

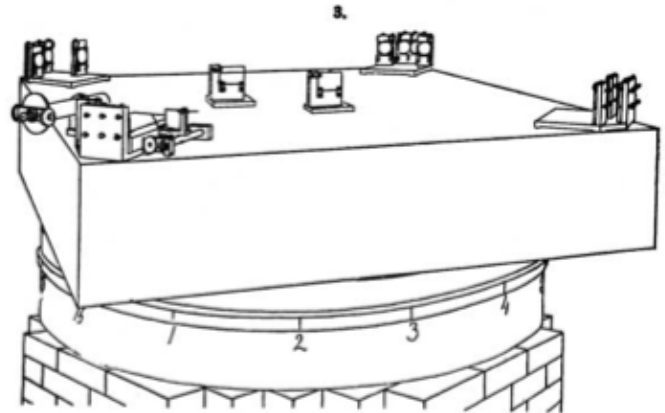
# HISTORY 152: HISTORY OF MODERN PHYSICS

SPRING 2019

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Harvey Mudd College, HSA Department

**OFFICE HOURS:** Friday 4 - 5 pm or by  
appointment

**CLASS:** Thursday 2:45 - 5:30 pm  
SHAN B450



**COURSE OVERVIEW:** Over the course of the semester we will investigate some of the key discoveries, personalities and institutions of physics in the last two hundred years. We will examine the extent of the rift between 19<sup>th</sup> C physics and the new theories of relativity and quantum physics in the early 20<sup>th</sup> C, asking whether the labels “classical” and “modern” are useful to our historical understanding. We will look as well at the role of physicists working on the atomic bomb project, the experiences of women and other marginalized groups in physics, changing cultural perceptions of physics and the relationship of physics to the other sciences.

## **GOALS:**

By the end of this course students will:

- Be able to explain and connect key arguments made by historians of physics
- Practice responding critically to primary and secondary sources through short thesis-driven papers
- Learn strategies for effectively leading a seminar discussion
- Undertake independent historical research

## **EVALUATION:**

Class discussion, in-class work and quick-writes	20%
4 Argumentative Papers (800-1000 words)	50%
Seminar	15%
Research Presentation:	
Proposal	5%
In-Class Presentation (10 minutes + questions)	10%

***You must complete all course requirements in order to pass the course***

## **Course Texts:**

- Michael Frayn, *Copenhagen* (New York: Anchor Books, 1998)  
Helge Kragh. *Quantum Generations: A History of Physics in the 20<sup>th</sup> Century* (Princeton University Press, 1999)  
Russell McCormach, *Night Thoughts of a Classical Physicist* (Cambridge: Harvard University Press, 1991)  
Iwan Morus. *When Physics Became King* (University of Chicago Press, 2005)

These books are available at the Huntley Bookstore and on Amazon. I highly recommend buying paperback versions of the two works of fiction (Frayn and McCormach) as we will be doing a close reading of both texts and it is important that page numbers be consistent.

The remaining course readings will all be available as pdfs on the Sakai site. In order to participate fully in discussion, **you must bring your readings and your reading notes to class.**

### **Class Participation (20%)**

**Discussion:** I will be doing some lecturing but for the most part we will approach the material together through discussion. You are expected to come prepared to contribute to the conversation each week. Please see the attached rubric showing how your contribution to the discussion will be evaluated. You are not being graded on attendance but if you are not present you cannot contribute. Missing more than one class session will negatively affect your final grade.

**Quickwrites:** We will take 15 minutes each class to generate short, informal responses to the reading. These quickwrites will allow you to reflect again on the texts, generate discussion points and demonstrate your careful reading. Quickwrites will be submitted through Assignments on Sakai. Each quickwrite will receive a grade of 0, 1-, 1 or 1+ (corresponding to F, C, B, A). You may miss one quickwrite without penalty.

### **Seminar (15%)**

Working in groups of 2 or 3, you will have the opportunity to lead the discussion during one of our meetings for one hour. Please see the attached seminar guidelines.

### **Response Papers (50%)**

You will write 4 short (800 – 1000 words) argumentative papers over the course of the semester, using the course readings. You will have the option to replace one of these papers with a short piece of historical fiction. Your best two papers will each be worth 15% of your final grade and the other two will be worth 10% each.

