

# GABRIEL LEE

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## RESEARCH INTERESTS

I have broad interests in various aspects of high-energy phenomenology and BSM physics, including supersymmetry (SUSY), Higgs physics, dark matter, effective field theory, and collider physics.

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## EDUCATION

**University of Chicago** 09.2007 – 08.2014

M.S. (2008) and Ph.D. (2014), Physics.

Thesis title: Applications of Effective Field Theory to the Higgs Mass Problem and the Proton Radius Puzzle.

Advisors: Carlos Wagner, Richard Hill.

**University of Toronto** 09.2003 – 05.2007

H.B.Sc. with High Distinction, Mathematics & Physics.

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## EMPLOYMENT

**Korea University/University of Toronto** 09.2020 – present  
*Research Professor, Institute of Basic Science/Visiting Scientist* Seoul, KR/Toronto, CA

**Korea University/Cornell University** 09.2017 – 09.2020  
*Research Professor, Institute of Basic Science/Postdoctoral Fellow, CLASSE* Seoul, KR/Ithaca, US

- Phenomenology of composite models including applications to the hierarchy problem, flavour anomalies, and dark matter model building.
- Applications of analyses of electron-proton scattering data to precision neutrino physics and atomic physics.
- Applications of effective field theory to searches for new physics in precision atomic physics.

**Technion – Israel Institute of Technology** 09.2014 – 08.2017  
*Postdoctoral Fellow, Faculty of Physics* Haifa, IL

- Collider phenomenology of SUSY flavour models, studies of bound states in dark matter and BSM physics.

**University of Chicago** 09.2007 – 08.2014  
*Research and Teaching Assistant, Enrico Fermi Institute* Chicago, US

- With Carlos Wagner, SUSY model building and effective field theory applied to MSSM Higgs physics.
- With Richard Hill, studied low-energy nuclear interactions and the proton charge radius problem.
- Graduate: mathematical methods, statistical mechanics, quantum mechanics, and quantum field theory.
- Undergraduate: introductory physics, thermodynamics, mechanics, quantum mechanics, electrodynamics.
- Nominated for Physical Sciences Teaching Prize, 2009.

**TRIUMF** 05.2006 – 09.2006  
*Summer Research Scholarship Student, Nuclear Structure Group* Vancouver, CA

- Active in the commissioning of the TIGRESS gamma-ray detector, with first measurements examining the nuclear structure of  $^{21}\text{Ne}$  and  $^{21}\text{Na}$ .

**University of Toronto** 2004 – 2006  
*Research Assistant, NSERC Summer Student* Toronto, CA

- With Stephen R. Julian, designed and constructed low-noise electronics for measurements of properties of crystalline metals and oxides under high magnetic field in a dilution refrigerator.
- With Paul J. Kushner, investigated localization of signatures of annular modes (large-scale atmospheric patterns).

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## AWARDS AND HONOURS

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- NSERC Postgraduate Scholarship D3, 2009–2012.
- Sachs Fellowship (Physics, U. Chicago), 2008.
- Ontario Graduate Scholarship, 2007 (declined).
- NSERC Postgraduate Scholarship M, 2007–2011 (declined).
- St. Michael’s College Silver Medal in Mathematics, 2007.
- TRIUMF Summer Research Award, 2006.
- NSERC Undergraduate Summer Research Award, 2005.
- University of Toronto Scholar, 2005 and 2006.
- St. Michael’s College Entrance Scholarship, 2003.

