

History of Science 280
Honors Seminar: Studies in Science, Technology and Medicine
Topic: Einstein and the Modern World, 1905-2005
Spring 2005

1:20-3:15 p.m. M, 4322 Social Sciences

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This honors seminar examines Einstein's extraordinary impact in physics and culture. The course surveys his life through his education in Germany and Switzerland; his work in the Patent Office in Bern and as a feted Professor in Berlin; and his life as scientific sage in Princeton. A century has passed since the publication of his early work on light quanta and relativity, which allows us to assess both what those works meant in their context, and how their author's extraordinary career has shaped perceptions of science to the present day. We will examine Einstein's papers and key historical studies to help us understand changing concepts of space and time, Einstein's social relations and political views, the relations between theory and experiment in his research, and so-called "Jewish physics" in Nazi Germany. A background in physics will not be assumed, but students should be ready to grapple with Einstein's major conceptual achievements. Developing independent projects, students will be able to investigate how factors as diverse as contemporary technology and modern art may have helped shape or been inspired by Einstein's research. The course requires a series of informal and formal writing assignments, leading up to a research paper of 10-12 pages with a major revision. Students will share their research projects with the class in oral presentations at the end of the semester. Writing Fellows will assist students in honing their ideas and expression.

Book List (University Bookstore and Underground Textbook Exchange)

Required:

Dennis Overbye, *Einstein in Love* (New York: Penguin, 2001).

Course Reader. Available for \$15.00 from the History of Science Department Office, 7143 Social Science. Note that the office is open from 7:30 a.m. - 3:00 p.m. daily (with extended hours through Wed. January 26), and there are no refunds on the reader.

Recommended:

Albert Einstein, *Relativity: The Special and the General Theory* (New York: Three Rivers Press, 1995 [1917])

Arthur I. Miller, *Einstein, Picasso: Space, Time, and the Beauty That Causes Havoc* (New York: Basic Books, 2002)

Our readings are intended to provide an overview of Einstein's work and influence at the same time as introducing the skills of historical research. We will often discuss both primary documents and interpretative historical studies in the same meeting. I

recommend reading the primary sources first – very closely – before going on to interpretative articles and the still more general biographical treatment. That will help you gain a fresh and independent understanding of the period.

Assessment

Assessment is through three primary tasks.

Class Participation (25%)

Class discussion of the assigned readings will be a primary forum for the intellectual work of the seminar, and a participation grade forms a significant component of your assessment. As I approach it “participation” includes regular attendance, completion of the informal assignment discussed below, and especially a willingness to engage actively in our discussions. Given differences in temperament and personality I do not expect all class members to contribute equally all the time, and I have no intention of penalizing people who may be shy or lack the confidence to talk a lot. However, it will be important for everybody to do their best to support the discussion, and I expect everyone to be ready to answer questions when asked.

Discussion Piece

Within the first three weeks of class, each person will be expected to complete one short “Discussion Piece” of 1-2 pages based on one or more of the readings for that week. This should be a forum for discussing the content and significance of particular readings or ideas raised in class. It could involve analysis of one or more of the assigned readings; discussion of a topic raised in our meetings; or a mixture of both. Write about something you find interesting, describing the argument an author has presented and evaluating the evidence they have offered. Do you agree with their point of view? Support your own opinions with concrete examples from course materials.

The discussion piece is to be submitted to me by noon on the Friday *before* the class concerned (if I’m not in my office, please leave a copy in my mailbox). The task will help focus our class discussions and will also provide helpful practice in writing.

Writing Assignments

There are two important writing assignments. In keeping with the collaborative and developmental features of scholarship each incorporates a cycle of draft and discussion on the way to producing the final product. The first assignment is a *research proposal* of about 3 pages. This will set out a potential topic examining Einstein’s work and influence, stating the main arguments you expect to develop and outlining the key primary and secondary sources on which you are likely to draw for evidence and interpretative aid. Think of this as a grant proposal in which you argue for the funding you will need to finish the project you have identified. A good quality draft will be distributed to two people: a fellow class member and a Writing Fellow. (By good quality I mean typewritten, polished, containing appropriate references and so on.)

