

Remembering Professor Steven Weinberg besides his major contributions to fundamental physics and a PS

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Abstract

As a theoretical physicist—being taught by him in the early 1960s at UC Berkeley, continually in touch with him until his passing on 7/23/2021, and forever inspired and guided by what he wrote and said—here I give my informal reminiscences about Professor Steven Weinberg with anecdotes besides his landmark contributions to fundamental physics.

Professor Steven Weinberg passed away on 7/23/2021, as reported by
[UT Austin Mourns Death of World-Renowned Physicist Steven Weinberg \(utexas.edu\)](#) and
[Steven Weinberg, Groundbreaking Nobelist in Physics, Dies at 88 - The New York Times \(nytimes.com\)](#)

He made major contributions to the advancement of our knowledge about the fundamental laws of nature: "*contributions to the theory of the unified weak and electromagnetic interaction between elementary particles*" as cited by [The Nobel Prize in Physics 1979 - NobelPrize.org](#) and "*continuous leadership in fundamental physics, with broad impact across particle physics, gravity and cosmology, and for communicating science to a wider audience*" as cited by the 2020 [Breakthrough Prize – Fundamental Physics Breakthrough Prize Laureates – Steven Weinberg](#).

The news of Steve's passing surprised and deeply saddened me. I had the good fortune of having him as one of my professors and friends while becoming and being a theoretical physicist. Here I recall some anecdotes that are besides his celebrated major contributions to fundamental physics as already described in the web pages given above.

On 2/26/2021 at the remote video meeting Memorial for Lay Nam Chang, Dean and Professor at Virginia Tech and Steve's first Ph.D. student at UC Berkeley in the early 1960s, he gave a heartfelt and gracious eulogy, expressing his appreciation of Lay Nam. He looked healthy and sounded strong.

As a graduate student contemporary with Lay Nam, my words of remembrance directly followed Steve's, thanks to the arrangement by the organizers. I recalled the stimulating environment that Lay Nam and I experienced at the beautiful UC Berkeley campus in the early 1960s, the first-rate physics while so many new particles were being discovered at the Lawrence Lab, along with the world-changing social movements happening on campus. In addition, I thanked Steve for having taught us general relativity, for his continuing guidance and inspiration

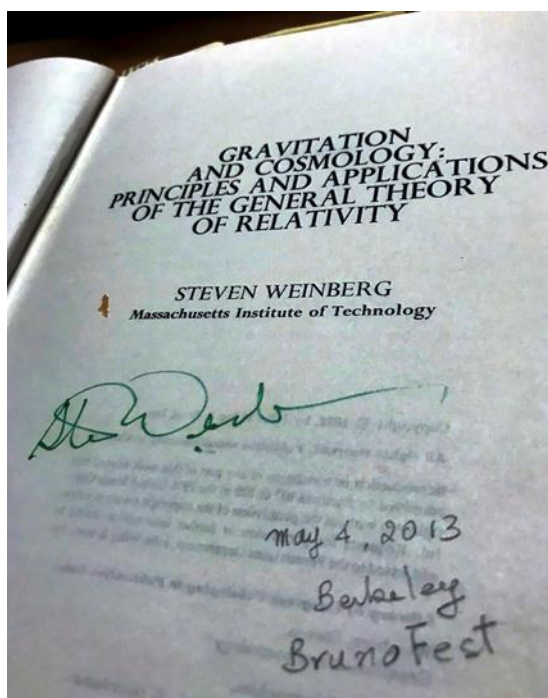
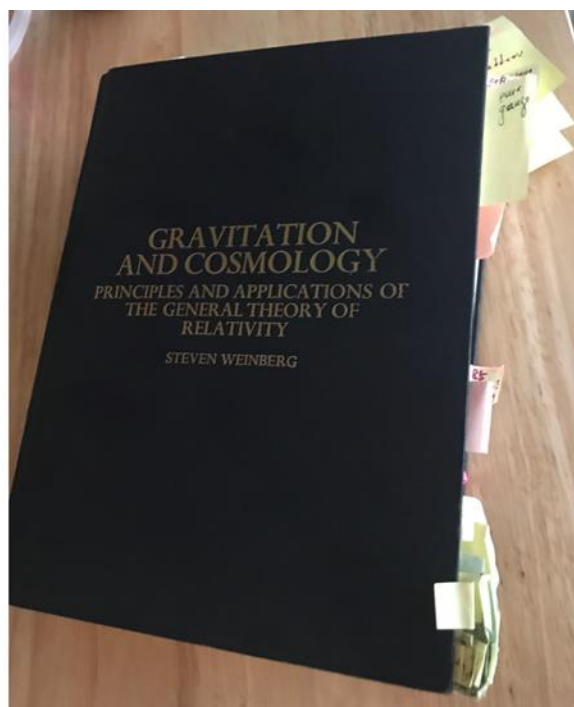
afterwards, and for his deeply profound advice about teaching (more on that below). Many attended the Memorial, and it was the last time for many of us to see Steve: sad but also precious.