## PUBLICATIONS

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- [1] K. Borah, R. J. Hill, G. Lee and O. Tomalak, “Parameterization and applications of the low- $Q^2$  nucleon vector form factors,” *Phys. Rev. D* **102**, 074012 (2020) [arXiv:2003.13640 [hep-ph]].
- [2] C. Csáki, G. Lee, S. J. Lee, S. Lombardo and O. Telem, “Continuum Naturalness,” *JHEP* **1903**, 142 (2019) [arXiv:1811.06019 [hep-ph]].
- [3] M. Geller, S. Iwamoto, G. Lee, Y. Shadmi and O. Telem, “Dark quarkonium formation in the early universe,” *JHEP* **1806**, 135 (2018) [arXiv:1802.07720 [hep-ph]].
- [4] Z. Ye, J. Arrington, R. J. Hill and G. Lee, “Proton and neutron electromagnetic form factors and uncertainties,” *Phys. Lett. B* **777**, 8 (2018) [arXiv:1707.09063 [nucl-ex]].
- [5] S. Iwamoto, G. Lee, Y. Shadmi and Y. Weiss, “Tagging new physics with charm,” *JHEP* **1709**, 114 (2017) [arXiv:1703.05748 [hep-ph]].
- [6] S. Iwamoto, G. Lee, Y. Shadmi and R. Ziegler, “Diphoton Signals from Colorless Hidden Quarkonia,” *Phys. Rev. D* **94**, no. 1, 015003 (2016) [arXiv:1604.07776 [hep-ph]].
- [7] N. Ierushalmi, S. Iwamoto, G. Lee, V. Nepomnyashy and Y. Shadmi, “LHC Benchmarks from Flavored Gauge Mediation,” *JHEP* **1607**, 058 (2016) [arXiv:1603.02637 [hep-ph]].
- [8] G. Lee and C. E. M. Wagner, “Higgs Bosons in Heavy Supersymmetry with an Intermediate  $m_A$ ,” *Phys. Rev. D* **92**, no. 7, 075032 (2015) [arXiv:1508.00576 [hep-ph]].
- [9] G. Lee, J. R. Arrington and R. J. Hill, “Extraction of the proton radius from electron-proton scattering data,” *Phys. Rev. D* **92**, no. 1, 013013 (2015) [arXiv:1505.01489 [hep-ph]].
- [10] P. Draper, G. Lee and C. E. M. Wagner, “Precise estimates of the Higgs mass in heavy supersymmetry,” *Phys. Rev. D* **89**, no. 5, 055023 (2014) [arXiv:1312.5743 [hep-ph]].
- [11] R. J. Hill, G. Lee, G. Paz and M. P. Solon, “The NRQED lagrangian at order  $1/M^4$ ,” *Phys. Rev. D* **87**, 053017 (2013) [arXiv:1212.4508 [hep-ph]].
- [12] R. Huo, G. Lee, A. M. Thalapillil and C. E. M. Wagner, “ $SU(2) \otimes SU(2)$  Gauge Extensions of the MSSM Revisited,” *Phys. Rev. D* **87**, 055011 (2013) [arXiv:1212.0560 [hep-ph]].
- [13] M. A. Schumaker *et al.*, “Coulomb excitation of the proton-dripline nucleus Na-20,” *Phys. Rev. C* **80**, 044325 (2009) [*Phys. Rev. C* **82**, 069902 (2010)].
- [14] A. M. Hurst *et al.*, “Narrowing of the neutron sd-pf shell gap in Na-29,” *Phys. Lett. B* **674**, 168 (2009).
- [15] M. A. Schumaker *et al.*, “Coulomb excitation of radioactive Na-21 and its stable mirror Ne-21,” *Phys. Rev. C* **78**, 044321 (2008).
- [16] P. J. Kushner and G. Lee, “Resolving the Regional Signature of the Annular Modes”, *J. Climate*, **20**, 2840 (2007).

## REVIEW PUBLICATIONS

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- [1] D. de Florian *et al.* [LHC Higgs Cross Section Working Group Collaboration], “Handbook of LHC Higgs Cross Sections: 4. Deciphering the Nature of the Higgs Sector,” arXiv:1610.07922 [hep-ph].
- [2] E. Bagnaschi *et al.*, “Benchmark scenarios for low  $\tan\beta$  in the MSSM”, LHCHSWG-2015-002, <https://cds.cern.ch/record/2039911>.

## CODE

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- **MhEFT**, **Mathematica** package for computing mass and couplings of the SM-like Higgs in the MSSM using effective field theory.
- **Python** fitting code for world elastic  $ep$ -scattering cross-section data and neutron form factors, included in Supplemental Material of Phys. Lett. B **777**, 8 (2018).

## INVITED SEMINARS

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- 2020.04.30 | U. Kentucky, US.
- 2018.11.12 | U. Oregon, US.
- 2018.11.07 | TRIUMF, CA.
- 2018.07.05 | U. Sussex, UK.
- 2018.06.07 | Seoul National U., KR.
- 2018.05.04 | KAIST, KR.
- 2018.05.01 | KIAS, KR.
- 2018.02.21 | Cornell U., US.
- 2018.02.15 | U. Toronto, CA.
- 2018.01.11 | Carleton U., CA.
- 2017.11.21 | New York U., US.
- 2017.05.29 | Korea U., KR.
- 2017.05.18 | Oxford U., UK.
- 2017.05.17 | King's College London, UK.
- 2017.05.12 | U. Manchester, UK.
- 2017.05.09 | U. Sussex, UK.
- 2017.04.05 | Joint Seminar in Particle Physics (Israel), Weizmann Institute, IL.
- 2016.10.21 | U. Pittsburgh, US.
- 2016.10.20 | U. Cincinnati, US.
- 2016.10.18 | Argonne National Laboratory, US.
- 2016.10.13 | U. Wisconsin Madison, US.
- 2016.01.18 | Johannes Gutenberg-Universität Mainz, DE.
- 2015.09.10 | York U., CA.
- 2015.09.08 | Perimeter Institute, CA.
- 2015.09.01 | SCIPP, U. California Santa Cruz, US.
- 2015.03.25 | Joint Seminar in Particle Physics (Israel), Technion, IL.
- 2014.02.25 | Argonne National Laboratory, US.