**Due Dates:** Monday, Feb. 18, Monday, March 11, Monday, April 8 and Friday, May 10 (seniors) or Monday, May 13.

### **Research Project (15%)**

This will be a chance for you and a partner to investigate an important discovery, controversy or issue in the history of modern physics that we did not have time to cover in class. The culmination of your research will be a 10 minute oral presentation.

**Proposal:** Monday April 1 at 9pm

**Presentations:** May 2 in class

## Schedule

Jan. 24: A. Introduction  
 B. 19th C Primary Source Investigation

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Jan. 31: Romanticism, Energy and the Aether

1. Morus, "The Romance of Nature," p. 54 – 86.
2. Morus, "The Science of Work," p.123 - 155.
3. Cynthia Russet, "The Machinery of the Body" in *Sexual Science* (Harvard University Press, 1989): p.104 -129.

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Feb. 7: Measurement and Technology

1. Morus, "Places of Precision," 226-260
2. Maxwell, "Introductory Lecture on Experimental Physics," (1870)
3. **(Seminar 1)** Bruce J. Hunt, "Doing Science in a Global Empire: Cable Telegraphy and Electrical Physics in Victorian Britain," in *Victorian Science in Context*, Ed. Bernie Lightman: p. 312 – 330.

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Feb. 14: Mysterious Rays

1. Morus, "Mysterious Fluids and Forces" 156-191
2. Kragh, "Spurious Rays," p. 34 - 37
3. **(Seminar 2)** Mary Jo Nye, "N-Rays: An Episode in the History and Psychology of Science," *Historical Studies in the Physical Sciences* 11 (1980): p. 125-156

*Paper 1 Due Monday, Feb. 18 at 9pm.*

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Feb. 21: *Night Thoughts*

1. McCormach, *Night Thoughts of a Classical Physicist*, p. 1 - 157.
2. Kragh, "Fin de siècle physics," p.3-12 (recommended)

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Feb. 28: Relativity

1. Kragh, "Einstein's Relativity, and Others'," p. 87 - 104.
2. **(Seminar 3)** Peter Galison, "Einstein's Clocks," in *Einstein's Clocks, Poincaré's Maps* (2003), p.221 – 293.
3. **(Seminar 4)** Katy Price, "Light Caught Bending: Relativity in the Newspapers" in *Loving Faster than Light: Romance and Readers in Einstein's Universe* (2014): 16-41.

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March 7: Quantum Physics

1. **(Seminar 5)** Paul Forman, "Weimar Culture, Causality and Quantum Theory," *Historical Studies in the Physical Sciences* 3 (1971), selection.
2. Kragh, "Quantum Jumps," p. 155 - 173.
3. Heisenberg, "The Copenhagen Interpretation of Quantum Theory" in *Physics and Philosophy* (1958), p. 44-58.
4. EPR debate (primary source tba).

*Paper 2 Due Monday, March 11 at 9pm.*

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March 14: Physics in National Contexts

1. Kragh, "Physics and the New Dictatorships," p. 230 - 244.
  2. **(Seminar 6)** Kenji Ito, "The *Geist* in the Institute: The Production of Quantum Physicists in 1930s Japan," in in *Pedagogy and the Practice of Science* (2005), 151 - 184.
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**SPRING BREAK**

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March 28: *Copenhagen*

1. Michael Frayn, *Copenhagen* (Act I and II), p. 3- 94
2. Michael Frayn, *Copenhagen* (Postscript), selection.
3. Selections from the Farm Hall Transcripts

*Research Presentation Proposal Due Monday, April 1 at 9pm.*

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April 4: The Atomic Bomb Project

1. Rhodes, "Trinity" in *The Making of the Atomic Bomb* (1986), p.617 - 678
2. **(Seminar 7)** Julie Des Jardins, "Introduction" + "Those Science Made Invisible: Finding the Women of the Manhattan Project," *The Marie Curie Complex*, p. 119 - 156

*Paper 3 Due Monday, April 8 at 9pm.*

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April 11: Post War Physics

1. **(Seminar 8)** Itty Abraham, "Science and Secrecy in Making of Postcolonial State," *Economic and Political Weekly* (1997): 2136 - 2145.
  2. **(Seminar 9)** David Kaiser, "Cold War requisitions, scientific manpower, and the production of American physicists after World War II," *Historical Studies in the Physical and Biological Sciences* 33 (2002): 131-159.
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April 18: No Class HSA Advising

