Rebecca K. Leane

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Research Interests

Dark Matter Phenomenology, Particle Astrophysics and Cosmology, Physics Beyond the Standard Model

Academic Appointments

SLAC National Accelerator Laboratory 2020–Present
SLAC Particle Theory Group, Stanford University
Postdoctoral Research Associate

Massachusetts Institute of Technology 2017–2020
MIT Center for Theoretical Physics
Postdoctoral Research Associate

Education

University of Melbourne 2013–2017
Centre of Excellence for Particle Physics at the Terascale (CoEPP)
Ph.D. in Theoretical Particle Physics
Thesis Advisor: Prof. Nicole Bell

University of Cambridge 2012–2013
Department of Applied Mathematics and Theoretical Physics (DAMTP)
Master of Advanced Study in Mathematics (Part III of the Mathematical Tripos)
Essay Advisor: Prof. Ben Allanach

Monash University 2008–2011
Bachelor of Science Advanced with Honours
Majors: Physics and Mathematics. High Distinction.
Thesis Advisor: Prof. Csaba Balazs

Funded Grants

NASA Fermi Guest Investigator Program, Cycle 12, $70,000 USD 2019–2020
Grant No. 80NSSC19K1515, Slatyer and **Leane**

Prizes, Awards & Scholarships

Chancellor's Prize for Excellence in the PhD Thesis, U. Melbourne	2018
Dean's Award for Excellence in Graduate Research, U. Melbourne	2018
Australian Government Research Training Program Scholarship	2017
Royal Society of Victoria Young Scientist Research Prize	2016
Science Abroad Travelling Scholarship	2016
Laby Foundation Early Career Researcher Travel Scholarship	2015
Australian Postgraduate Award (APA)	2012–2016
Monash Jubilee Honours Scholarship	2011
J. L. William Honours Scholarship	2011

Publications

inSPIRE profile and arXiv publication list

Asterisk indicates alphabetical order list (as per convention in theoretical particle physics).

20. **R. K. Leane***, J. Smirnov — 2020
Exoplanets as New Sub-GeV Dark Matter Detectors
MIT-CTP/5230, SLAC-PUB-17556,
[arXiv:2010.00015 [hep-ph]]

19. D. Croon, G. Elor, **R. K. Leane***, S. McDermott — 2020
Supernova Muons: New Constraints on Z' Bosons, Axions, and ALPs
Submitted to JHEP, MIT-CTP/5214, [arXiv:2006.13942 [hep-ph]]

18. **R. K. Leane** — 2020
Indirect Detection of Dark Matter in the Galaxy
MIT-CTP/5199, [arXiv:2006.00513 [hep-ph]]

17. **R. K. Leane** and T. R. Slatyer — 2020
Spurious Point Source Signals in the Galactic Center Excess
Phys. Rev. Lett. 125, 121105 (2020),
MIT-CTP/5170, [arXiv:2002.12370 [astro-ph.HE]]

16. **R. K. Leane** and T. R. Slatyer — 2020
The Enigmatic Galactic Center Excess:
Spurious Point Sources and Signal Mismodeling
Phys. Rev. D 102, 063019 (2020),
MIT-CTP/5178, [arXiv:2002.12371 [astro-ph.HE]]

15. D. Hooper, **R. K. Leane***, Y. Tsai, S. Wegsman, S. Witte — 2019
A Systematic Study of Hidden Sector Dark Matter:
Application to the Gamma-Ray and Antiproton Excesses
JHEP 07 (2020) 163, MIT-CTP/5157, [arXiv:1912.08821 [hep-ph]]

14. J. Acevedo, J. Bramante, **R. K. Leane***, N. Raj — 2019
Cooking Pasta with Dark Matter:
Kinetic and Annihilation Heating of Neutron Star Crusts
JCAP 03 (2020) 038, MIT-CTP/5152, [arXiv:1911.06334 [hep-ph]]

13. **R. K. Leane** and T. R. Slatyer — 2019
Dark Matter Strikes Back at the Galactic Center
Phys. Rev. Lett. 123 (2019) 241101, MIT-CTP/5104,
[arXiv:1904.08430 [astro-ph.HE]]
Selected as PRL Editor's Suggestion, Featured in Physics