Your fellow student will critically analyse the overall aim and the resources you expect to use, writing a short report (1-2 pages) that responds briefly to the promise of the topic and identifies any potential weaknesses. This is a response to the content of your proposal. The Writing Fellow will focus on your writing, with the aim of helping you develop, deepen and hone your thinking by gaining control of the writing process through

which ideas take shape and are expressed. They will both comment on the paper and organize a conference meeting in which to discuss the draft with you.

Both kinds of feedback will form the basis for the final version submitted three weeks later. (Note that this means each class member will both produce their own research proposal and comment on someone else's.)

The second assignment is the *research paper* itself. In this case also, you will first produce a good quality draft which will be commented on by your Writing Fellow. An oral presentation of your project to the class will also give you the opportunity to describe your project to others and benefit from their discussion before undertaking revisions and submitting the final version.

The different steps we work through reflect the collaborative nature of good scholarship, and the fact that good writing rests on *rewriting*, taking the opportunity not just to correct spelling and grammatical errors, but to rethink what you are trying to do in a paper, and to assess critically how well you achieve your goals.

Research Proposal, 3 pages (20% in total)

An outline of a project on a topic of your choice, that sets out the main argument you envisage developing, and discusses the primary and secondary material to be used.

March 7	Polished draft due (to be reviewed by peer and Writing Fellow)
March 18 (Fri.)	Peer review of a colleagues' proposal completed (5%) Conference with Writing Fellow completed (draft & review 5%)
April 1 (Fri.)	Final version due (10%)

Research Paper, 10-12 pages (55% in total)

Your contribution to our understanding of Einstein and the modern world, 1905-2005.

April 11–May 2	Oral presentations delivered in class
April 19 (Tue.)	Polished draft due (to be reviewed by Writing Fellow)
May 3 (Tue.)	Conference with Writing Fellow completed (draft & review 15%)
May 10 (Tue.)	Final version due (40%)

Research and Library Resources

The UW-Madison General Library System has over forty libraries, quite a few of which are potentially relevant to topics exploring one or the other facet of Einstein's work and influence. If you are unfamiliar with the campus library system, you can get a useful introduction by doing CLUE (Computerized Library User Education), an interactive, multimedia tutorial, located at <<http://clue.library.wisc.edu>>.

On February 21 we will be holding a workshop session with Robin Rider in Memorial Library to introduce research methods and strategies focused on our work with Einstein in particular. (Dr. Rider is Curator and Head of the Department of Special Collections, and a historian of science.) In addition to the guidance you receive then, continued use of both libraries and reference librarians is likely to be extremely important in developing your research. As you refine your topic it is helpful to work on two fronts: making critical use of secondary sources (the approaches that historians and others have taken to the material before you) and finding and investigating primary sources (books, letters etc. from the people, period, and subject you are interested in).

Secondary Sources

Our first understanding of a field most often comes from interpretative historical accounts. The assigned readings and bibliographical notes in our syllabus will be your most direct guide here, and for your reference the course reader also includes short “Reader’s Guides” on books published before 2000 on Einstein, quantum theory, quantum mechanics, and relativity. A far more extensive coverage of potential secondary sources is provided by an internet bibliography of books and articles in history of science, medicine and technology. RLIN’s History of Science and Technology (HST) database is nicknamed “Eureka” and contains entries in various bibliographies from 1975 to the present.

How to get there:

1. From the Libraries homepage go to Journal, Magazine, Newspapers Databases
2. Go to Databases by Title: H
3. Then go to History of Science, Medicine, Technology (1975-)

While very useful this bibliography only includes material published relatively recently. For older material you should go directly to the cumulative bibliographies of the journals *Isis* or *Technology and Culture*. Of course there are many other bibliographies that will help you navigate through literature on Einstein and related topics. Research and reference librarians will often have invaluable suggestions on ways to approach your interest: ask for help!

