

# History of Physics

NEWSLETTER

A FORUM OF THE AMERICAN PHYSICAL SOCIETY • VOLUME XIV • NO. 1 • FALL 2018

## April Session Report: “The Legacy of Richard Feynman”

By Alan Chodos

Richard Feynman was born in 1918, and the centennial of his birth was celebrated at the APS April Meeting with the theme “A Feynman Century.” The theme was reflected in many sessions at the meeting devoted to science. The Forum on History, however, fulfilled its mission by organizing an invited session, The Legacy of Richard Feynman, that primarily dealt with Feynman the individual.

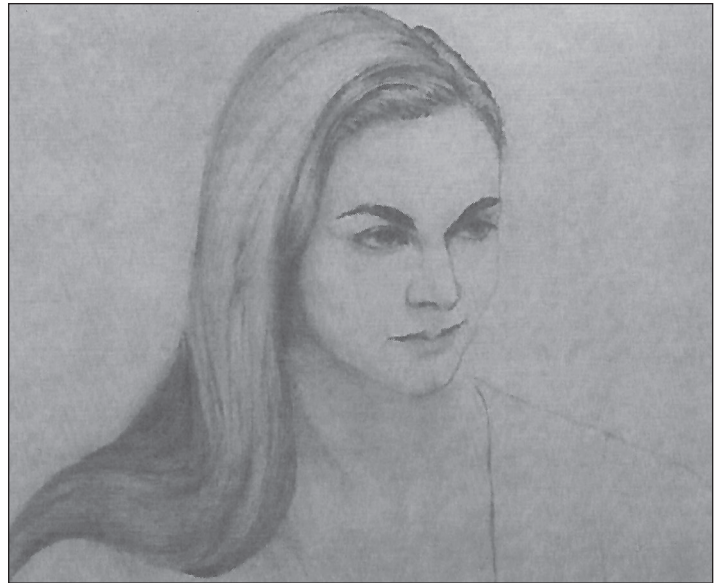
The three speakers were Paul Halpern of the University of the Sciences in Philadelphia, John Preskill of Caltech, and Virginia Trimble of the University of California, Irvine.

Halpern is the author of the recent book, *The Quantum Labyrinth*, about the relationship between Feynman and his Princeton thesis advisor, John Wheeler. Halpern distilled three ways in which the careers of these two giants displayed parallel characteristics: learning by teaching, thinking in pictures, and embracing seemingly crazy ideas.

Halpern revealed that Feynman chose Princeton for graduate work because of its new cyclotron with a 50-ton magnet; Feynman wanted to be close to experimental developments. He thought he would work with Wigner, but was randomly assigned to Wheeler, only 8 years his senior, as an advisor, and the two hit it off. They collaborated on an unconventional formulation of electrodynamics that used advanced and retarded potentials and did away with the field concept in an effort to tame the infinities of quantum field theory. Although in the end it didn’t work, it was a crucial stepping stone to Feynman’s later development of his path-integral approach, to which Wheeler gave the name “sum over histories”.

Throughout their careers, Wheeler was the one who tended to come up with the crazier ideas, and used Feynman as a sounding board. Feynman was often able to extract the kernel of truth from Wheeler’s insights. Both men had a keen interest in art. Wheeler took art lessons during a sabbatical in Paris, and Feynman seriously pursued painting and especially drawing during his time at Caltech, an activity that Trimble described from a more personal perspective in her talk (see below).

Preskill overlapped for about 5 years with Feynman at Caltech in the 1980s, from 1983 when he arrived there to Feynman’s death in early 1988. In addition to his own recollections, in his talk Preskill assembled observations of and about Feynman from numerous other physicists, such



Richard Feynman’s drawing of Virginia Trimble, sometime in the mid-1960s, when he was using her as a model.