## CONFERENCE AND WORKSHOP TALKS

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- 2019.09 | TOP2019 (Beijing, CN): Plenary, “Continuum Naturalness”.
- 2019.07 | KAIST-KAIX Workshop for Future Colliders (KAIST, KR): “Continuum Naturalness”.
- 2019.06 | Indirect Searches for New Physics Across the Scales (Mainz ITP, DE): “Dark Quarkonium Formation in the Early Universe”.
- 2019.05 | Searching for New Physics on the Horizon (Korea U., KR): “Continuum Naturalness”.
- 2018.09 | Beyond the Standard Model: Where Do We Go from Here? (Galileo Galilei Institute, IT): “Dark Quarkonium Formation in the Early Universe”.
- 2016.08 | EFT's as Discovery Tools (Mainz ITP, DE): “Bound States for (Diphoton) Signals”.
- 2016.06 | Precision Higgs Mass Initiative (IFT Madrid, ES): “MhEFT Package”.
- 2016.05 | Physics of Simple Atomic Systems (Hebrew U., IL): “New Extraction of the Proton Radius from  $ep$ -Scattering Data”.
- 2015.12 | Israel Physical Society (Bar-Ilan U., IL): “Higgs Bosons in Heavy SUSY with Intermediate  $m_A$ ”.
- 2015.09 | Higgs Days (IFCA, Santander, ES): “Higgs Bosons in Heavy SUSY with Intermediate  $m_A$ ”.
- 2015.08 | SUSY 2015 (Lake Tahoe, US): “Higgs Bosons in Heavy SUSY with Intermediate  $m_A$ ”.
- 2015.06 | Indirect Searches for New Physics in the LHC and Flavour Precision Era (MIAPP, DE): “New Extraction of the Proton Radius from  $ep$ -Scattering Data”.
- 2015.05 | Precision Higgs Mass Initiative (LPTHE, FR): “Higgs Bosons in Heavy SUSY with Intermediate  $m_A$ ”.

- 2014.06 | Proton Radius Puzzle (Mainz ITP, DE): “Model-Independent Fits to  $ep$  Scattering Cross-Section Data”.
- 2014.04 | Precision Higgs Mass Initiative (MPI Munich, DE): “Precise Estimates of the Higgs Mass in Heavy SUSY”.
- 2013.06 | New Perspectives (Fermilab, US): “The NRQED Lagrangian at Order  $1/M^4$ ”.
- 2013.05 | Pheno 2013 (U. Pittsburgh, US): “The NRQED Lagrangian at Order  $1/M^4$ ”.
- 2011.05 | Pheno 2011 (U. Wisconsin-Madison, US): “Constraints on a Dark Matter Model with an Axino LSP and a Gravitino NLSF”.

## CONFERENCE, WORKSHOP, & SUMMER SCHOOL PARTICIPATION

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- 2019.09 | The Energy Frontier Beyond the LHC Run 2 (Aspen Centre for Physics, US).
- 2019.06 | The Weak Scale at a Crossroads: Lessons from the LHC and Beyond (MIAPP, DE).
- 2018.07 | CERN-CKC Institute: Physics at the LHC and Beyond (CERN, CH).
- 2018.05 | Cosmological Probes of BSM Physics (Centro de Ciencias de Benasque Pedro Pascual, ES).
- 2017.08 | Reaching New Summits: The LHC at Full Strength (Aspen Centre for Physics, US).
- 2017.06 | CERN-CKC Institute: What’s Going on at the Weak Scale? (Korea U., RK).
- 2016.10 | Higgs EFT (Niels Bohr Institute, DK).
- 2015.05 | Beyond WIMPs (Tel Aviv U., IL)
- 2014.11 | Naturalness (Weizmann Institute, IL).
- 2013.11 | SUSY at the Near Energy Frontier Workshop (Fermilab, USA).
- 2012.12 | Workshop on LHC Physics in the Higgs Era (U. Chicago, US).
- 2012.05 | Workshop on LHC Physics (U. Chicago, US).
- 2012.05 | Next Stretch of the Higgs Magnificent Mile (Northwestern U., US).
- 2011.08 | Pre-SUSY Summer School (Chicago, US).
- 2011.07 | SLAC Summer Institute (Stanford, US).

## ACADEMIC SERVICE

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### Referee

- European Physical Journal C, 2016–20.
- JHEP, 2018–19.

### Seminar and Conference Organization

- 4th New Physics in Korea Institute workshop: Searching for New Physics on the Horizon, Seoul, KR, May 2019.
- Co-organizer, Israel Joint Seminar in Particle Physics, 2015–16.
- Local coordinator for students of Pre-SUSY summer school, 2011.

### Student Activities

- Organizer of gravity/fluids group meetings at U. Chicago, 2011.
- Student member of the 2010–2011 Graduate Student Admissions Committee, Dept. of Physics of U. Chicago.

## OTHER

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**Citizenship:** Canadian.

**Languages:** English (fluent), French (functional), Cantonese (basic conversational).