Amongst the many websites exploring different facets of Einstein’s work, two are particularly helpful. The Einstein Papers Project has an Einstein Archives Online search < <http://www.einstein.caltech.edu/> >. The American Institute of Physics has an online exhibit on Einstein, Einstein links, and visual archives < <http://www.aip.org/history/> >. There are European and American websites focused on the World Year of Physics at: <<http://www.wyp2005.org/overview.html>> and <<http://www.physics2005.org/>>

Primary Sources

I can’t recommend too strongly the importance of using a variety of materials from the time period and field of interest in order to build historical understanding; and learning how to locate primary sources and interpret them will be an important task. In the case of Einstein we are fortunate enough to have many published collections of his papers and correspondence with various figures. The most important of these is *The Collected Papers of Albert Einstein* (Princeton, NJ: Princeton University Press, 1987-), which now runs to nine volumes spanning from Einstein’s birth in 1879 through to 1921 (writings) and 1920 (correspondence). In addition to short scholarly introductions to different facets of his work, the project has also published a set of companion volumes containing workable translations into English. These books are on reserve at College Library. Other useful collections include Albert Einstein, *Einstein on Peace*, eds. O. Nathan and H. Norden (New York: Simon and Schuster, 1960) and *The Born-Einstein Letters*, trans. Irene Born (London: Macmillan, 1971).

Depending on your topic, journal publications, newspaper collections, literature, artworks, popularisations and biographies may also form potential primary sources. We are particularly fortunate because the UW-M library system has excellent collections of relevant books and journals, and may even have original manuscript holdings relevant to

your interests. Although it is not particularly strong in twentieth century materials, the Special Collections Department of Memorial Library has a number of excellent History of Science manuscript collections. Go to their website [<http://www.library.wisc.edu/libraries/SpecialCollections/>](http://www.library.wisc.edu/libraries/SpecialCollections/) and look under Collections for more details. Robin Rider will be very willing to help interested students individually if you make an appointment. Likewise the History of the Health Sciences Collection in the Ebling Library has extremely good resources (and the curator, Micaela Sullivan-Fowler, even keeps a supply of M&Ms on hand for needy researchers).

Syllabus

All of the material listed below may be found in the Course Reader. Making use of the footnotes and bibliographies included in different papers or chapters will often help open a trail of discovery. For those interested in exploring more deeply the topics discussed in a particular week I have included a section offering more detailed bibliographical notes.

Introduction

Jan. 24 Meetings with Einstein. Introductions.

Jan. 31 Early Days

Selections from *The Collected Papers of Albert Einstein [CPAE]*, Vol. 1: *The Early Years, 1879-1902*, trans. Anna Beck, (Princeton, NJ: Princeton University Press, 1987), Docs. 22, 50, 52, 92, 96, 114, 129 and 130.

Henri Poincaré, excerpts from *Science and Hypothesis* [1902, German transl. 1904] in idem, *The Value of Science*, edited by Stephen Jay Gould (New York: Modern Library, 2001), pp. 73-74, 109-117 and 126-136.

Overbye, pp. 3-92.

Note: Discussion pieces (from 9 students)

Feb. 7 The Patent Office and Relativity

Selections from *CPAE*, Vol. 5: *The Swiss Years, Correspondence, 1902-1914*, trans. Anna Beck, (Princeton, NJ: Princeton University Press, 1995), Docs. 27, 28, 47, 87, 88 and 162.

Albert Einstein, "On the Electrodynamics of Moving Bodies," in John Stachel, ed. *Einstein's Miraculous Year: Five Papers that Changed the Face of Physics* (Princeton, NJ: Princeton University Press, 1998), pp. 123-160, but focus esp. pp. 123-130.

Peter Galison, "Einstein's Clocks: The Place of Time," *Critical Inquiry* 26 (2000), 355-389.

Overbye, pp. 93-160.

Note: Discussion pieces (from 8 students)

Feb. 14 Quantum Theory and The Scientific Community

Selections from *CPAE*, Vol. 5, Docs. 37, 47, 210 and 445.