12. M. Un Nisa, J. F. Beacom, S. Y. BenZvi, — 2019
R. K. Leane, T. Linden, K. C.Y. Ng, A. H.G. Peter, B. Zhou
The Sun at GeV-TeV Energies: A New Laboratory for Astroparticle Physics
Astro2020 Science White Paper (2019) [arXiv:1903.06349 [astro-ph.HE]]

11. HAWC Collaboration and 2018
J.F. Beacom, **R. K. Leane***, T. Linden, K. C.Y. Ng, A. Peter, B. Zhou
Constraints on Spin-Dependent Dark Matter Scattering
with Long-Lived Mediators from TeV Observations of the Sun with HAWC
Phys. Rev. D 98 (2018), 123012, MIT-CTP/5038, [arXiv:1808.05624 [hep-ph]].

10. HAWC Collaboration and 2018
J.F. Beacom, **R. K. Leane***, T. Linden, K. C.Y. Ng, A. Peter, B. Zhou
First HAWC Observations of the Sun Constrain Steady TeV Gamma-Ray Emission
Phys. Rev. D 98 (2018), 123011, MIT-CTP/5037, [arXiv:1808.05620 [astro-ph.HE]]

9. **R. K. Leane**, T. R. Slatyer, J. F. Beacom, K. C.Y. Ng 2018
GeV-Scale Thermal WIMPs: Not Even Slightly Dead
MIT-CTP/5020, Phys. Rev. D98 (2018), 023016 [arXiv:1805.10305 [hep-ph]]

8. N. F. Bell, Y. Cai, J. B. Dent, **R. K. Leane***, T. J. Weiler 2017
Enhancing Dark Matter Annihilation Rates with Dark Bremsstrahlung
Phys. Rev. D96 (2017), 023011 [arXiv:1705.01105 [hep-ph]]

7. **R. K. Leane**, K. C.Y. Ng, J. F. Beacom 2017
Powerful Solar Signatures of Long-Lived Dark Mediators
Phys. Rev. D95 (2017), 123016 [arXiv:1703.04629 [astro-ph.HE]]

6. N. F. Bell, Y. Cai, **R. K. Leane*** 2016
Impact of Mass Generation for Spin-1 Mediator Simplified Models
JCAP 01 (2017) 039 [arXiv:1610.03063 [hep-ph]]

5. N. F. Bell, Y. Cai, **R. K. Leane*** 2016
Dark Forces in the Sky: Signals from Z' and the Dark Higgs
JCAP 08 (2016) 001 [arXiv:1605.09382 [hep-ph]]

4. N. F. Bell, Y. Cai, **R. K. Leane*** 2015
Mono-W Dark Matter Signals at the LHC: Simplified Model Analysis
JCAP 01 (2016) 051 [arXiv:1512.00476 [hep-ph]]

3. N. F. Bell, Y. Cai, J. B. Dent, **R. K. Leane***, T. J. Weiler 2015
Dark matter at the LHC: Effective field theories and gauge invariance
Phys. Rev. D92, 053008 (2015) [arXiv:1503.07874 [hep-ph]]

2. N. F. Bell, Y. Cai, **R. K. Leane***, A. D. Medina 2014
Leptophilic dark matter with Z' interactions
Phys. Rev. D 90, 035027 (2014) [arXiv:1407.3001 [hep-ph]]

1. G. Brooijmans et al (incl **R. K. Leane***) 2012
Les Houches 2011: Physics at TeV Colliders New Physics Working Group Report
FERMILAB-CONF-12-924-T (2012) [arXiv:1203.1488 [hep-ph]]
(*Note:* Contribution 1, "DLHA: Dark Matter Les Houches Agreement", is heavily based on my bachelor thesis.)

