

Cliff Burgess

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Education

B.Sc. (Hons) Physics & Applied Mathematics

The University of Waterloo (1976-1980)

Undergraduate Awards:

Science Faculty Alumni Gold Medal;

Sir Isaac Newton Fellowship

Co-op work experience:

Chalk River Nuclear Laboratories

(Plutonium Lab, Nuclear Physics Branch, Special Projects Branch);

Polish Academy of Sciences (Warsaw)

Ph.D. Theoretical High Energy Physics

The University of Texas at Austin (1980-1985)

Graduate Awards:

NSERC 1967 Centennial Fellowship;

John Archibald Wheeler Entrance Scholarship;

Graduate Research Fellow

Thesis Supervisor:

Steven Weinberg (Nobel Laureate)

Professional Awards/Prizes

Buchalter Cosmology Prize 2017 (3rd prize for arXiv:1604.06048)

Buchalter Cosmology Prize 2016 (3rd prize for arXiv:1408.5002)

**Canadian Association of Physicists & Centre de Recherches
Mathématiques Prize in Theoretical Physics 2010**

Fellow of the Royal Society of Canada, Elected 2008

Killam Foundation Research Fellow 2005 – 2007

**Academic
Experience**

McMaster University (2005 – present)

Professor of Physics

Appointment: Full Professor 2005

Perimeter Institute for Theoretical Physics (2004 – present)

Associate Faculty

McGill University (1987 – 2005)

Professor of Physics

Appointments: James McGill Professor 2003;

Full Professor 1995;

Associate Professor 1991;

Assistant Professor 1987

Institute for Advanced Study Princeton (1985 – 1987)

Research Member

Postdoctoral Awards: NSERC Postdoctoral Fellowship

**Visiting
Appointments**

CERN Theory Division (2014 – 2015)

Scientific Associate

CERN Theory Division (2007 – 2008)

Scientific Associate

McMaster University (2004 – 2005)

Visiting Professor

Institute for Advanced Study Princeton (2000 – 2001)

Research Member

Ambrose Monell Foundation Fellow

Universitat de Barcelona (1998 – 1999)

Visiting Professor

Université de Neuchâtel (1993 – 1994)

Visiting Professor

Swiss National Foundation Fellow

**Selected
Community
Service**

NSERC ATLAS Canada Review Committee 2017+
Intl Org Committee, Rencontres de Moriond Cosmology 2014+
Steering Committee, SNOLab 5-year Plan 2016
Advisory Committee on TRIUMF (ACOT) 2011-2014
NSERC Subatomic Long Range Planning Committee 2010-2011
IPP Member of Council 1992 – 95 and 2003 – 2006.
NSERC Subatomic Grant Selection Committee 2004 – 2007
SNOLAB Experiment Assessment Committee 2004 – 2007

Research Interests

My interests lie at the interface between particle physics and cosmology, linking Dark Matter, Dark Energy and Primordial Fluctuations to fundamental physics. I use ideas like branes and extra dimensions from string theory to tackle problems in cosmology. I am developing Effective Field Theory for open systems since these techniques (some of which come from condensed matter) seem the most appropriate for quantum gravity at observable scales.

Selected Publications

Books and Encyclopaedia entries

Introduction to Effective Field Theory, *C.P. Burgess*, Cambridge University Press, 2019

The Standard Model: A Primer, *C.P. Burgess and Guy D. Moore*, Cambridge University Press, 2007 (Higgs update 2012)

Supersymmetry and Supergravity, *C.P. Burgess*, in the *Encyclopedia of Physics* (2nd Edition, 1991) and (3rd Edition, 2004), VCH Publishers, New York.

Selected Invited Review Articles

Intro to Effective Field Theory in Inflation, *C.P. Burgess*, in the proceedings of the school 'Effective Field Theory,' Les Houches France, July 2017 (arXiv: 1711.10592)

Testing General Relativity with Present and Future Astrophysical Observations, *C.P. Burgess* contribution to book by E. Berti et.al., Cambridge University Press, 2015 (arXiv:1501.07274 [gr-qc])

The Cosmological Constant Problem: Why it is Hard to get Dark Energy from Micro-Physics, *C.P. Burgess*, in the proceedings of the school 'Post-Planck Cosmology', Les Houches France, July 2013 (arXiv:1309.4133 [hep-th]).

Challenges for String Cosmology, *C.P. Burgess* and Liam McAllister, *Classical and Quantum Gravity* 28 (2011) 204002 (18 pages) (selected for 2011-2012 Highlights of Classical and Quantum Gravity) (arXiv:1108.2660)

Effective Theories and Modifications of Gravity, *C.P. Burgess*, chapter in *Foundations of Space and Time: Reflections on Quantum Gravity*, edited by J. Murugan, Cambridge University Press, 2010 (arXiv:0912.4295 [gr-qc]).

