

# **PHIL 245: Seminar in Philosophy of Science: Laws and Randomness**

Fall 2023. UCSD  
Syllabus

Instructor: Eddy Keming Chen  
Email: [eddykemingchen@ucsd.edu](mailto:eddykemingchen@ucsd.edu)  
Website: [www.eddykemingchen.net](http://www.eddykemingchen.net)

Version of September 24, 2023

## **1 Course Description**

In this seminar, we will discuss philosophical issues related to laws of nature, chance, complexity, and randomness.

## **2 Course Information**

- Meeting time: Friday 1:00-3:50pm. First seminar on Friday Sep 29th.
- Classroom: RWAC 0472.
- Office hours (in my office): Monday & Friday 10:00 - 10:45am. [You may attend in person or via Zoom at 202-988-3478]
- Office hours (right after class): I will also stay for 20 minutes after each seminar. Other times by appointment.
- Most readings will be posted on Canvas.

## **3 Topic: Laws and Randomness**

Laws of nature is an important topic in metaphysics, philosophy of science, and philosophy of physics. It is widely discussed and often taught in philosophy PhD programs. In contrast, randomness is less familiar to philosophers and rarely taught in philosophy PhD programs. However, it is also an important topic, connected to

philosophical puzzles about probability, chance, complexity, vagueness, explanation, as well as laws of nature. In this seminar, we will try to bridge the gap and explore the following questions:

- What kind of things are laws of nature?
- How is the concept of laws related to ideas about modality, counterfactuals, causation, explanation, induction, and determinism?
- How do laws govern the world?
- Can laws explain everything?
- Can laws be vague?
- Why are laws so simple?
- How are laws related to chance and objective probability?
- Are concepts of chance and probability related to the concept of randomness?
- What is randomness?
- Can laws explain the random patterns observed in nature? Can randomness be part of the constraint imposed by the laws? If so, are they further examples of vague laws?
- How might recent progress in the foundations of quantum mechanics and statistical mechanics inform us about the character of laws and the nature of randomness?

We won't be able to cover all of those questions. Depending on the interests of the participants, we may add other topics in the seminar. We will not assume in-depth knowledge of advanced physics or mathematics. Some familiarity with college-level physics would be helpful, but not required.

#### **4 Assessments and Expectations**

- Grade assignment:  $100 \geq A+ \geq 98 \geq A \geq 92 \geq A- \geq 88 \geq B+ \geq 85 \geq B \geq 82 \geq B- \geq 78 \geq C+ \geq 75 \geq C \geq 72 \geq C- \geq 68 \geq D \geq 59 \geq F \geq 0$ .
- Reading Responses: 25%

Before each seminar on Friday, you will be asked to write a short response to the assigned readings. For each required reading, you should write at least one paragraph criticizing or developing some arguments in the reading; you should also raise two questions for seminar discussion.

Deadline: Thursday 9pm before each seminar. Please post your response on Canvas -> Discussion Board. Please make sure to submit your responses on time so that I can read and think about them before the seminar.

- Participation and Presentations: 25%

I expect lively discussions. However, if you are usually quiet in class, you can choose to email me your thoughts or reflections before or after class. If you have any questions, please feel free to ask in class and during office hours.

I think the best way for one to truly understand something is to teach it to others. Opportunities are limited. Please let me know if you are interested in presenting.

- Midterm short paper: 20%

Word limit: 3000. Deadline: 8pm Oct 29th.

- Final paper: 30%

Word limit: 5000. Deadline: 8pm Dec 15th.

- Please feel free to visit my office hours to discuss your questions about the class materials. If you cannot come to my regular office hours, I am happy to make appointments with you to accommodate your schedule.
- If possible, please do not be late. Please do not text or call on your phone, or surf the internet (Twitter, Facebook, Instagram) during class.

## 5 Accessibility

I would like to make sure that everyone in the class feels safe and respected. If you have any particular need, please contact the UCSD Office for Students with Disabilities at the beginning of the quarter. They will forward the necessary information to me. We can work out the details together.

*From the website of the UCSD Office for Students with Disabilities:*

The Office for Students with Disabilities (OSD) at UC San Diego works with undergraduate, graduate, and professional school students with documented disabilities, reviewing documentation and, through an interactive process with the student, determining reasonable accommodations. Disabilities can occur in the following areas: psychological, psychiatric, learning, attention, chronic health, physical, vision, hearing, and acquired brain injuries, and may occur at any time during a student's college career. We encourage you to contact the OSD as soon as you become aware of a condition that is disabling so that we can work with you. Students registered with the OSD have the same responsibilities as other students: getting to class regularly, meeting with faculty and peers to study and learn, and finally demonstrating understanding and mastery of course content. OSD helps students with disabilities navigate that system by establishing a set of academic accommodations based on each student's individual disability. In order to receive support, students must schedule an appointment with the OSD to discuss obtaining reasonable accommodations based on their current, functional limitations, particularly as they pertain to a higher education academic setting.