Talks

Invited Plenary/Overview Talks, and Colloquia:

63. Invited Plenary Talk, Identification of DM 2021, Vienna, Austria — Jul 2021
62. Invited Colloquium, University of Albany SUNY, Albany NY, USA — Mar 2021
61. Invited Plenary Talk, Identification of DM 2020, Vienna, Austria — Jul 2020
60. Invited Overview Talk, Dark Matter 2020, Santander, Spain — Jun 2020
(postponed to 2021 due to covid-19)
59. Invited Plenary Talk, 3rd World Summit on EDSU, Guadeloupe — Mar 2020
58. Invited Colloquium, MIT, Cambridge MA, USA — Feb 2020
57. Invited Plenary Talk, DM@LHC 2019, Seattle WA, USA — Aug 2019
56. Invited Colloquium, University of Melbourne, Melbourne Australia — Dec 2018
55. Invited Overview Talk, CAASTRO-CoEPP Joint Workshop, Australia — Jan 2017

Invited Seminars and Other Conference Talks:

54. Invited Seminar, UC Santa Cruz, Santa Cruz CA, USA (remote) — Nov 2020
53. Invited Seminar, SLAC, Menlo Park CA, USA (remote) — Nov 2020
52. Invited Talk, Snowmass CF-01 Group Meeting (remote) — Aug 2020
51. Invited Seminar, Sydney CCPC, Sydney, Australia (remote) — Aug 2020
50. Invited Seminar, Kavli IPMU, Tokyo, Japan (remote) — May 2020
49. Parallel Talk, Pheno 2020, Pittsburgh PA, USA (remote) — May 2020
48. Invited Talk, Astrophysical Signatures of DM Workshop, MI, USA — May 2020
(postponed due to covid-19)
47. Invited Talk, Aspen Winter Conf. on Particle Physics, Aspen CO, USA — Mar 2020
(postponed due to covid-19)
46. Invited Seminar, U. Mass Amherst, Amherst MA, USA — Feb 2020
45. Invited Seminar, Tufts University, Medford MA, USA — Feb 2020
44. Invited Seminar, Boston University, Boston MA, USA — Nov 2019
43. Invited Seminar, SLAC, Menlo Park CA, USA — Oct 2019
42. Invited Seminar, Texas A&M University, College Station TX, USA — Oct 2019
41. Invited Seminar, MIT Center for Theoretical Physics, Camb. MA, USA — Sep 2019
40. Invited Seminar, Perimeter Institute, Waterloo ON, Canada — Jun 2019
39. Invited Talk, Aspen Center for Physics, Aspen CO, USA — Jun 2019
38. Invited Seminar, KICP, University of Chicago, Chicago IL, USA — Apr 2019
37. Invited Seminar, Brown University, Providence RI, USA — Apr 2019
36. Invited Seminar, Fermilab, Batavia IL, USA — Mar 2019
35. Invited Seminar, Brandeis University, Boston MA, USA — Mar 2019
34. Invited Seminar, Princeton University, Princeton NJ, USA — Feb 2019
33. Invited Talk, TRIUMF Dark Matter Workshop, Vancouver BC, Canada — Feb 2019
32. Parallel Talk, DESY Theory Workshop, Hamburg, Germany — Sep 2018

31. Invited Seminar, University of Melbourne, Melbourne VIC, Australia Sep 2018
30. Parallel Talk 1, IDM 2018, Providence RI, USA Jul 2018
29. Parallel Talk 2, IDM 2018, Providence RI, USA Jul 2018
28. Invited Parallel Talk, PASCOS 2018, Cleveland OH, USA Jun 2018
27. Parallel Talk, Pheno 2018 Symposium, Pittsburgh PA, USA May 2018
26. Invited Seminar, California Institute of Technology, Pasadena CA, USA Apr 2018
25. Invited Seminar, LBNL, Berkeley CA, USA Apr 2018
24. Invited Seminar, University of Michigan, Ann Arbor MI, USA Apr 2018
23. Invited Seminar, Dartmouth University, Hanover NH, USA Apr 2018
22. Invited Seminar, University of Melbourne, Melbourne VIC, Australia Jan 2018
21. Invited Seminar, MIT Center for Theoretical Physics, Camb. MA, USA Sep 2017
20. PhD Completion Seminar, University of Melbourne, Melb VIC, Australia Mar 2017
19. Invited Talk, TRIUMF, Vancouver BC, Canada (remote) Dec 2016
18. Invited Talk, ATLAS Astroparticle Forum Plenary Meeting, CERN (remote) Nov 2016
17. Invited Talk, CETUP Dark Matter Workshop, Deadwood SD, USA Jul 2016
16. Invited Seminar, University of Cincinnati, Cincinnati OH, USA May 2016
15. Invited Seminar, CCAPP, Ohio State University, Columbus OH, USA Jun 2016
14. Invited Seminar, UC Riverside, Riverside CA, USA May 2016
13. Invited Seminar, UC Irvine, Irvine CA, USA May 2016
12. Parallel Talk, Pheno 2016 Symposium, Pittsburgh PA, USA May 2016
11. Invited Seminar, University of Melbourne, Melbourne VIC, Australia Apr 2016
10. Invited Seminar, SLAC, Menlo Park CA, USA Oct 2015
9. Invited Seminar, CCAPP, Ohio State University, Columbus OH, USA Oct 2015
8. Invited Seminar, Fermilab, Batavia IL, USA Sep 2015
7. Invited Seminar, Vanderbilt University, Nashville TN, USA Sep 2015
6. Invited Seminar, University of Melbourne, Melbourne VIC, Australia Aug 2015
5. Parallel Talk, SUSY2015, Lake Tahoe CA, USA Aug 2015
4. Seminar, Geoff Opat Seminar Series, U. Melbourne, Australia May 2015
3. Parallel Talk, CoSPA2014, Auckland, New Zealand Dec 2014
2. Contributed Talk, RESCEU APCosPA School, Matsumoto, Japan Jul 2014
1. Invited Seminar, University of Cambridge, UK Jun 2013