String Cosmology: Cosmic Defects in the Lab, *C.P. Burgess*, 'News and Views' article, *Nature Physics* 4 (2008) 11.

Lectures on Cosmic Inflation and its Potential Stringy Realizations, *C.P. Burgess*, *Classical and Quantum Gravity* 24 (2007) S795-S852, and *Proceedings of Science* (arXiv:0708.2865 [hep-th])

Introduction to Effective Field Theory, *C.P. Burgess*, *Annual Reviews of Nuclear and Particle Science* 57 140508, (hep-th/0701053)

The Great Cosmic Roller-Coaster Ride, *C.P. Burgess and F. Quevedo*, *Scientific American* November 2007.

Quantum Gravity and Precision Tests, *C.P. Burgess*, chapter in *Towards Quantum Gravity*, edited by D. Oriti. Cambridge University Press, 2006, (gr-qc/0606108).

Towards a Natural Theory of Dark Energy: Supersymmetric Large Extra Dimensions, *C.P. Burgess*, in the proceedings of Strings and Cosmology, Texas A&M University, College Station Texas, March 2004, AIP Conference Proceedings 743 (2005) 417-449, (hep-th/0411140)

Quantum Gravity in Everyday Life: General Relativity as an Effective Field Theory, *C.P. Burgess*, Living Reviews in Relativity 7 (2004) 5 (57 pages), (gr-qc/0311082)

Most Recent Research Articles

Effective Field Theory and Black Hole Echoes, *C.P. Burgess, R. Plestid and M. Rummel*, Journal of High Energy Physics 1809 (2018) 113 (27 pages) (arXiv:1808.00847)

Failure of Perturbation Theory Near Horizons: the Rindler Example, *C.P. Burgess, J. Hainge, G. Kaplanek and M. Rummel*, Journal of High Energy Physics 1810 (2018) 122 (25 pages) (arXiv:1806.11415)

Fall to the Centre in Atom Traps and Point-Particle EFT for Absorptive Systems, *R. Plestid, C.P. Burgess and D.H.J. O'Dell*, Journal of High Energy Physics 1808 (2018) 059 (43 pages) (arXiv:1804.10324)

Power Counting During Single-field Slow-roll Inflation, *P. Adshead, C.P. Burgess, R. Holman and S. Shandera*, Journal of Cosmology and Astroparticle Physics 1802 (2018) 016 (arXiv:1708.07443)

Reduced Theoretical Error for $^4\text{He}^+$ Spectroscopy, *C.P. Burgess, P. Hayman, M. Rummel and L. Zalavari*, Physical Review A98 (2018) 052510 (20 pages) (arXiv:1708.09768)

Point Particle Effective Field Theory III: Relativistic Fermions and the Dirac Equation, *C.P. Burgess, P. Hayman, M. Rummel, M. Williams and L. Zalavari*, Journal of High Energy Physics 1709 (2017) 007 (47 pages) (arXiv:1706.01063)

Point Particle Effective Field Theory II: Relativistic Effects and Coulomb/Inverse-Square Competition, *C.P. Burgess, P. Hayman, M. Rummel, M. Williams and L. Zalavari*, Journal of High Energy Physics 1707 (2017) 072 (31 pages) (arXiv:1612.07334)

Point Particle Effective Field Theory I: Classical Renormalization and the Inverse-Square Potential, *C.P. Burgess, P. Hayman, M. Williams and L. Zalavari*, Journal of High Energy Physics 1704 (2017) 106 (31 pages) (arXiv:1612.07313)

Summary of publication/citation history

Taken from InSPIRE (Stanford) database: Jul 31 2019

Total of 242 citeable publications (h-index of 61) of which 195 are published in refereed research journals.

(My publications appear in the journals: Journal of High Energy Physics; Journal of Cosmology & Astrophysics; Nuclear Physics B; Physics Letters B; Physical Review Letters; Physical Review D (Particles & Fields); Physical Review B (Condensed Matter); Astrophysical Journal; Monthly Notices of the Royal Astronomical Society; etc)

InSPIRE (Stanford) Topcite citation statistics (July 31, 2019)

<i>Statistic:</i>	<i>All publications</i>	<i>Refereed publications</i>	<i>Total for field</i>
<i>Number of docs:</i>	242	195	710,915
<i>Total Citations:</i>	12,786	12,135	22,167,084
<i>Citations per paper:</i>	52.8	62.2	31.2
<i>500-999 Citations:</i>	2 (0.83%)	2 (1.0%)	3,716 (0.52%)
<i>250-499 Citations:</i>	6 (2.5%)	6 (3.1%)	7,721 (1.1%)
<i>100-249 Citations:</i>	23 (9.5%)	21 (11%)	32,255 (4.5%)
<i>50-99 Citations:</i>	46 (19%)	45 (23%)	57,912 (8.1%)

For an up-to-date list of my publications and citations see [here](#).

