# Richard A. Galvez, Ph.D.


CONTACT INFORMATION

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## EDUCATION

**Ph.D., Physics**, Syracuse University — February 2015
- Dissertation title:
  "Topics in Supersymmetry: Implications for Cosmology and Non-Perturbative Studies on a Spacetime Lattice"

**M.Sc., Computational Physics**, Florida International University — May 2009

**B.Sc., Physics**, Florida International University — May 2007

## ACADEMIC POSITIONS

**Fisk-Vanderbilt Bridge Postdoctoral Fellow** — September 2015 - Present
Vanderbilt University
- Current research program includes investigating physics beyond the standard model of particle physics and cosmology, as well as methods in machine learning and deep learning frameworks as applied to astrophysical and cosmological observations.
- As a postdoctoral fellow in the Bridge program, mentorship and support of Ph.D. and Master's students in all STEM fields is a large part of my job, one which I approach with passion and take on whole-heartedly.
- Teach and tutor graduate courses; I designed and carried out a curriculum for a graduate course on Mathematical Methods for Physicists, and formally assisted in Quantum Mechanics, Electromagnetism and Classical Dynamics.
- Tutor Bridge students in all courses within the computer science, mathematics and physics curriculums.

**Aerospace Research Scientist** — August 2014 - September 2015
Syracuse University
- Carried out a short term postdoctoral research position between completion of Ph.D. dissertation and beginning of current position.
- Developed a computational fluid dynamics model that produced a 10x speedup leveraging GPUs and the CUDA library.
- Served as a mentor, advised on engineering projects and contributed a presentation at the American Physical Society's Fluids Division yearly conference.

**Research Assistant** — July 2009 - August 2014
Syracuse University
- Carried out a research program focusing on cosmological aspects of supersymmetric quantum field theories and wrote software to simulate supersymmetric lattice field theory.
- Wrote and ran particle physics simulations on the distributed computing resources at FermiLab National Laboratory.
- Sped up matrix inversions by 10x using GPUs and the CUDA library implementing a conjugate gradient algorithm.
- This work led to 15+ appearances in national and international conferences, 10+ publications and international fellowship prizes.

**Teaching Assistant** — September 2010 - August 2013
Syracuse University
- Taught master's level course preparing students for their Ph.D. qualification exam covering the entire program of graduate physics at Syracuse University.
- Teaching assistant in the laboratory courses and recitations of Scientific Python, General Physics, Astrophysics and Observational Astronomy.

**Visiting Researcher** — May 2013 - September 2013
University of Auckland, *Auckland, NZ*
- Awarded the East Asia and Pacific Summer Institutes for U.S. Graduate Students (EAPSI) Fellowship from the National Science Foundation.

- Learned about Bayesian methods in cosmology and analyzed data from the Cosmic Microwave Background (CMB) using a multi-nested sampler called MultiNest.
- Took a course in maximally extended supersymmetric quantum field theory and supersymmetric gravity (SUGRA).
- Collaborated on a paper outlining a possible mechanism in the production of dark matter from the decay of a heavy scalar in the early Universe.

**Visiting Researcher** May 2007 - September 2007
CERN, *Geneva, CH*

- Awarded the CHEPREO CERN Summer Research Fellowship from Florida International University.
- Assisted in the design of a power-safety module written in C++.
- Worked with the Monte Carlo simulation software used to calculate the standard model background processes for the CMS experiment.

## Skills

**Computational:**
Python (including Numpy, Matplotlib, Scikit-learn, Scipy, Pandas), Machine Learning, C/C++, Tensor Flow, CUDA, Mathematica, Fortran, Matlab, Awk, Perl, Bash, Git, SQL, Deep neural networks, signal processing, data scraping, Monte Carlo methods, Bayesian statistics, compressed sensing, image processing, principal component analysis.

**Operating Systems:**
Linux, OS X, any Unix variant.

**Communication Skills:**
Gave over 40 national and international research presentations in front of small (10 people), medium (20), and large (100) audiences and selected to give Ted talk on November 13th 2016 (available online afterwards). Have taught multiple college level (graduate and undergraduate courses).

**Writing:** Published 10 first-authored papers in leading scientific journals.

## Honors

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| Vanderbilt University Federal STEM Policy and Advocacy, awarded | 2016 |
| TedxVanderbilt, contributed talk | 11/2016 |
| University of Michigan *NextProf Science*, awarded | 2016 |
| Fisk-Vanderbilt Bridge Postdoctoral Fellowship | 2015-2018 |
| Harvard Society of Fellows, nominee | 2015-2017 |
| Data Incubator Data Science Fellowship, finalist | 2015 |
| Syracuse University Levinstein Fellowship | 2014-2015 |
| East Asia and Pacific Summer Institutes National Science Foundation (NSF) Fellowship – University of Auckland, Auckland, NZ | 2013 |
| Ford Foundation Dissertation Year Fellowship, Alternate/Honorable Mention | 2014-2015 |
| Syracuse University NSF AGEP/STEM Graduate Fellowship | 2009 - 2015 |
| Florida International University Outstanding Academic Achievement Award | 2009 |
| Florida International University CHEPREO Fellowship | 2005-2007 |

## Select Publications

1. R. Galvez and N. Hinkel,
"On the Relationship Between Stellar Metallicity and the Formation of Exoplanets,"
*In preparation.*

2. R. Galvez, D. Lee and M. Lund,
"Is Intelligent Life Detectable on Earth?"
*In preparation.*

3. R. Galvez and R. J. Scherrer,
"Cosmology with Independently Varying Neutrino Temperature and Number,"
arXiv:1609.06351 [astro-ph.CO].

