

CASEY D. MCCOY

University of California San Diego
Department of Philosophy
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Research Interests

Specialization: Philosophy of Physics, Philosophy of Science
Competence: Philosophy of Mathematics, Logic, Metaphysics, Epistemology

Education

Mar 2016 (expected) Ph.D. Philosophy, University of California San Diego (UCSD), La Jolla, CA
Dissertation Title: *Philosophical Implications of Inflationary Cosmology*
Supervisor: Craig Callender
Committee: Nancy Cartwright, Brian Keating, David Meyer, Christian Wüthrich

Jun 2013 M.A. Philosophy, UCSD, La Jolla, CA

May 2008 M.A. Liberal Arts, St. John's College, Annapolis, MD

Jun 2003 B.S. Computer Engineering, Oregon State University (OSU), Corvallis, OR
B.S. Computer Science, OSU, Corvallis, OR
B.S. Electrical Engineering, OSU, Corvallis, OR
B.S. Engineering Physics, OSU, Corvallis, OR
B.S. Physics, OSU, Corvallis, OR

Publications

02. "Prediction in General Relativity." *Synthese* (forthcoming)
Preprint Available at <http://philsci-archive.pitt.edu/11657/>
01. "Does Inflation Solve the Hot Big Bang Model's Fine-Tuning Problems?" *Studies in History and Philosophy of Modern Physics*, 51 (2015): 21-36

Fellowships, Grants, and Prizes

June 2015 UCSD Philosophy Graduate Student Annual Essay Prize (\$500)
for "Does Inflation Solve the Hot Big Bang Model's Fine-Tuning Problems?"

Sep 2014 - Jun 2015 Dissertation Fellowship (\$18,000)
UCSD Department of Philosophy

Sep 2014 Conference Travel Grant (\$1,500)
Philosophy of Cosmology Conference, Tenerife, Canary Islands
Rutgers Templeton Project in Philosophy of Cosmology

Oct 2013 - June 2014 Fulbright - Mach Grant (\$11,500)
University of Vienna, Vienna, Austria
Austrian-American Educational Commission (Fulbright Commission)
Austrian Agency for International Cooperation in Education and Research

Jun 2013 - July 2013 Summer School Stipendiary Grant (\$3,000)
Summer Institute in Philosophy of Cosmology, UC Santa Cruz
Rutgers Templeton Project in Philosophy of Cosmology

Oct 2011 - June 2012 Frieda Daum Urey Academic Fellowship (\$4,000)
Oceanids and UCSD

Academic Positions

Professional and Visiting

Feb 2015 - Jul 2015	Lecturer (Docent) Faculty of Science, Radboud University Nijmegen (RU)
Sep 2014 - Jul 2015	Visiting Research Scholar Institute for Mathematics, Astrophysics, and Particle Physics, RU
Jul 2014	Lecturer Department of Philosophy, UCSD
Oct 2013 - Jun 2014	Visiting Research Student Faculty of Philosophy, University of Vienna
Aug 2008 - May 2009	Visiting Graduate Student Department of Philosophy, University of Maryland, College Park

Graduate Teaching Assistantships

Sep 2015 - Jun 2016	Revelle College Writing Program, UCSD
Sep 2012 - Jun 2013	Department of Philosophy, UCSD
Sep 2010 - Jun 2012	Muir College Writing Program, UCSD
Sep 2009 - Jun 2010	Department of Philosophy, UCSD

Other Education

Jun 2013 - Jul 2013	Summer Institute in Philosophy of Cosmology, Santa Cruz (3 wks)
Aug 2012	Einstein's Philosophy of Science, Forum Scientiarum, Tübingen (1 wk)
Jul 2012	Applied Science, 12th Vienna Summer University, Vienna (2 wks)

Invited Presentations

05. "Cosmological Probabilities: General Relativity and Statistical Mechanics Writ Large"
Colloquium in Logic, Philosophy of Science and Philosophy
20 May, 2015, Munich Center for Mathematical Philosophy, Munich, Germany
04. "Prediction in General Relativity"
Spacetime Structuralism Workshop
6 March, 2015, Erasmus University Rotterdam, Rotterdam, Netherlands
03. "What Is the Horizon Problem?"
Southern California Philosophy of Physics Research Group
10 January, 2015, University of California, Irvine, USA
02. "Probability, Theory Interpretation and Conceptual Analysis"
Philosophy of Science Colloquium
30 May, 2014, Vienna Circle Institute, Vienna, Austria
01. "Underdetermination in Cosmology"
Theory, Evidence and Scientific Realism Workshop
28 March, 2014, Slovak Academy of Sciences, Bratislava, Slovakia