Teaching

Guest Lecturer for MIT graduate level course *8.811: Particle Physics II* 2017
Lecture Title: "Dark Matter Model Building"

ATLAS International Masterclass Tutor, U. Melbourne 2015

Physics Teaching Assistant (Tutorials, Grading, Office Hours), U. Melbourne 2014

Physics Teaching Assistant (Lab Demonstrator, Grading), U. Melbourne 2012

Physics Teaching Assistant (Lab Demonstrator, Grading), Monash U. 2011

High School Senior Tutoring, Physics and Mathematics 2008–2010

Outreach & Press

Interview, *The Boston Globe Newspaper*, MIT scientists find dark matter could be cause of mysterious energy at the center of our galaxy 2019
Interview, *MIT News*, Is there dark matter at the center of the Milky Way? 2019
Press Piece, *APS Physics*, New Hope for Milky-Way Dark Matter 2019
Interview, *Gizmodo*, The Future of Particle Physics Is Bright, Bleak, and Magical 2019
Interview, *Quanta Magazine*, Dark Matter Gets a Reprieve in New Analysis 2019
Interview, *Kavli Foundation*, Dark Matter is Back 2019
Interview, *Science Magazine*, Physicists Revive Hunt for Dark Matter in the Heart of the Milky Way 2019
Interview, *Popular Mechanics*, Filling the Void: What is Dark Matter? 2019
Open House Talk, MIT Center for Theoretical Physics, Cambridge MA, USA 2018
Young Scientist Research Prize Talk, Royal Society of Victoria, Australia 2016

Key Scientific Researcher on International Science Documentary Series 2014–2015
"Uranium: Twisting the Dragon's Tail"
Worked with Emmy Award winning producer Sonya Pemberton and writer Wain Fimeri part time over 12 months. Had a major role in explaining science content and developing the script for the series. Aired in the United States, Australia, Germany, France, Middle East, Norway and Sweden. The series has been nominated for and won numerous science communication and film awards.

Public Talk, Strathcona Girls' School, Australia 2014
Panel Member, National Science Week: Kids Ask Questions, Australia 2013
Panel Member, National Science Week: Ask a Scientist, Australia 2013
Public Talk, Monash University Open Day Seminar Series, Australia 2011
Physics Demonstrator, Monash University Open Day, Australia 2011

Service

Convener, Dark Matter Session, TeV Particle Astrophysics (TeVPA) Conference 2019
Particle Theory Seminar Organizer, MIT Center for Theoretical Physics 2018–2020
MIT Heising-Simons Physics Research Fellowship Peer Review Committee 2018

Technical Skills

Programming Languages:
C/C++, Python, Bash/zsh, HTML/CSS, Mathematica (all working proficiency level)

Packages & Frameworks:
FeynRules, MadGraph, Pythia, ROOT, MadAnalysis, Fastjet, Delphes, MultiNest, MicrOMEGAs, PPPC4DMID, DRAGON, FeynArts, FeynCalc, Ti*k*Z, Minuit, Matplotlib

Other:
Linux OS, LaTeX

October 11, 2020