian Ratchet"
Next: ChemE. B.Tech. student, IIT Kharagpur
Now: ChemE. Ph.D. student, MIT

Kristopher Samant
(May 2018 - Aug 2018)
"An Investigation Into the Properties and Modelling of the CivaDot in egs_brachy"
Next: Physics B.Sc. student, Carleton University
Now: Physics M.Sc. student, University of British Columbia

Teaching Experience

Graduate Student Teaching Assistant – Energy Sciences & Engineering

(Apr 2024 - June 2024)

Description: ENERGY 201c: Energy Storage and Conversion Systems at Stanford University.

Graduate Student Teaching Assistant – Chemistry

(Sept 2021 - June 2022)

Description: Physical Chemistry (CHEM 173: Quantum Mechanics, CHEM 175/273: Statistical Mechanics, CHEM 131: Analytical Chemistry) at Stanford University.

10-24 upper-class Chemistry majors/graduate students.

Simon Fraser University Peer Educator

(Jan 2017 - Dec 2017)

Description: Served as a volunteer peer educator for first year Physics courses for the Life Sciences, holding open lab hours, helping students in the Life Sciences that are confused with concepts taught in class. Coordinated with the professors teaching these classes to ensure cohesiveness in explanations between lectures and open labs.

Volunteer Experience

Secretary

(Sept 2020 - Sept 2021)

Organization: Simon Fraser University - Physics Graduate Caucus

Description: Responsible for attending all Physics Graduate Caucus meetings and taking minutes. Elected position.

Alternative Representative to the Graduate Student Society

(Sept 2019 - Sept 2021)

Organization: Simon Fraser University - Physics Graduate Caucus

Description: Responsible for attending Graduate Student Society meetings in the event of the Executive representative is unable to do so. Elected position.

Science Rendezvous Volunteer

(May 2016, May 2017)

Organization: Simon Fraser University

Description: Day volunteer, ran physics demonstrations illustrating the concepts of electrostatics, electromagnetism, and optics.