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# Session Report: “Historical Trends Across the Disciplines”

By Daniel Kennefick

The only April session featuring contributed historical talks took place on Sunday morning. One invited talk was added to the session, the talk given by the FHP’s first essay contest winner Ryan Chaban. This talk was very well received and helped to anchor the session. Chaban’s subject was General Atomic’s contribution to

Fusion research and his talk was both entertaining and informative. Virginia Trimble, who also spoke in the Feynman session, gave an interesting talk on the difficulties experienced in the 19th century in organizing transit of Venus and eclipse expeditions. Don Salisbury gave a talk which bridged the divide between history and physics, discussing

a successful path towards a quantum gravity theory in vacuum. Finally, Per Carlson concluded the session with an entertaining talk discussing how Carl Anderson’s famous positron cloud chamber track could have been an upward moving positron.

## History of Physics NEWSLETTER

The Forum on History of Physics of the American Physical Society publishes this Newsletter biannually at <http://www.aps.org/units/fhp/newsletters/index.cfm>. Each 3-year volume consists of six issues.

The articles in this issue represent the views of their authors and are not necessarily those of the Forum or APS.

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# Session Report: “Dark Matter & Galaxies: The Legacy of Vera Rubin”

By Daniel Kennefick

A session co-sponsored with FPS and DAP in honor of the astronomer Vera Rubin featured two invited presentations and a segment of audience participation. Annika Peter gave a very accessible account of the impact of Rubin’s work on modern astrophysics and cosmology. Deidre Hunter gave an engaging personal account of Rubin. Her story about the refusal of a famous observatory to grant observing time to Rubin on the grounds that they had no woman’s bathroom, excited a great deal of commentary and a few amusing anecdotes from the audience in the last part of the session, which also featured further personal reminiscences of Rubin from members of the audience. The session was ably chaired by Beverly Hartline of FPS.



Vera Rubin

# Session Report: History of Women Pioneers in Astronomy

By Daniel Kennefick

A session co-sponsored with DAP was held to mark the 150th anniversary of the birth of Henrietta Swan Leavitt. It opened with a talk by acclaimed author Dava Sobel on Leavitt and Celia Payne and the women computers of the Harvard Observatory. She discussed the role of the Observatory's director Edward Pickering in promoting women contributors to astronomy. Alan Lightman, who had been unable to attend due to a flight cancellation, gave his talk via audio link. He gave some additional little-known details on the life of Leavitt and the session closed with a presentation by Adam Reiss on the most recent work using Leavitt's law to calibrate supernova measurements of the rate of acceleration of the Universe's expansion. The session thus managed to combine the purely historical with the current relevance of the work of 19th century women astronomers such as Leavitt. The session was chaired by Priya Natarajan and was well attended with an interested audience.



*Dava Sobel*



*Adam Reiss*

## History of Physics

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# Session Report: The Chapel Hill Conference and its Role in the Renaissance of General Relativity

By Daniel Kennefick

The very last session of the April meeting looked at the role of the 1957 Chapel Hill conference in the development of general relativity and had four speakers, two of whom were present at Chapel Hill. The first talk by Peter Saulson discussed how a presentation by Felix Pirani at the conference in 1957 convinced relativists that gravitational waves were a real phenomenon. Dieter Brill then discussed

the contributions to the conference from John Wheeler's research group, in which he was a graduate student at the time. Historian Dean Rickles then gave the background to the conference's organization and planning and he was followed by Josh Goldberg who, in his role at the Air Force's research lab at Wright-Patterson Air Force base was responsible for funding the conference. The session was remarkably well

attended considering it came at the end of the conference and the talks were all very interesting and enjoyed by the audience, who stayed on afterwards for an animated and extended discussion of the conference. This was ably facilitated by session chair Don Salisbury.