Martin J. Klein, "Einstein and the Development of Quantum Physics," in *Einstein: A Centenary Volume*, ed. A.P. French, (Cambridge, MA: Harvard University Press, 1979), pp. 133-151.

Thomas S. Kuhn, "Einstein's Critique of Planck," in Harry Woolf, ed. *Some Strangeness in the Proportion* (Reading, MA: Addison Wesley, 1980), pp. 186-191 and 194, and excerpt from, "Afterword: Revisiting Planck," in *Black Body Theory and the Quantum Discontinuity 1894-1912* (Chicago and London: University of Chicago Press, 1987 [1978]), pp. 362-370.

Overbye, pp. 161-218.

Note: Discussion pieces (from 8 students)

Feb. 21 Memorial Library visit

Library workshop with Robin Rider on sources, research strategies and skills, followed by bibliographic prospecting related to potential topics.

Feb. 28 Discussion of Research Proposals

Each student should be ready to outline a tentative proposal for their research project, to provide the basis for an open discussion on aims, sources and strategies.

Mar. 7 General Relativity and the Relations between Theory, Experiment and the Press

Selections from *CPAE*, Vol. 5, Doc. 336; *CPAE*, Vol. 8: *The Berlin Years: Correspondence, 1914-1918*, trans. Ann M. Hentschel, (Princeton, NJ: Princeton University Press, 1998), Docs. 22, 23, 24, 26, 94, 103, 292, 337 and 374.

Alistair Sponsel, "Constructing a 'Revolution in Science': The Campaign to Promote a Favourable Reception for the 1919 Solar Eclipse Experiments," *British Journal for the History of Science* 35 (2002), 439-467.

Overbye, pp. 221-298 and 351-365.

Draft Research Proposal due (to be distributed to a peer and your Writing Fellow)

Mar. 14 Science and Politics: Popular Relativity and "Jewish Science"

Klaus Hentschel, ed. and Ann M. Hentschel, ed. assistant and translator, *Physics and National Socialism: An Anthology of Primary Sources* (Basel, Boston and Berlin: Birkhäuser, 1996: pp. 18-24, 100-109 and 152-157.

Britta Scheideler, "The Scientist as Moral Authority: Albert Einstein between Elitism and Democracy, 1914-1933," *Historical Studies in the Physical and Biological Sciences* 32 (2002), 319-346.

Loren R. Graham, "The Reception of Einstein's Ideas: Two Examples from Contrasting Political Cultures," in Gerald Holton and Yehuda Elkana, eds. *Albert Einstein: Historical and Cultural Perspectives* (Princeton: Princeton University Press, 1982), pp. 107-136.

Overbye, pp. 313-380.

Friday March 18: Peer and Writing Fellow reviews of research proposal completed

Mar. 19-27 Spring Recess

Mar. 28 Modern Physics and Modern Art

David Cassidy, *Einstein and Our World* (Amherst: Humanity Books, 1995), pp. 75-90.

Arthur I. Miller, *Einstein, Picasso: Space, Time, and the Beauty That Causes Havoc* (Basic Books, 2002), pp. 1-8, 85-125.

Anke te Heesen, "News, Paper, Scissors: Clippings in the Sciences and Arts Around 1920," in Lorraine Daston ed. *Things That Talk: Object Lessons from Art and Science* (New York and Cambridge, Mass.: Zone Books, 2004), pp. 297-328.

Friday April 1: Final version of Research Proposal due

Apr. 4 Physics, Philosophy and the Old and Mythic Einstein

Arthur Fine, "The Young Einstein and the Old Einstein," in *The Shaky Game: Einstein Realism and the Quantum Theory* (Chicago: University of Chicago Press, 1986), pp. 12-25.

Philipp Frank, *Einstein: His Life and Times* (Cambridge, MA: Da Capo Press, 2002 [1947]), pp. 265-298.

