# MOLLY KAO

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## AREAS OF SPECIALIZATION

General philosophy of science, History and philosophy of physics

## AREAS OF COMPETENCE

Epistemology, Game theory, Philosophy of biology

## ACADEMIC APPOINTMENTS

Assistant professor, Université de Montréal *July 2016–present*

## EDUCATION

**PhD, Philosophy** (2016) **University of Western Ontario**
Dissertation: *Evaluating the Quantum Postulate in the Context of Pursuit*
Supervisor: Wayne Myrvold

**MA, Philosophy** (2009) **University of Western Ontario**
Supervisor: John L. Bell

**BA, Philosophy & Mathematics** (2008) **University of Windsor**
Minor in French

## PUBLICATIONS

### REFEREED CONTRIBUTIONS

"Unificatory Power in the Old Quantum Theory: Informational Relevance of the Quantum Hypothesis." (2015). *Philosophy of Science*, 82(5), pp. 1200–1210.

"A New Role for Data in the Philosophy of Science." (2015). *Philosophia Scientiae*, 19(1), pp. 9–20.

### Other Contributions

"Is the Inferential Conception of Applied Math Complete?" (2011). *Proceedings of the 37th Annual Meeting of the Canadian Society for History and Philosophy of Mathematics and 5th Joint Conference with the British Society for History of Mathematics*, Volume 24, pp. 68-78.

Review of "From a Geometrical Point of View: A Study of the History and Philosophy of Category Theory" by Jean-Pierre Marquis. (2010). First author. Co-authored with Nicolas Fillion and John Bell. *Philosophia Mathematica*, Volume 18(2), pp. 227-234.

### In Preparation

"Perrin and Planck: Two Cases of Unification." There has been much philosophical discussion on the nature of Jean Perrin's claim for the reality of atoms as related to his work in determining Avogadro's constant. I propose that we can better understand this argument by comparing it with a different case, namely, with the argument for quantization in the case of multiple agreeing measurements of Planck's constant.

"Evaluating a Solution to Old Evidence: Lessons from the Development of Quantum Theory." I evaluate Hartmann & Fitelson's solution to the Bayesian problem of old evidence. I argue that it requires additional formal assumptions to accurately explicate support in this case, but that these assumptions are appropriate given the historical facts.

## Presentations

* = Invited talk

"Une comparaison du rôle d'unification dans l'histoire de Perrin et de Planck."* Colloque 2016 du Laboratoire étudiant interuniversitaire en philosophie des sciences (LEIPS), 23-24 September 2016, Montreal, Canada (upcoming)

"Einstein, Millikan and quantum theory: the evidential import of the photoelectric effect." 6e congrès de la société de philosophie des sciences, 29 June-1 July 2016, Lausanne, Switzerland

"The Role of Old Evidence in the Development of Quantum Theory." Philogica IV: IV Colombian Conference on Logic, Epistemology and Philosophy of Science, 17-19 February 2016, Bogotá, Colombia

"Quantum Theory and the Context of Pursuit: Defining the Quantum Hypothesis." WIP Series, Munich Centre for Mathematical Philosophy, January 2015, Munich, Germany

"Unificatory Power and the Quantum Hypothesis: Measuring Planck's Constant 1900-1913." Philosophy of Science Association Biannual Meeting, 6-8 November 2014, Chicago, USA

"Quantization in the Early Twentieth Century: Investigating an Instance of Theory Change."* Structuralism, Structural Realism and Theory Change Workshop, 3 July 2014, Munich Centre for Mathematical Philosophy, Munich, Germany

"Unification in the Old Quantum Theory: Planck's Constant and the Quantum Hypothesis." Inductive Logic and Confirmation in Science, 17-18 October 2013, University of Kent, Paris campus, France

"Theory Pursuit and the Old Quantum Theory." Congress on Logic and Philosophy of Science, 16-18 September 2013, Ghent, Belgium

"Unification in the Old Quantum Theory." 17th UK and European Meeting on Foundations of Physics, 29-31 July 2013, Munich, Germany

"Confirmation and the Old Quantum Theory" PGSA Colloquium Series, Department of Philosophy, University of Western Ontario, October 2012, London, Canada