**Selected Invited
Lecture Series**

What is the Universe Made Of? 4-hour lecture series presented to: Journeys into Theoretical Physics, ICTP-SAIFR Summer School, Sao Paulo Brazil, **July 2019**

Introduction to Effective Field Theories, 4-hour lecture series presented to: Nordic Winter School, Lillehammer Norway, **Jan 2019**

Effective Field Theories & Inflation, 3-hour lecture series presented to: Les Houches Summer School Post-Planck Cosmology, Les Houches France, **July 2017**

Explorations in Particle Astrophysics, 10-hour lecture series presented to: Perimeter Scholars International, Perimeter Institute, April 2016

Beyond the Standard Model, 5-hour lecture series presented to: XVIII Swieca School of Physics, Campos do Jordao, Brazil, January 2015

The Cosmological Constant Problem: Why it is Hard to get Dark Energy from Micro-physics, 3-hour lecture series presented to: Les Houches Summer School Post-Planck Cosmology, Les Houches France, **July 2013**

Effective Field Theory and Cosmology, 3-hour lecture series presented to: Essential Cosmology for the Next Generation (Cosmology on the Beach), Cancun, Mexico, **January 2012**

Inflation, Dark Matter and Dark Energy, 4-hour lecture series presented to: Nordic Winter School on Cosmology and Particle Physics, Gausdal, Norway, **January 2011**

Introduction to the Standard Model, 4-hour lecture series presented to: TRIUMF Summer Institute, Vancouver, BC, **July 2009**

Physics Beyond the Standard Model, 3-hour lecture series presented to: Universite de Paris IX/Bielefeld International Graduate Course on Physics Beyond the Standard Model, Bielefeld, Germany, **September, 2008** and to the Benasque School on Flavor Physics, Benasque, Spain, **August, 2008**

Effective Field Theory, 5-hour lecture series presented to: British Universities Graduate Summer Schools (BUSSTEPP) in York, England, **August 2007** and 3-hour lecture series at BUSSTEPP in Edinburgh, Scotland, **September 2006**

Cosmic Inflation, 4.5-hour lecture series presented to: Cargèse School on Cosmology and Particle Physics Beyond the Standard Models, Cargèse, France, **August 2007** and to the CERN RTN Graduate School, Geneva, Switzerland, **January 2007** and to the Central European Joint Program of Doctoral Studies in Theoretical Physics (Particle Physics, Gravity and Cosmology), Dubrovnik, Croatia, **August 2006** and a 3-hour lecture series presented to: International Graduate School on Cosmology, Universite de Paris XI/Bielefeld, Paris, France, **March 2006**

**Selected Recent
Invited Conference
Talks**

Late-time Obstacles to Reliable EFT Predictions with Horizons
Energy of the Vacuum, KITP UC Santa Barbara, Jun 2019

Qubits in Space: Late-time Evolution with Horizons
24th Rencontres Itzykson, IPhT CEA-Saclay, Paris Jun 2019

Limitations to Wilsonian Methods in Gravity
Geometrical Tools for String Cosmology, Oaxaca, Mexico, Apr 2019
BASIC 2019, Stella Maris Bahamas, Apr 2019

Gravity as an Open System: Turning up the Heat
Analytical Methods in Cosmology, Inst. H. Poincare, Paris, Sep 2018
Universe as a Quantum Lab, APC Paris, Sep 2018
Testing Gravity, Simon Fraser University, Vancouver BC, Jan 2019

EFTs for Point Sources
Precision Measurements & Fund. Physics, MITP Mainz, Sep 2018

Open EFTs: Gravity as an Effective Medium
IR Physics in Gauge Theories & Inflation, Lake Biwa Japan, Jan 2018
EFT Approaches to Gravity, ETH Zurich, Switzerland, Mar 2018
CAP Congress, Dalhousie University, Halifax NS, Jun 2018
BASIC 2018, Stella Maris Bermuda (e-talk), Jul 2018

The Power of Counting: use of EFTs in Inflation
String Cosmology, Bologna Italy, Sep 2017

Effective Field Theory & Modified Gravity: The view from below
Testing Gravity 2017, Vancouver BC, Jan 2017
Quantum Vacuum & Gravitation 2017, MITP Mainz, Mar 2017

Prospects for Testing Gravity
Gravity and Experiment, Paris, France, Dec 2016

Inflation Outside the Box
FANCY 2016, Odense, Denmark, Oct 2016
String Inflation after Planck, Liverpool UK, Sept 2016

The Future is Stochastic (Probably)
Gordon Conference (String Thy & Cosmol), Tuscany Italy, May 2017
Utrecht Cosmology Symposium, Utrecht Netherlands, June 2016
Atlantic Symposium on General Relativity, Halifax NS, June 2016
Aspects of String Pheno & Cosmology, ICTP Italy, May 2016
Theory & Experiment in Quantum Gravity, Galiano Island, Aug 2015

Self-tuning Under the Microscope
Quantum Gravity from UV to IR, KITP Santa Barbara, May 2015

Dark Energy (Naturally): A Bad Cop, a Wet Blanket & a Cold Shower
Beyond LCDM, Oslo Norway, Jan 2015

A more complete listing of my recent talks can be found [here](#).