Alan J. Friedman and Carol C. Donley, "A Myth Portrayed," *Einstein as Myth and Muse* (Cambridge: Cambridge University Press, 1985), pp. 154-194.

Apr. 11 Project presentations (from 6 students)

Apr. 18 Project presentations (from 6 students)

Tuesday April 19: Draft of Research Paper due by 4 p.m. (to be distributed to your Writing Fellow)

Apr. 25 Project presentations (from 7 students)

May 2 Project presentations (from 6 students)

Tuesday May 3: Writing Fellow review and conference completed

Tuesday May 10 Final Paper due by 9:45 a.m.

Bibliographic Notes and Resources

Overviews

Einstein offered his own “obituary” in Paul Arthur Schilpp, ed. *Albert Einstein: Autobiographical Notes* (La Salle, IL: Open Court, 1979). Biographical treatments date from the 1920s and often reflect the period in which they were written. The closest we have to standard biographies are Albrecht Fölsing, *Albert Einstein: A Biography* (New York: Viking, 1997) and Abraham Pais, *Subtle is the Lord ...': The Science and the Life of Albert Einstein* (Oxford: Oxford University Press, 1982). Pais offers the best overall treatment of Einstein’s scientific work. John Stachel’s *Einstein from ‘B’ to ‘Z’* (Boston, Basel and Berlin: Birkhäuser, 2002) also includes very helpful overviews of different facets of Einstein’s research (targeted to different audiences), as do the editorial notes of *The Collected Papers of Albert Einstein* (Princeton: Princeton University Press, 1987-).

Jan. 31 Early Days

Carl Seelig’s documentary biography is particularly strong on the early, Swiss period of Einstein’s life, *Albert Einstein: A Documentary Biography*, trans. Mervyn Savill, (London: Staples Press, 1956).

For studies of Einstein’s social environment see chapters in Lewis Pyenson, *The Young Einstein* (Bristol: Adam Hilger, 1985) and Lewis S. Feuer, “The Social Roots of Einstein’s Theory of Relativity,” in *Einstein and the Generations of Science* (New York: Basic Books, 1974), pp. 3-105. Considerable attention has been paid to Einstein’s relation to his first wife Mileva since the publication of their correspondence in 1987. See Roger Highfield and Paul Carter, *The Private Lives of Albert Einstein* (London and Boston: Faber and Faber, 1993) and on their daughter, Michele Zackheim, *Einstein’s Daughter: The Search for Lieserl* (New York: Riverhead Books, 1999).

For sketches of physics at the turn of the century see J.L. Heilbron, “Fin-de-Siècle Physics,” in Carl Gustaf Bernhard, Elisabeth Crawford, and Per Sörbom, eds. *Science, Technology and Society in the Time of Alfred Nobel* (Oxford: Nobel Foundation, 1982), pp. 51-73; and Helge Kragh, *Quantum Generations: A History of Physics in the Twentieth Century* (Princeton, NJ: Princeton Univ. Press, 1999), pp. 3-26.

Feb. 7 The Patent Office and Relativity

For those interested in popularization, this would be a good point to read Albert Einstein, *Relativity: The Special and the General Theory* (New York: Three Rivers Press, 1995 [1917]), Part I.

A number of studies address perceptions of space and time and the general cultural background to relativity theory. See Peter Galison, *Einstein’s Clocks, Poincaré’s Maps: Empires of Time* (New York and London: Norton, 2003); Wolfgang Schivelbusch, *The Railway Journey: Trains and Travel in the Nineteenth Century* (New York: Urizen Books, 1979) “Railroad Space and Railroad Time,” pp. 41-50; and Stephen Kern, *The Culture of Time and Space 1880-1918* (Cambridge, MA: Harvard University Press, 1983), especially pp. 1-35, 80-81 and 131-154.