*Peter Saulson*



*Josh Goldberg*



*Dean Rickles*



*Dieter Brill*

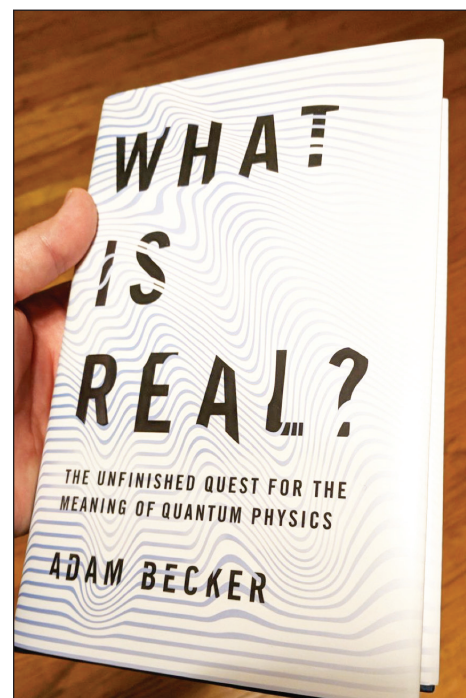
# Session Report: What is Real? The Unfinished Quest for the Meaning of Quantum Physics

Author: Adam Becker, Basic Books, 2018

This book explores a question which should have been bugging all physicists who have used quantum mechanics since its advent in the 1920's – What does it mean? What is the relation between the particles we observe to the wave mechanics we use to reliably and correctly predict our observations? Its prime “heroes” are Bell, Bohm, Bohr, and Einstein, though many others are brought into the picture. The Copenhagen interpretation, pilot waves, many worlds, Bell’s theorem, EPR, decoherence, superposition, entanglement, determinism, measurement, etc., are repeatedly qualitatively discussed. A great deal of history, philosophy, politics, and personalities, are fruitfully incorporated. The problem of quantum measurement is repeatedly brought up, from the views of the various authors mentioned and, at the book’s end, the author concludes: he

doesn’t know what it means, a quandary with which I concur. The book is primarily aimed at the non-physicist, and so there is no mathematics or specific ideas such as the relation between “particle” and its “pilot wave”, or the meanings of “decoherence” and “entanglement”. But the book is a good read and is highly recommended for the physicist who wishes to question the foundations of his subject. Certainly, it refreshed many questions from my long-ago student days and raised new questions for me to think about. The questions are all there; the answers are yet to come.

Alvin M. Saperstein, Emeritus  
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## FHP Essay Contest: Report on 2018

Flavio Del Santo, a doctoral student at the University of Vienna, has won the 2018 Essay contest sponsored by the Forum for the History of Physics (FHP) for his essay entitled “Striving for Realism, not for Determinism: Historical Misconceptions on Einstein and Bohm.” His doctoral research is conducted at the Institute for Quantum Optics and Quantum Information of the Austrian Academy of Sciences. He is also associated with the Basic Research Community for Physics. Del Santo’s essay was highly praised by the competition judges and it will be published in *APS News*. The judges (who are the members of the FHP’s Executive Committee) selected two finalists from 11 entries in the competition and the runner-up was Grigoris Panoutsopoulos of the National and

Kapodistrian University of Athens, whose essay entitled “Maintaining the Balance between Unity and Disunity in the era of Big Science: The case of the ‘Sister Experiments’ UA1 and UA2 at CERN” was also very well regarded by the judges. He is a doctoral student in the History and Philosophy of Science.

This is the second year in which the FHP’s essay contest has been held. Its goal is “to promote interest in the history of physics among those not, or not yet, professionally engaged in the subject. Entries can address the work of individual physicists, teams of physicists, physics discoveries, or other appropriate topics.” The competition provides a stipend of \$1000 for the winner, with \$500 going to the runner-up. The contest is aimed primarily at undergraduate or graduate students with an interest in the history



Flavio Del Santo

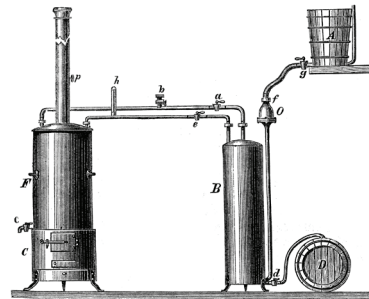
of physics, but is open to anyone who has not (yet) received a PhD in either history or physics.

# 2019 History of Physics Essay Contest

The Forum for History of Physics (FHP) of the American Physical Society is proud to announce the **2019 History of Physics Essay Contest**.