## 6 Course Plan

### Week 1: Sep 29th. Introduction to Laws and Randomness.

Note: this is the first seminar. No reading response is due before this meeting.

Readings:

Roberts, "Laws of Nature," in *Oxford Handbook of Philosophy of Science*, 2015

Chen, *Laws of Physics*, manuscript, Chapters 1-2.

(optional) Cartwright, *Nature the Artful Modeler*, Open Court, 2019

(optional) Hildebrand, *Laws of Nature*, Cambridge, 2022

### Week 2: Oct 6th. How Do Laws Govern?

Reading response due on Canvas by Thursday 9pm (San Diego time) before the meeting.

Readings:

Chen and Goldstein, "Governing without a Fundamental Direction of Time: Minimal Primitivism about Laws of Nature," in Yemima Ben-Menahem (ed.), *Rethinking the Concept of Law of Nature*, Springer, 2022

(optional) Maudlin, "A Modest Proposal Concerning Laws, Counterfactuals, and Explanations," in *The Metaphysics Within Physics*, Oxford University Press, 2007

(optional) Hildebrand, "Non-Humean theories of natural necessity," *Philosophy Compass*, 2020

(optional) Beebe, "The Non-Governing Conception of Laws of Nature," *Philosophy and Phenomenological Research*, 2000

(optional) Loewer, "Two Accounts of Laws and Time," *Philosophical Studies*, 2012

### Week 3: Oct 13th. Can Laws Determine Everything?

Reading response due on Canvas by Thursday 9pm (San Diego time).

Readings:

Hoefer, "Causal Determinism," *Stanford Encyclopedia of Philosophy*, revised version of Sep 21, 2023

Chen, "Strong Determinism," *The Philosopher's Imprint*, forthcoming

### Week 4: Oct 20th. Can Laws Be Vague?

Reading response due on Canvas by Thursday 9pm (San Diego time).

Readings:

Chen, "Fundamental Nomic Vagueness," *The Philosophical Review*, 2022

Chen, "Welcome to the Fuzzy-Verse," *New Scientist*, 2020 [popular and shorter version of "Fundamental Nomic Vagueness"]

(optional) Keefe and Smith, "Introduction," in *Vagueness: A Reader*, 1996

## **Week 5: Oct 27th. Why Are Laws So Simple?**

Reading response due on Canvas by Thursday 9pm (San Diego time).

Readings:

Chen, "The Simplicity of Physical Laws," manuscript

Earman and Roberts, "Contact with the nomic: A challenge for deniers of Humean supervenience about laws of nature part II: The epistemological argument for Humean supervenience," *Philosophy and Phenomenological Research*, 2005.

(optional) Earman and Roberts, "Contact with the Nomic Part I: Humean Supervenience," *Philosophy and Phenomenological Research*, 2005

**Midterm short paper due online by 8pm Oct 29th.**

## **Week 6: Nov 3rd. Probability, Chance, and Randomness**

Reading response due on Canvas by Thursday 9pm (San Diego time).

Readings:

Hájek, "Interpretations of Probability," *Stanford Encyclopedia of Philosophy*, revised version of Aug 28, 2019

Eagle, "Probability and Randomness," in Hájek and Hitchcock (eds.), *The Oxford Handbook of Probability and Philosophy*, Oxford University Press, 2016

## **Week 7: Nov 10th. NO CLASS due to Veterans Day holiday**

## **Week 8: Nov 17th. What is Algorithmic Randomness?**

Reading response due on Canvas by Thursday 9pm (San Diego time).

Readings:

Dasgupta, "Mathematical Foundations of Randomness," In Bandyopadhyay and Forster (eds.), *Handbook of the Philosophy of Science, Vol. 7: Philosophy of Statistics*, Elsevier, 2011.

(optional) Porter, "Mathematical and Philosophical Perspectives on Algorithmic Randomness," PhD dissertation, the University of Notre Dame, 2012, chapter 7.

## **Week 9: Nov 24th. NO CLASS due to Thanksgiving holiday**

## **Week 10: Dec 1st. How Do Probabilistic Laws Govern? (Answer: With a Randomness Constraint)**

Reading response due on Canvas by Thursday 9pm (San Diego time).

Readings:

Barrett and Chen, "Algorithmic Randomness and Probabilistic Laws," manuscript, 2023

(optional) Briggs, "The Anatomy of the Big Bad Bug," *Noûs*, 2009

(optional) Elga, "Infinitesimal chances and the laws of nature," *Australasian Journal of Philosophy*, 2004

## **Week 11: Dec 8th. Special Topics**

Readings:

Belot, "Unprincipled," manuscript

Zaffora Blando, "Bayesian merging of opinions and algorithmic randomness," *British Journal for the Philosophy of Science*, 2022

**Final Paper due online by 8pm Dec 15th.**