4. R. Galvez,
"Kahler Moduli Inflation in Type IIB Compactifications: A random tumble through the Calabi-

Yau landscape,"
arXiv:1603.06631 [hep-th]. Accepted to Physical Review D.

5. R. Galvez,
"Topics in Supersymmetry: Implications for Cosmology and Non-Perturbative Studies on a Spacetime Lattice,"
*Ph.D. Dissertation*

6. R. Easther, R. Galvez, O. Ozsoy and S. Watson,
"Supersymmetry, Nonthermal Dark Matter and Precision Cosmology,"
Phys. Rev. D **89**, 023522 (2014) [arXiv:1307.2453 [hep-ph]].

7. S. Catterall, P. H. Damgaard, T. Degrand, R. Galvez and D. Mehta,
"Phase Structure of Lattice N=4 Super Yang-Mills,"
JHEP **1211**, 072 (2012) [arXiv:1209.5285 [hep-lat]].

8. R. Galvez, S. Catterall, A. Joseph and D. Mehta,
"Investigating the sign problem for two-dimensional $\mathcal{N} = (2, 2)$ and $\mathcal{N} = (8, 8)$ lattice super Yang–Mills
theories," PoS LATTICE **2011**, 064 (2011) [arXiv:1201.1924 [hep-lat]].

9. D. Mehta, S. Catterall, R. Galvez and A. Joseph,
"Supersymmetric gauge theories on the lattice: Pfaffian phases and the Neuberger 0/0 problem,"
PoS LATTICE **2011**, 078 (2011) [arXiv:1112.5413 [hep-lat]].

10. S. Catterall, R. Galvez, A. Joseph and D. Mehta,
"On the sign problem in 2D lattice super Yang-Mills,"
JHEP **1201**, 108 (2012) [arXiv:1112.3588 [hep-lat]].

11. S. Catterall, R. Galvez, J. Hubisz, D. Mehta and A. Veernala,
"Non-abelian gauged NJL models on the lattice,"
Phys. Rev. D **86**, 034502 (2012) [arXiv:1112.1855 [hep-lat]].

12. R. Galvez and S. Catterall,
"Center symmetry restoration with 2 flavor large N Yang-Mills in the adjoint representation,"
PoS LATTICE **2010**, 050 (2010).

13. R. Galvez and G. van Anders,
"Accelerating the solution of families of shifted linear systems with CUDA,"
arXiv:1102.2143 [hep-lat].

14. S. Catterall, R. Galvez and M. Unsal,
"Realization of Center Symmetry in Two Adjoint Flavor Large-N Yang-Mills,"
JHEP **1008**, 010 (2010) [arXiv:1006.2469 [hep-lat]].

15. R. Galvez, A. Hietanen and R. Narayanan,
"Large N QCD in two dimensions with a baryonic chemical potential,"
Phys. Lett. B **672**, 376 (2009) [arXiv:0812.3449 [hep-lat]].

## Contributed Talks

*"Cosmology with Varying Neutrino Number and Neutrino Temperature"*
Dark Matter Santander, Spain — July 2016
Carnegie Mellon University — May 2016
University of Michigan — April 2016

*"Flexing Our Cosmological Muscles: What are the Bicep Results Telling Us?"*
SACNAS National Conference, Los Angeles, CA — October 2014

*"Calabi-Yau Inflation in Type IIB String Theory: Insights from the Holomorphic Sectional Curvature."*
Western Kentucky University — March 2016
Vanderbilt University — November 2014

DESY Hamburg, Germany — September 2014
Syracuse University — August 2014

*"Supersymmetry, Non-Thermal Dark Matter and Precision Cosmology"*
CP3-Origins Institute, Denmark — June 2014
Pennsylvania State University, US — March 2014

*"Spontaneous Symmetry Breaking of Lorentz Symmetry"*
University of Auckland, NZ — August 2013

*"The Recent Results of the Planck Satellite"*
Onondaga Community College, Syracuse, NY — May 2013

*"Beyond the Standard Model of Particle Physics and Cosmology"*
Florida International University, Miami, FL — August 2012

*"Violating the Null Energy Condition via Symmetry Breaking of a Ghost Condensate in Dilaton Gravity"*
East Coast Gravity Meeting, Syracuse University, NY — May 2012

*"The Twisted Formulation of $\mathcal{N} = 4$ Supersymmetric Gauge Theories."*
George Washington University, Washington, DC — March 2012

*"The Fermionic Sign Problem in 2D and 4D Supersymmetric Gauge Theory."*
High Energy Physics Seminar, Syracuse University, NY — January 2012

*"The Sign Problem in $\mathcal{N} = 2$ and $\mathcal{N} = 4$ Supersymmetric Gauge Theories."*
The XXIX International Symposium on Lattice Field Theory,
Lake Tahoe, California — July 2011

*"Center Symmetric Large-N Gauge Theory with Adjoint Fermions."*
The XXVIII International Symposium on Lattice Field Theory.
Sardinia, Italy — July 2010

*"Two Dimensional Large N QCD at Finite Density."*
South Eastern Section of APS (SESAPS). Raleigh, North Carolina. — October 2008

**Summer Schools**

Prospects in Theoretical Physics, Institute for Advanced Study, Princeton — 2014

**Outreach**

2016 Bridge Research Celebration Day – Organizer — May June 2016
Panelist for Minority PhD Student Orientation
Syracuse University — 2012, 2013, 2014
Science volunteer work
at Onondaga Community College — 2013