The development and reception of special relativity have attracted a great deal of attention. Valuable full length studies include Gerald Holton, *Thematic Origins of Scientific Thought: Kepler to Einstein* (Cambridge, MA: Harvard University Press, 1988 revised ed.), and Arthur I. Miller, *Albert Einstein's Special Theory of Relativity: Emergence (1905) and Early Interpretation (1905-1911)* (Reading, Mass.: Addison Wesley, 1981). For a more recent overview of the relation of Einstein's work to that of his predecessors see Olivier Darrigol, "The Electrodynamical Origins of Relativity Theory," *Historical Studies in the Physical and Biological Sciences (HSPS)* 26 (1996), 241-312.

Harry Collins and Trevor Pinch offer an accessible account of the Michelson-Morley experiment in *The Golem: What You Should Know about Science*, 2nd ed., (Cambridge: Canto, 1998), pp. 27-55 and 151-180. The standard source is Loyd S. Swenson, *The Etherial Aether: A History of the Michelson-Morley Aether-Drift Experiments* (Austin: University of Texas Press, 1972). On Planck's role in the development and reception of relativity see Stanley Goldberg, "Max Planck's Philosophy of Nature and his Elaboration of the Special Theory of Relativity," *HSPS* 7 (1976), 125-160 and Pyenson, *The Young Einstein*, pp. 194-214. For an overview of the early development of the theory in Germany see Richard Staley, "On the Histories of Relativity: The Propagation and Elaboration of Relativity Theory in Participant Histories in Germany, 1905-1911," *Isis* 89 (1998), 263-299. For a study of the fortunes of special relativity in Britain see Andrew Warwick, *Masters of Theory: Cambridge and the Rise of Mathematical Physics* (Chicago and London: University of Chicago Press, 2003), chaps. 7 and 8.

Feb. 14 Quantum Theory and the Scientific Community

Einstein and Infeld offered a popular account of quantum theory in Albert Einstein and Leopold Infeld, *The Evolution of Physics: From Early Concepts to Relativity and Quanta* (New York: Clarion, 1938), pp. 249-297.

The classic accounts of Einstein's work on quantum theory are a series of papers by Martin J. Klein: "Einstein's First Paper on Quanta," *The Natural Philosopher* 2 (1963), 59-86; "Einstein and the Wave-Particle Duality," *The Natural Philosopher* 3 (1964), 3-49; "Einstein, Specific Heats, and the Early Quantum Theory," *Science* 148 (1965), 173-180; "Thermodynamics in Einstein's Thought," *Science* 157 (1967), 509-516. Kuhn gave new emphasis to Einstein's recognition of the role of quantization in the black-body law in Thomas S. Kuhn, *Black-Body Theory and the Quantum Discontinuity 1894-1912* (Chicago and London: University of Chicago Press, 1987), but see also Olivier Darrigol, "The Historians' Disagreements over the Meaning of Planck's Quantum," *Centaurus* 43 (2001), 219-239. Excellent overviews of relativity and quantum theory in the German physics community are provided in Christa Jungnickel and Russell McCormmach, *Intellectual Mastery of Nature: Theoretical Physics from Ohm to Einstein*. Volume 2: *The Now Mighty Theoretical Physics, 1870-1920* (Chicago and London: University of Chicago Press, 1986), pp. 304-321.

Mar. 7 General Relativity and the Relations between Theory, Experiment and the Press

For his popular treatment see Einstein, *Relativity*, Part II and Appendix 3.

For an overview of the conceptual development of general relativity see John Stachel, "The Genesis of General Relativity," in *Einstein from 'B' to 'Z'*, pp. 233-244. Key specialist studies are collected in Don Howard and John J. Stachel eds. *Einstein and the History of General Relativity* (Boston: Birkhäuser, 1989), and subsequent volumes of the series on *Einstein Studies*. The classic account of the eclipse expeditions is John Earman and Clark Glymour, "Relativity and Eclipses: The British Expeditions of 1919 and Their Predecessors," *HSPS* 11 (1980), 49-85. For an assessment of the different proofs of relativity see Clifford M. Will, *Was Einstein Right? Putting General Relativity to the Test* (New York: Basic Books, 1993 [1986]).