Steve was a member of the committees of my Ph.D. thesis and Oral exam, while Geoff (Professor Geoffrey Chew) was my thesis advisor. Before I got my Ph.D. in 1966, Steve started to teach a course on Einstein's general relativity (GR), using his own notes for a book. I diligently attended his classes and took notes, although I had already finished all the required courses and GR was not related to my Ph.D. research subject.

Steve always walked energetically. You could hear him when he was coming or going. For the GR course, he gave two 2-hour-long lectures per week. He wrote all the equations on a blackboard in chalk, and read aloud all the Greek sub and superscripts of Einstein's equations while writing and walking energetically in front of the blackboard for an hour and then, after a short break, for another hour! It was quite an unforgettable experience, both of him and of GR!

In 1972 he published his 657-page book, "*GRAVITATION AND COSMOLOGY: PRINCIPLES AND APPLICATIONS OF THE GENERAL THEORY OF RELATIVITY*", which he dedicated to his wife Louise. I bought it right away, studied it, and have used it ever since. It also started my habit of owning and studying GR and cosmology books — volumes of them! I published papers about GR, e.g., on the integrability properties of supersymmetric gravity theories.

Below are two photos of my copy of Steve's GR book, including one of the inside pages that has his autograph from 2013 at Berkeley during the celebration of the 90th birthday of Professor Bruno Zumino (Bruno90).



After his book on GR, he continued to write advanced textbooks. A partial list includes "*The Quantum Theory of Fields*", 1995, vol. I, 609 pages; 1996, vol. II, 419 pages; and 2000, vol. III, 489 pages and "*Cosmology*", 2008, 593 pages, dedicated to his wife Louise, daughter Elizabeth, and granddaughter Gabrielle. The page numbers illustrate the voluminousness of the books and the dedications show his love of family. When studying his books and papers,

one cannot avoid being impressed by and appreciative of his thoroughness in providing references, in addition to his prowess in producing and writing the content!

For the general public, Steve also wrote many books on cosmology and particle physics. The first one was the 1977 *"The First Three Minutes: A Modern View of the Origin of the Universe"*. The 1993 edition has the Afterword: *Cosmology Since 1977*, giving important updates of the impressive progress of the field and also affirming the continuing validity and relevance of the original book. Besides the dazzling contents of the book, the rigor and details he gave to the units are exceptional even though the book was meant for the general public. That fact not only did not take away the accessibility of the book to the general public, but also added to the value of the book for experts.

It is hard to imagine how he managed to write all these high quality and authoritative books in addition to accomplishing his original research work that were not only honored by prizes such as the Nobel and the Breakthrough, but will last as long as there are humans!

At Bruno90 in Berkeley 2013, I asked Steve, "How do you manage to write those books in addition to writing papers about your original research?" He replied, "I've been asked about that a lot. My standard answer is 'I don't do lot of things other people do, like going to operas, skiing, etc.'" I replied "But that is only necessary, not sufficient!" He laughed. For sure, he was one of the, if not the, most time-conscious efficient person!

Besides research papers, advanced textbooks, and popular books about the frontiers of particle physics and cosmology, Steve also wrote short articles. For example, his one-page-ish book review, [Oppenheimer: Portrait of an Enigma: Physics Today: Vol. 58, No. 1 \(scitation.org\)](#) January 2005, shows his skill as a writer and his insightfulness about people. At the end of the article, he related an anecdote about Oppenheimer: *I remember that once as a postdoc at Columbia University, I was invited to give a talk at the Institute on some of my recent work. My talk was terribly formal, bristling with mathematical complications. Oppenheimer interrupted me and said that I reminded him of himself when he was my age. I stupidly blurted out "Thank you," to which he gravely replied, "It wasn't a compliment."*

At Bruno90, I said to Steve, "Your textbook writings remind me of Landau and Lifshitz, but you are writing them all by yourself!" He replied, "Thank you, I consider your statement a compliment." I said, "Great, I sincerely meant it!" We both laughed, having in mind what Oppenheimer had said to him as he quoted above.