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April 25: Marginalization and Identity in Physics

1. **(Seminar 10)** Traweek, "Pilgrim's Progress: Male Tales Told during a Life In Physics," in *The Science Studies Reader* (Mario Biagioli, ed), p. 525 – 542.
  2. Chanda Prescod-Weinstein, "[Black Women Physicists in the Wake.](#)"
  3. Keolu Fox, "[Protecting Mauna A Wakea: The Space Between Science and Spirituality.](#)" *Mixed Race Politics*, April 16, 2015.
  4. Bryan Kamaoli Kuwada, "[We Live in the Future. Come Join Us.](#)"
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May 2: Research Presentations

*Paper 4 due:*

*Friday, May 10 at 9pm, graduating seniors  
Monday, May 13 at 5pm, everyone else*

### **Seminar Guidelines (15%)**

You will work with one other person to lead the class for 1 hour. Please prepare a PowerPoint or keynote presentation and follow the format below.

**A. Quick Overview.** Aim to start with a 5-10 minute presentation in which you give the class an overview of the topic and the historical context. This may include a timeline and/or a brief explanation of the physics being discussed. [Practice this and time yourselves so that it isn't too long! This should not be a summary of the reading].

**B. Discussion of reading.** Prepare a set of discussion questions that will ensure that your classmates have a chance to talk about and explore the reading. I will be grading you on how successfully you have helped your classmates **draw out and analyse the main arguments made by the author(s)**, evidence given for those arguments, and your ability to connect the reading to the larger themes of the class. [You may want to organize an activity or split the class into discussion groups but be careful of timing. I highly recommend that you prepare a set of main points that you hope to draw out of the reading so that you can steer the conversation if it starts to veer off track.]

**C.** Bring in at least one extra **primary source** to share with the class. This might be a newspaper piece, an excerpt from a journal article, a short video clip or a set of pictures that sheds light on the issues being discussed. Give your classmates a chance to examine, analyse and discuss this new evidence. [If you bring in a textual source make sure that it is short enough to read in 5 minutes.]

**Due at 5pm the day before your seminar:** Please email me one copy of the presentation, which should include the discussion questions / activity and a copy of your primary source. I will make copies of the primary source to distribute to the class.

### Participation Rubric

You will be graded on the contributions that you make each week to the class discussion. Careful reading and preparation for each class will help you to make thoughtful and meaningful contributions.

**In order to participate fully, you must bring your readings and your reading notes to class.**

A	A-	B	C	D	F
<ul style="list-style-type: none"> <li>actively supports, engages and listens to peers (ongoing)</li> <li>arrives fully prepared to every class</li> <li>continually plays an active role in discussion</li> <li>comments consistently advance the level and depth of discussion</li> </ul>	<ul style="list-style-type: none"> <li>actively supports, engages and listens to peers (ongoing)</li> <li>arrives fully prepared to almost every session</li> <li>plays an active role in discussion (ongoing)</li> <li>comments occasionally advance the level and depth of the dialogue</li> </ul>	<ul style="list-style-type: none"> <li>makes a sincere effort to interact with peers (ongoing)</li> <li>arrives mostly, if not fully, prepared</li> <li>participates constructively in discussions (ongoing)</li> <li>makes relevant comments based on the assigned material</li> </ul>	<ul style="list-style-type: none"> <li>limited interaction with peers</li> <li>preparation, and therefore level of participation, are both inconsistent</li> <li>when prepared, participates constructively in discussions and makes relevant comments based on the assigned material</li> </ul>	<ul style="list-style-type: none"> <li>virtually no interaction with peers</li> <li>rarely prepared</li> <li>rarely participates</li> <li>comments are generally vague or drawn from outside of the assigned material</li> <li>demonstrates a noticeable lack of interest (on occasion)</li> </ul>	<ul style="list-style-type: none"> <li>no interaction with peers</li> <li>never prepared</li> <li>never participates</li> <li>demonstrates an ongoing lack of interest in the material</li> </ul>

Adapted from a rubric presented by Adam Chapnick in *The Teaching Professor* March 2005.