Mar. 14 Science and Politics: Popular Relativity and "Jewish Science"

Biographies from this period include that of the journalist Alexander Moszowski, *Einstein the Searcher: His Work Explained from Dialogues with Einstein*, trans. Henry L. Brose (London: Methuen, 1921), and one by Einstein's son-in-law Anton Reiser, *Albert Einstein: A Biographical Portrait* (London: Thornton Butterworth, 1931)

There are accounts of the scientific and popular reception of relativity in different countries in Glick, *The Comparative Reception*, and Stanley Goldberg, *Understanding Relativity: Origin and Impact of a Scientific Revolution* (Boston: Birkhäuser, 1984). On the popular response in particular see Alan J. Friedman and Carol C. Donley, "The Popularization of the New Ideas," in *Einstein as Myth and Muse* (Cambridge: Cambridge University Press, 1985), pp. 7-25, and Michel Biezunski, "Popularisation and Scientific Controversy: The Case of the Theory of Relativity in France," in Terry Shinn and Richard Whitley, *Expository Science: Forms and Functions of Popularisation* (Dordrecht: Reidel, 1985), pp. 183-94.

In addition to the excellent introduction to Hentschel's volume, on Einstein and the political environment of Germany see Alan D. Beyerchen, "The Background," in *Scientists Under Hitler: Politics and the Physics Community in the Third Reich* (New Haven : Yale University Press, 1977), pp. 1-14, 211-214; Fritz Stern, "Einstein's Germany," in Holton and Elkana, eds. *Albert Einstein*, pp. 319-343.

Mar. 28 Modern Physics and Modern Art

As well as Miller's study of Einstein and Picasso, and Friedman and Donley's volume, general studies of Einstein's impact in art and literature include Meyer Schapiro, *The Unity of Picasso's Art* (New York: George Braziller, 2000); Roslynn D. Haynes, *From Faust to Strangelove: Representations of the Scientist in Western Literature* (Baltimore: Johns Hopkins University Press, 1994); Michael H. Whitworth, *Einstein's Wake: Relativity, Metaphor, and Modernist Literature* (Oxford: Oxford University Press, 2001).

Apr. 4 Physics, Philosophy and the Old and Mythic Einstein

Philipp Frank's biography was the first to picture Einstein as a divided figure; and Clark set out to critically appraise the myth and reminiscence dominating earlier biographies in Ronald W. Clark, *Einstein: The Life and Times* (New York and Cleveland: The World Publishing Company, 1971). There is a treatment of Einstein's life in the U.S. in Jamie Sayen, *Einstein in America: The Scientist's Conscience in the Age of Hitler and Hiroshima* (New York: Crown Publishers, 1985).

On Einstein's critique of quantum theory see in addition to other chapters in Fine's philosophical study the account of his sparring partner Niels Bohr, "The Bohr-Einstein Dialogue," in A.P. French and P.J. Kennedy, eds. *Niels Bohr: A Centenary Volume* (Cambridge: Harvard University Press, 1985), pp. 121-40.

Interesting facets of Einstein's thinking on social questions and religion are indicated in Albert Einstein, "Science and Religion (I-1939; II-1949)," "The Common Language of Science (1941)," and "Why Socialism? (1949)," in *Out of My Later Years*, (New York: Philosophical Library, 1950), pp. 25-33, 107-109 and 119-126. For studies of Einstein and religion see William F. Lawhead, "Religion, Relativity, and Common Sense: Einstein and the Religious Imagination," in Dennis P. Ryan, ed. *Einstein and the Humanities* (New York, West Port, Conn. and London: Greenwood Press, 1987), pp. 37-45; Roy D. Morrison II, "Einstein on Kant, Religion, Science and Methodological Unity," *ibid.*, pp. 47-57. For a valuable recent study see Max Jammer, *Einstein and Religion: Physics and Theology* (Princeton University Press, 1999). Roy D. Morrison II takes a highly philosophical approach to the subject in *Science, Theology and the Transcendental Horizon: Einstein, Kant and Tillich* (Atlanta, GA: Scholars Press, 1994).