**Selected Recent
Colloquia**

Modifying Gravity: The view from below
University of Colorado at Boulder, Boulder CO, Feb 2019
University of Buffalo, Buffalo NY, Apr 2018

Gravitational Waves: the Sounds of Spacetime
Universite de Montreal, Montreal QC, Apr. 2016

Self-tuning Under the Microscope: Extra Dimensions, Brane Back-reaction and the Cosmological Constant Problem
Stanford University, Stanford CA, Nov. 2015

Naturalness, Hierarchies & the LHC: the Dog that Didn't Bark
Austrian Academy of Sciences, Vienna Austria, Mar. 2015

What is the Universe Made of? The case for Dark Energy & Dark Matter
Chung-Ang University, Seoul South Korea, Oct. 2014
National Taiwan University, Taipei Taiwan, Jun. 2014

Last Chance to be Wrong About What They'll See at the LHC
Penn State University, State College PA, Sep 2012
Tufts University, Somerville MA, Apr. 2012
+ 12 other locations starting from 2008

Finding the gravity of every situation: Implications of the AdS/CFT Correspondence
University of Alberta, Edmonton AB, Dec 2013
Universite de Montreal, Montreal QC, Nov. 2010
University of Houston, Houston TX, Sep. 2009

A more complete listing of my recent talks can be found [here](#)

**Recent Research
Seminars**

The Power of Counting: the use of EFTs in Inflation
Perimeter Institute, Waterloo ON, Oct 2017

Effective Theories for Point Sources
Caltech, Pasadena CA, Apr 2017
Fermilab, Batavia IL, Apr 2017

The Future is Stochastic (Probably)
University of British Columbia, Vancouver BC, Nov 2017
University of Michigan, Ann Arbor MI, Jan 2017
Neils Bohr Institute, Copenhagen Denmark, Nov 2016
Perimeter Institute, Waterloo ON, Feb 2016
Canadian Institute for Theoretical Astrophysics, Toronto ON, Sep 2015
University of Toronto, Toronto ON, Nov. 2015
University of Pennsylvania, Philadelphia PA, Oct. 2015

Self-tuning Under the Microscope: Implications for the LHC
EPFL, Lausanne Switzerland, **Mar. 2015**
Univeritat de Barcelona, Barcelona Spain, **Mar. 2015**
CERN Theory Division, Geneva Switzerland, **Mar. 2015**
Technische Universitat Dresden, Dresden Germany, **Nov 2014**

Large Fields, Open EFTs & Stochastic Inflation
LAPTh, Annecy-le-Vieux, France, **Feb 2015**
University of Amsterdam, Amsterdam Netherlands, **Feb 2015**
Oxford University, Oxford UK, **Feb 2015**
CERN Theory Division, Geneva Switzerland, **Nov 2014**
IPMU, Tokyo Japan, **Oct 2014**
DAMTP Cambridge University, Cambridge UK, **Oct 2014**
Southampton University, Southampton UK, **Oct 2014**
Universite de Geneve, Geneva Switzerland, **Sep 2014**

A more complete listing of my research talks can be found [here](#)

Recent Outreach

Gravitational Waves: the Sounds of Spacetime
Ontario Assoc of Physics Teachers, York University, **May 2017**
Engineering & Science Olympics, McMaster University, **Nov 2016**
Royal Astronomical Society of Canada, Waterdown ON, **June 2016**
Undergraduate Astronomy Club, McMaster University, **Mar. 2016**

Higgs @ CERN: What is it and what does its discovery mean?
Einstein Plus, Perimeter Institute, **Jul. 2015**
Einstein Plus, Perimeter Institute, **Jul. 2014**;
Origins Institute Public Lecture, McMaster University, **Oct. 2012**
Open Streets McMaster, Hamilton, **Sep. 2012**
Ontario Assoc of Phys Teachers, Perimeter Inst, Waterloo ON, **Apr. 2012**

A more complete listing of my outreach talks can be found [here](#)

Student Supervision

I currently supervise 5 PhD students and 1 MSc student (with a second MSc student shared with another supervisor)

Since 2014 I have supervised 7 PhD students, 7 MSc students and 10 undergraduate research projects