The contest is designed to promote interest in the history of physics among those not, or not yet, professionally engaged in the subject. Entries can address the work of individual physicists, teams of physicists, physics discoveries, or other appropriate topics. Entries can range from about 1500-2000 words, and while scholarly should be accessible to a general scientific audience.

The contest is intended for undergraduate and graduate students, but open to anyone without a PhD in either physics or history. Entries with multiple authors will not be accepted. Entries will be judged on originality, clarity, and potential to contribute to the field. Previously published work, or excerpts thereof, will not be accepted. The winning essay will be published as a Back Page in *APS News*, and its author will receive a cash award of \$1000, plus support for travel to an APS annual meeting to deliver a talk based on the essay. The judges may also designate one or more runners-up, with a cash award of \$500 each.



**Entries will be judged by members of the FHP Executive Committee and are due by September 1, 2019.** They should be submitted to [fhf@aps.org](mailto:fhf@aps.org), with "Essay Contest" in the subject line. Entrants should supply their names, institutional affiliations (if any), mail and email addresses, and phone numbers. Winners will be announced by December 1, 2019.

## FHP March and April Sessions

### March Sessions

**Monday 3/4 8:00**

The Author in Dialogue: David Kaiser's "How the Hippies Saved Physics"

**Monday 3/4 2:30**

Foundations of Physics Debate: How Should We Interpret The Formalism of Quantum Mechanics?

**Tuesday 3/5 8:00**

History of Contemporary Chinese Physics

**Tuesday 3/5 11:15**

How Physicists Communicate (FGSA Co-Sponsor)

### April Sessions

**Saturday 4/13 10:45**

Remembering Julian Schwinger (DPF co-sponsor)

**Saturday 4/13 3:30**

Secrecy and Espionage in Science (FPS co-sponsor)

**Sunday 4/14 8:30**

Centennial of the Eddington Eclipse Expedition (DGRAV co-sponsor)

**Sunday 4/14 3:30**

Pais Prize Session: Helge Kragh



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as Matthew Sands, Steven Weinberg, Murray Gell-Mann, Robbie Vogt, Paul Steinhardt, Michael Turner and Sidney Coleman.

The picture that emerges is of someone who pursued his own way, without paying much attention to current fashions. For example, Feynman caused Gell-Mann great frustration, which developed over the years into mutual antagonism, with his parton model (Gell-Mann called them "put-ons"). Gell-Mann felt that Feynman had merely reformulated aspects of the quark model while deliberately refusing to call them quarks.

As described by Weinberg, Feynman could be extremely intimidating to seminar speakers. But in his lectures at Caltech, Feynman put a lot of effort into his interactions with students. Preskill described in some detail the genesis of the famed Feynman Lectures, including the anecdote that Feynman was at first reluctant to participate, until Sands told him that, as far as he knew, no great physicist had ever given a course of lectures for freshmen. That piqued Feynman's interest and he agreed to do it.

In addition to the Feynman Lectures, over many years Feynman also gave a course for freshmen dubbed "Physics X", in which students could ask him virtually anything and the discussion ranged widely. Conventional questions relating to derivation of formulas or homework problems were not allowed; as Steinhardt said, it had to be about "trying to understand something." As Michael Turner recalled, "in those days [the late '60s] Feynman was everyone's hero: the students and the faculty. I'm not sure who worshipped him more." (This was not, however, true of Gell-Mann. In the *Physics Today* memorial issue published a year after Feynman's death, all the contributions are hagiographic, except for that of Gell-Mann, who barely avoids speaking ill of the dead.)

Preskill devoted some time to describing Feynman's interest in simulating physics with computers, focusing on a lecture Feynman gave at MIT in 1981 (more than 20 years after his



Paul Halpern



John Preskill

perhaps more famous talk "There's Plenty of Room at the Bottom" about the possibilities of nanotechnology). Feynman clearly foresaw the advent of quantum computers, although there is some controversy as to whether he appreciated their potentially vast improvement in computing power over classical computers.