Contributed Presentations

09. "Cosmological Probabilities: General Relativity and Statistical Mechanics Writ Large"
European Philosophy of Science Association Biennial Meeting
23 September, 2015, Heinrich Heine University Düsseldorf, Düsseldorf, Germany
08. "Prediction in General Relativity"
Congress of Logic, Methodology and Philosophy of Science
3 August, 2015, University of Helsinki, Helsinki, Finland
07. "Metaphysical Modeling and Scientific Epistemology"
Joint Session of the Aristotelian Society and the Mind Association
12 July, 2015, University of Warwick, Coventry, UK

06. "Metaphysical Modeling and Scientific Epistemology"
OZSW Graduate Conference in Theoretical Philosophy
30 April, 2015, Radboud University Nijmegen, Nijmegen, Netherlands
05. "Interpreting Probability Measures in Statistical Mechanics"
Munich Graduate Workshop in Mathematical Philosophy
11 April, 2015, Munich Center for Mathematical Philosophy, Munich, Germany
04. "Prediction in General Relativity"
Spring Meeting of the German Physical Society
18 March, 2015, Technical University of Berlin, Berlin, Germany
03. "Cosmological Inflation's Quantum Measurement Problem"
UK/European Foundations of Physics Conference
29 July, 2013, Ludwig Maximilian University, Munich, Germany
02. "Classical Motion and Instantaneous Velocity"
Philosophy of Logic, Mathematics, and Physics Graduate Conference
21 May, 2012, University of Western Ontario, London, Canada
01. "Kolmogorovian Censorship, Bell's Theorem, and Causal Republicanism"
Annual Graduate Symposium (Keynote Speaker: Chris Hitchcock)
14 May, 2011, University of California, San Diego, USA

Unpublished Drafts and Work in Progress

05. "The Stochastic Observables Interpretation of Statistical Mechanics" (Under Review)
Preprint Available at <http://philsci-archive.pitt.edu/11658/>
04. "Cosmological Probabilities: General Relativity and Statistical Mechanics Writ Large"
Long Abstract Available
03. "Classical Motion and Instantaneous Velocity"
Full Draft Available
02. "Metaphysics of Models and Scientific Epistemology"
Long Abstract Available
01. "Epistemic Justification and Luck in Inflationary Cosmology"
Long Abstract Available

Teaching Experience

Primary Instructor ("*" indicates graduate course)

Foundations and History of Mathematics	RU, Spring 2015
Foundations of Quantum Mechanics*	RU, Winter 2015
Introduction to Logic	UCSD, Summer 2014
Critical Writing II (College Writing Program)	UCSD, Winter 2012, Spring 2012
Critical Writing I (College Writing Program)	UCSD, Fall 2010, Winter 2011, Spring 2011, Fall 2011

Teaching Assistant

Humanities (College Writing Program)	UCSD, Winter 2016, Spring 2016
Introduction to Metaphysics	UCSD, Winter 2013
Introduction to Epistemology	UCSD, Fall 2012
Aristotle's <i>Politics</i>	UCSD, Winter 2012
Ethics and Society	UCSD, Winter 2010, Summer 2010, Spring 2013
Introduction to Logic	UCSD, Fall 2009, Spring 2010

Professional Organizations and Service

Professional Memberships: European Philosophy of Science Association; Aristotelian Society
 Referee for *Synthese*; *Journal for the General Philosophy of Science*
 Referee for 3rd Graduate Conference of the Vienna Forum for Analytic Philosophy (2014)
 Coordinator, Philosophy of Science Reading Group, UCSD (2011-2013)

Selected Graduate Coursework

University of California, San Diego

Philosophy

Epistemology of Science (C. Wüthrich) (audit)
 Metaphysics (C. Wüthrich) (audit)
 Introduction to Science Studies (R. Westman)
 Time (C. Callender)
 Philosophy of Quantum Mechanics (C. Callender)
 Structure in Phil., Math., and Physics (C. Wüthrich)
 Frege (C. Tolley)
 Consciousness, Computation,
 and Incompleteness (G. Sher)
 Topics in Logic (G. Sher)
 Law and Order (N. Cartwright & J. Doppelt) (audit)
 20th Century Analytic Philosophy (D. Rutherford)

Mathematics

Differential Geometry (B. Chow)

University of California, Irvine

Logic and Philosophy of Science

Probability and Determinism (D. Malament)

Physics

Mechanics I-II (D. Arovas, E. Jenkins)
 Mathematical Physics (M. Fogler)
 Classical Electrodynamics (T. O'Neil)
 Quantum Theory I-II (G. Fuller, A. Manohar)
 Particles and Fields (A. Manohar)
 General Relativity (K. Griest)
 Cosmology (B. Keating)

