RICHARD **FEYNMAN**

Title: Feynman Diagrams

Biography:

Richard Phillips Feynman (1918–1988) was an American theoretical physicist known for his work in the path integral formulation of quantum mechanics, the theory of quantum electrodynamics, and the physics of the superfluidity of supercooled liquid helium, as well as in particle physics for which he proposed the parton model. For contributions to the development of quantum electrodynamics, Feynman received the Nobel Prize in Physics in 1965 jointly with Julian Schwinger and Shin'ichirō Tomonaga. Feynman developed a widely used pictorial representation scheme for the mathematical expressions describing the behavior of subatomic particles, which later became known as Feynman diagrams. During his lifetime, Feynman became one of the best-known scientists in the world. In a 1999 poll of 130 leading physicists worldwide by the British journal *Physics World,* he was ranked as one of the ten greatest physicists of all time (en.wikipedia.org/wiki/Richard_Feynman).

Description:

In work and play, Feynman was a distinctively visual thinker. He achieved fame as a theoretical physicist by making sense of the interactions of elementary particles, and in the process inventing the Feynman diagrams that illustrated these interactions. For Feynman to do physics was to write and draw.

When an interviewer suggested that "the work was done in your head, but the record is still here," Feynman protested. "No, it's not a *record*," he said. "It's working. You have to work on paper, and this is the paper." The work in this exhibition, then, is not a record of Feynman's work; it is an opportunity to directly experience a portion.

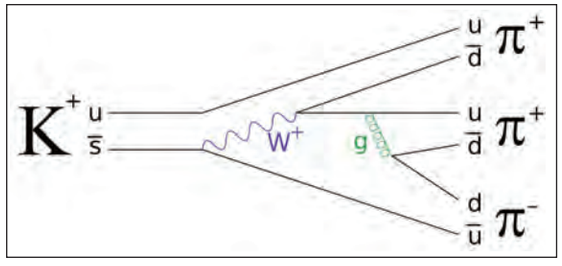
Writing and drawing were also part of Feynman's life beyond his research. He brought his poetry into the physics classroom, and in middle age learned how to draw and paint in order to share his vision of the world.

Feynman's sensory imagination was not only visual; he relied not only on the mind's eye, but also on the mind's ear. Feynman played drums throughout his adult life, and heard rhythm and tempo in physics. Filling out a questionnaire for psychologists studying how scientists think, he checked off "visual images" from a list, but wrote in "acoustic images" too, and in interviews he spoke of perceiving the "jiggle-jiggle-jiggle" of physical phenomena.

Finally, Feynman was a performer. He wrote and drew to teach himself, but spoke to teach others, and his most widely read books—*The Feynman Lectures on Physics* and two memoirs, *Surely You're Joking, Mr. Feynman* and *What Do You Care What Other People Think?*—are each based on transcripts of Feynman the orator.

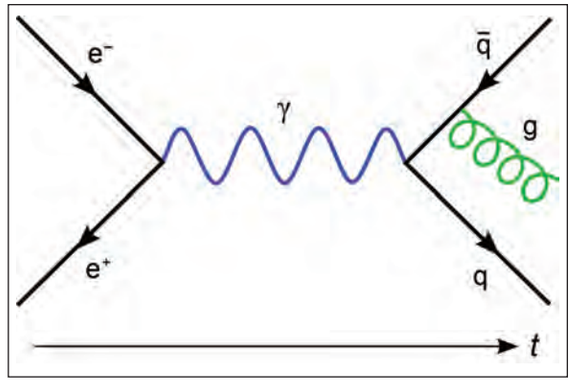
The images shown here trace not only how Feynman thought and how he experienced the world, but also the events and accomplishments of his life and work, from youth to the Manhattan Project to quantum electrodynamics, and then from *The Feynman Lectures* to the origins of nanotechnology to investigating the explosion of the Space Shuttle *Challenger*. This is a mind at work. This is the paper.

Text courtesy of Peter S. Collopy, University Archivist and Head of Archives and Special Collections, Caltech Library, Caltech, Pasadena, California



Title: Gluon Radiation

In this diagram, a kaon, made of an up and strange antiquark, decays both weakly and strongly into three pions, with intermediate steps involving a W boson and a gluon, represented by the blue sine wave and green spiral, respectively (Courtesy of Joelholdsworth).



Title: Kaon Decay

In this diagram, an electron and a positron annihilate, producing a photon (represented by the blue sine wave) that becomes a quark–antiquark pair, after which the antiquark radiates a gluon (represented by the green helix) (Courtesy of Jabberwok).