Trimble's talk consisted of rapid-fire anecdotes that greatly entertained the audience, but to which it is difficult to do justice on the page. She enjoyed a close personal relationship with Feynman over the last 25 or so years of his life, beginning in the mid '60s, when Feynman was learning to draw and she, then a graduate student at Caltech (one of the very few women) was one of his models. She showed a drawing that Feynman did of her from that time, and recounted that while she was posing, Feynman would often talk non-stop, because, as she said, he didn't like silence, and "he'd talk if you didn't."

Some years after Feynman's tragic first marriage (his wife Arline died of tuberculosis shortly after their wedding), Feynman married Mary Louise Bell. It was an unhappy marriage that Trimble illustrated with the well-known Thurber cartoon from the *New Yorker*, in which a man approaches his house with a gigantic image of his wife lurking menacingly. By the time Trimble knew him, Feynman had undertaken a successful 3rd marriage with 2 children.

Trimble claimed that the legend of Feynman studying Spanish to prepare for a trip to Brazil is at least somewhat true, it not being clear at what point he realized his mistake. In any case, she showed some pages from books he read (in English) about the European conquest of Peru and Mexico – these were serious works of scholarship that perhaps belied the impression one gets from Feynman's own books of a happy-go-lucky character who takes physics very seriously but not much else.

Feynman was very attractive to women, and enjoyed close relationships with many of them, but, according to Trimble, none regretted their association. (Given the large number of such liaisons documented in James Gleick's biography of Feynman, this statement seems unlikely on purely statistical grounds).

In Trimble's last memory of Feynman, she visited Caltech for what she thought would be a lunch date with him. She waited for him outside the room where he was giving a lecture, and could hear his voice on the other side of the door. But when the lecture ended, Feynman, in ill health, headed straight home.

She never saw him again. He succumbed soon after to the cancer that he had battled for a decade, at the age of 69.

# April Session Report: Staged Reading of the Play Flight

By Brian Schwartz, Brooklyn College and the Graduate Center of CUNY

The Forum on the History of Physics sponsored a staged reading of the play titled *Flight* by the playwright Arthur Giron at the April meeting of the Society. The play is about Orville & Wilbur Wright: two American brothers, inventors, and aviation pioneers. The Wright brothers are generally credited with inventing, building, and flying the world's first successful airplane. The action of the play takes place in the Wright's hometown Dayton, Ohio in the late 19th century and at Kitty Hawk, North Carolina, in the early 1900s. The play *Flight* was specifically chosen because the Society was meeting in Ohio (Columbus). The playwright makes use of some basic biographical facts and supposed what it was like for Orville and Wilbur growing up in the dysfunctional Wright family. The play explores the lives of the

Wright family in warm and comic theatrical terms. The playwright does not claim it happened exactly as the play story. It is not a documentary. The play involves five real life characters, the Wright brothers, their parents and Otto Lilienthal, a German pioneer of aviation who became known as the flying man. Lilienthal was the first person to make well-documented, repeated, successful flights with unpowered airplanes. The Wright Brothers had extensive contact with Otto and they credit him as a major inspiration for their decision to pursue manned flight.

Actors associated with the Available Light Theatre Company in Columbus, Ohio performed the staged reading. <http://avltheatre.com/> The Company is dedicated to building a more conscious and compassionate world by creating joyful and profound theatre

serving the community. The playwright, Arthur Giron, is the co-playwright of the recent 2015 Broadway Musical, *Amazing Grace*. He has written fifteen plays. Among them are the science-based plays, *Emilie's Voltaire*, winner of the Galileo Prize and the play *Moving Bodies* about the life of Richard Feynman which was performed as a staged reading at the March 2017 meeting of the APS in New Orleans. Arthur's play *Flight* toured 120 US cities. Arthur was Head of Graduate Playwriting at Carnegie Mellon University. He is a founding member of the Ensemble Studio Theatre in New York. The play director, some of the actors, Brian Schwartz, CUNY and Smitha Vishveshwara, University of Illinois, conducted a talkback discussion with the audience after the play reading.



*Aviation pioneers Orville and Wilbur Wright made history December 17, 1903, with the first powered and sustained flight*