[I then quickly and briefly mentioned to him about Oppenheimer's influence on me as a theoretical physicist, which I detour to talk a bit here. I had read and heard so much about Oppenheimer. With deep regret, I missed meeting him in person by a few months. He had been the Director of the Institute for Advanced Study (IAS) since 1947. His phenomenal skill in recognizing talented people and organizing them was well established in his carrying out the Manhattan Project. As the Director of the IAS, he took hiring people seriously. In 1966, the IAS under his directorship recruited and offered me a two-year 1967–1969 appointment. By the time I arrived at the IAS, he had already passed away in February 1967. As the story goes, when dying from a serious sickness, he was still talking about who were hired in 1966, mentioning "XX is good." XX was among my young colleagues at the IAS. The quote by Oppenheimer saying "XX is good" became XX's claim of fame ever since. Almost all the theoretical physicists there, with diverse research directions and varied seniorities and from many countries, were hired when he was the Director. It happened that Murray Gell-Mann was also there for one whole year on sabbatical. Murray, who passed in 2019, was and still is one of the most distinguished theoretical physicists. He proposed the particles he called quarks as the basic few building blocks for all baryon particles like protons and neutrons as well as the zoo of particles that were continually being discovered at the Lawrence Lab. For that he was awarded the 1969 Nobel Prize. He was also one of the proponents of QCD as the theory for strong interactions. Therefore, my horizon in theoretical physics was further opened up and extended by the influence of Oppenheimer's Directorship, continuing my good luck of being at the right place at the right time. My first

job offered by the IAS under his Directorship had also started my lucky streak of always being recruited and never having to personally apply for jobs as a theoretical physicist.]

It would be remiss of me not to mention the following anecdote about how I got Steve's advice about teaching. In the early 1980s, my son went to the Philip Exeter Academy for high school. They asked me to give a talk at one of the morning assemblies of the whole academy about exciting developments in physics. I decided to give a talk with the title "Physics of Charm and Beauty Particles" about some of the exciting physics I was working on. Exeter is the second oldest prep school in the US (three years younger than the Philip Academy at Andover founded in 1778) and has the following distinction among other things, as described in [Abraham Lincoln in New Hampshire: Elwin L. Page, Mike Pride, Mike Pride: 9780981821511: Amazon.com: Books](#) : "*On February 29, 1860, Abraham Lincoln arrived in Exeter, New Hampshire, to visit his oldest son, Robert, a student at Phillips Academy. During the next three days, he made four speeches in New Hampshire that helped to propel him to the presidency.*" (See also [Lincoln Sesquicentennial — Exeter Historical Society \(exeterhistory.org\)](#).) Since then, as a tradition, youngsters at Exeter have been treated with speeches by presidential candidates. I was excited by the challenge of talking to the students about the frontiers in particle physics, but also nervous.

For advice, I wrote to Steve, whose daughter had already graduated from the Philips Academy at Andover. He quickly wrote back with the following advice (which I have not seen published by him anywhere else):

"Consider that the students have infinite wisdom, but zero knowledge!"

Wow, so wise and thoughtful!

Steve will be dearly missed, and what he had done will be in the hearts and minds as long as there are humans!

PS

It has been a few tough years for me. Also gone are my two other close professors in the 1960s at Berkeley, with whom I had continued to keep in touch until their passing, Stanley Mandelstam in 2016 and Geoffrey Chew in 2019. Here are some of my remembrances:

<http://chau.physics.ucdavis.edu/Chau-PhysicsToday-obi-Mandelstam-2017May.pdf>

<http://chau.physics.ucdavis.edu/Chau-biogSlctPaprr-Mandelstam-Memo-WS-2017-dstPost.pdf>

<http://chau.physics.ucdavis.edu/Chau-remember-Prof-Chew-inMemoVol-WS-postd2021Jan.pdf> .