"From Foundation to Function: Rethinking the Role of Data in Science." Congress for Logic, Methodology and Philosophy of Science, 19-26 July 2011, Nancy, France

"Is the Inferential Conception of Applied Mathematics Complete?" Canadian Society for History and Philosophy of Mathematics, 15-17 July 2011, Dublin, Ireland

"From Foundation to Function: Rethinking the Role of Data in Science." Canadian Society for History and Philosophy of Science, 28-31 May 2011, Fredericton, Canada

"Is the Inferential Conception of Applied Math Complete?" Canadian Philosophical Association, 30 May-2 June 2011, Fredericton, Canada

"Why de Broglie-Bohm Theory is Not Everettian." Canadian Philosophical Association, 30 May-2 June 2010, Montreal, Canada

## FELLOWSHIPS, AWARDS AND PRIZES

Mary Routledge Fellowship, 2016 ($1,000)

Richard A. Harshman Memorial Scholarship, 2014 ($1,000)

Research Assistantship, Online course development for Introduction to Critical Thinking, University of Western Ontario, 2014

University of Western Ontario Graduate Thesis Research Award, 2014 ($1,200)

Rotman Institute of Philosophy Graduate Research Award, 2012, 2013 ($5,000 x 2)

University Students' Council Teaching Honour Roll Award of Excellence, 2012

Ontario Graduate Scholarship Doctoral Level, 2013–2014 ($15,000)

Social Sciences and Humanities Research Council of Canada, Doctoral Fellowship, 2011–2013 ($20,000 x 2)

Ontario Graduate Scholarship Doctoral Level, 2011–2012 (declined)

Ontario Graduate Scholarship Doctoral Level, 2009–2011 ($15,000 x 2)

Social Sciences and Humanities Research Council of Canada, Canada Graduate Scholarship Masters Level, 2008–2009 ($20,000)

Ontario Graduate Scholarship Masters Level, 2008–2009 (declined)

Dean's Entrance Scholarship, Faculty of Arts & Humanities, University of Western Ontario, 2008 ($2,000)

Board of Governors' Medal in Philosophy, University of Windsor, 2008

## Teaching Experience

Instructor

Basic Logic: University of Western Ontario (Winter 2012)

Teaching Assistant

Introduction to Logic: University of Western Ontario (2010-2011)
Reasoning and Critical Thinking: University of Western Ontario (2008-2010)
Linear Algebra III, University of Windsor (Winter 2008)
Mathematical Foundations: University of Windsor (2007-2008)

## Other Academic Activity

Participant in round table "Naturaliser en science," organised by Christophe Malaterre and *Centre interuniversitaire de recherche sur la science et la technologie*, Université du Québec à Montréal, 21 September, Montreal, Canada (upcoming)

Visiting Student, Munich Center for Mathematical Philosophy, Ludwig-Maximilians-Universität München, 2013–2015, Munich, Germany

Rotman Summer Institute, "Foundations of Statistical Mechanics," Rotman Institute of Philosophy, 14-20 July 2013, Ontario, Canada

## Service

Category Editor for *Philpapers*, History of Quantum Mechanics (2015–present)

Referee for *Philosophy of Science* (2012–present) and *Studies in History and Philosophy of Modern Physics* (2016–present)

Reviewer, "Annual Graduate Conference in Philosophy of Physics," Munich Center for Mathematical Philosophy, Ludwig-Maximilians- Universität (2014)

Committee Chair, "Annual Graduate Conference in Philosophy of Logic, Mathematics and Physics," University of Western Ontario (2011–2013)

Committee Member, "Annual Graduate Conference in Philosophy of Logic, Mathematics and Physics," University of Western Ontario (2010–2011)

Co-president, Philosophy Graduate Students Association, University of Western Ontario (2010–2012)

Department representative, Society of Graduate Students, University of Western Ontario (2008–2009)

## PROFESSIONAL MEMBERSHIPS

Philosophy of Science Association
Canadian Society for History and Philosophy of Science
Canadian Philosophical Society

## LANGUAGES

English (native speaker)
French (good reading and speaking knowledge)
German (basic reading knowledge)
Mandarin Chinese (conversational)