University of Maryland, College Park

Philosophy

Causation (M. Frisch)

Languages

English	Native
German, Spanish	Intermediate (CEF B1-2)
French, Dutch, Italian	Basic (CEF A1-2)

References Available Upon Request

Craig Callender, Chair and Professor, Department of Philosophy, University of California San Diego
 9500 Gilman Drive, La Jolla, CA 92093-0119, +1.858.822.4911, ccallender@ucsd.edu

Christian Wüthrich, Associate Professor, Dept. of Philosophy, University of Geneva
 2, rue de Candolle, 1211 Geneva 4, Switzerland, +41.22.379.70.53, christian.wuthrich@unige.ch

Richard Dawid, Fellow, Munich Center for Mathematical Philosophy, Ludwig Maximilian University
 Geschwister Scholl Platz 1, D-80539 Munich, Germany, +43.650.7287299, richard.dawid@univie.ac.at

F. A. Muller, Associate Professor, Department of Philosophy, Erasmus University Rotterdam
 Burgemeester Oudlaan 50, 3062 PA Rotterdam, The Netherlands, +31.10.4088968, f.a.muller@fwb.eu.nl

Teaching Reference

Luca Consoli, Assistant Professor, Faculty of Science, Radboud University Nijmegen
 Heyendaalseweg 135, 6525 AJ Nijmegen, The Netherlands, +31.24.3653065, l.consoli@science.ru.nl

Dissertation Abstract

Philosophical Implications of Inflationary Cosmology

My dissertation investigates the conceptual and physical foundations of cosmological inflation, a central component of the modern standard theory of cosmology. Inflationary theory (originally proposed in the early 1980s) is based on the supposition that the very early universe underwent a brief period of accelerated and exponential spatial expansion. Proponents regularly remark that the effect of inflation is to flatten the spatial geometry of the universe and make its contents more uniform. (One may usefully compare it to the inflation of a balloon, which decreases the curvature of the balloon's surface and smooths small irregularities.) Proponents also claim that the old standard cosmological model, the famous hot big bang model, suffers from fine-tuning problems, such that only problematic special initial conditions can give rise to the presently-observed conditions (of uniformity and flatness). Since uniformity and flatness are thought to be natural outcomes of inflation, the previous paradigm's fine-tuning problems appear to be solved by inflationary theory, leading to the claim that inflationary models represent an advance over the hot big bang model. The major contributions of the dissertation are an analysis and critique of this argument, which has been taken as the standard rationale for the initial (and even continuing) widespread acceptance of inflation in cosmology, and the construction of a more rationally compelling account of why inflationary theory should nevertheless be understood as an advance over the hot big bang model.

In the first part of the dissertation I analyze and criticize the aforementioned standard motivation for the inclusion of inflation in modern cosmological models. I argue that cosmologists' fine-tuning allegations depend essentially on the attribution of probabilities to individual physically possible cosmological models. (In this context a possible cosmology is a spacetime model allowed by the general theory of relativity, perhaps with other physically-motivated modal constraints.) One would then say that a cosmological model is fine-tuned if it is improbable according to this attribution of probabilities. I consider the viability and justification of introducing such cosmological probabilities to see if the standard argument can be sustained. The conceptual and technical considerations which I raise show the prospects to be quite dim at best, and empty at worst. I also propose some other possible, non-probabilistic ways to understand fine-tuning that evade these considerations; nevertheless I argue that there are strong *prima facie* challenges to the viability of these interpretations as well. I therefore conclude that there is at present no compelling justification for the adoption of inflation based on fine-tuning arguments.

In the second part of the dissertation I defend the inflationary paradigm from its critics and develop a more compelling rationale for its adoption in cosmology. Prominent physicists have criticized inflationary theory by using arguments based on the second law of thermodynamics (i.e. entropy is almost always non-decreasing). The claim that inflation avoids fine-tuning by making uniformity and flatness likely is inconsistent with the general increase of entropy, i.e. evolution to increasingly improbable states. Such arguments obviously only make sense when cosmological fine-tuning is interpreted probabilistically. If one jettisons this conception of fine-tuning, as I urge one should, then these arguments fail to gain any traction. I go on to argue that inflation is well-motivated once one sets aside the fine-tuning concerns that dominate attention in these debates. Although inflation's place in the standard model of cosmology is also motivated by its (alleged) empirical confirmation, I claim that it is necessary to give an account for its adoption in advance of this empirical confirmation, which confirmation occurred well after the idea's widespread adoption. The account I provide depends on recognizing an essential component of theory assessment that goes beyond direct empirical confirmation of a theory's predictions. In particular it includes explanatory considerations which I argue are not merely of pragmatic value but indeed essential for establishing knowledge and theoretical progress in science.