## GRADUATE COURSES

* = Audited course

PHILOSOPHY OF SCIENCE
Symmetry in Philosophy and Physics*
Philosophy of Probability*
Empiricism and Philosophy of Science
20th Century Philosophy of Science
Philosophy of Quantum Mechanics
Philosophy of Physics
Game Theory
Philosophical Foundations of Modern Physics*
Philosophy of Biology
Darwin's Origin of Species*
Newton's Universal Gravitation*
Emergence
Philosophy of Applied Mathematics
Philosophy of Mathematics
Category Theory

OTHER
Survey of Philosophy of Law*
Metaphysics from Leibniz to Kant
Kant's First Critique
Kant and the Philosophy of Mind
Empiricism Through the Ages
Evolutionary Perspectives on Ethics and Epistemology

## REFERENCES

**Wayne C. Myrvold**
Professor of Philosophy and Field Director for the Philosophy of Science, University of Western Ontario; Affiliate Member of the Perimeter Institute for Theoretical Physics.
Tel. 519-661-2111 ext. 85754.
Email: wmyrvold@uwo.ca

**William L. Harper**
Professor Emeritus of Philosophy, University of Western Ontario.
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**Chris Smeenk**
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**Lorne Falkenstein (Teaching)**
Professor of Philosophy, University of Western Ontario.
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## Abstract for "Evaluating the Quantum Postulate in the Context of Pursuit"

In recent years, there has been a surge in the philosophy of science literature on the "context of pursuit," stemming from recognition of the fact that scientists do not simply accept or reject scientific theories, but must decide whether or not to pursue them for various reasons. This decision must often be made while the developing theory is still incomplete or problematic, and is thus not a candidate for acceptance in its given form. While there is much of interest in the literature on pursuit, the tendency is to focus on cases where a new theory has already been put forth, and its promise must be evaluated. In my dissertation, I use a Bayesian framework to analyse a particular example of theory pursuit in order to show how pursuit can occur even in the absence of such a tentative theory.

While Bayesian epistemology has contributed significantly to confirmation theory, it has generally been overlooked by those discussing the context of pursuit. I argue that the probabilistic framework of Bayesian epistemology suits the nature of pursuit extremely well, since it allows us to make judgments about the varying levels of promise of hypotheses. We are thus already in possession of a powerful tool for evaluating epistemic features of emerging theories. However, there is little in the way of detailed case studies in the Bayesian literature, which my dissertation helps to remedy.

Before 1900, one of the central assumptions in physics was the idea that energy is a continuous quantity that could not be naturally divided into parts. However, new experiments at the end of the nineteenth century yielded results that could not be accounted for in these terms. Max Planck's conjecture of discrete packets of energy as a way to recover the behaviour of observed phenomena was a revolutionary step, and eventually led to the enormously successful theory of quantum mechanics. From 1900 to 1914, there was no overarching theoretical framework that included such a 'quantum postulate' in which scientists could situate their investigations. Nevertheless, they were able to pursue this postulate to great effect.

I first consider specific ways in which scientists were using a postulate about the discrete behaviour of energy in different contexts. I argue that while there was no consensus on the underlying mechanisms of energy exchange, we can nevertheless identify a common assumption about the behaviour of energy that was used in these different ways. I then provide a detailed analysis of the role of this quantum postulate in the pursuit of a quantum theory by examining its application to phenomena such as the photoelectric effect, specific heats, and spectral observations. Bayesian explications of evidential support show how the phenomena under consideration contributed to the promise of the quantum postulate.

Finally, I argue that the features previously discussed all contribute to a larger unification type argument. A crucial feature of the support for the quantum postulate arises from the inclusion of a theoretical parameter $h$ in the postulate, now referred to as Planck's constant. Experimental results that made use of the quantum postulate can be interpreted as helping to constrain the numerical value of $h$ in each case. A Bayesian explication of this unifying power shows how it provided support for the quantum postulate over and above that derived from individual experimental results.

Overall, this analysis provides insight into how specific aspects of a developing theory can be promising and help to guide research when an overall theory is under dispute, or nonexistent. A general account of theory pursuit should not ignore this feature. A better understanding of the context of pursuit can thus contribute to our analyses of currently developing scientific theories that are in the same state of uncertainty.