



Isolation and influence

Hideki Yukawa

“The window of my little world opened out only to the garden of science, but from that window, enough light streamed in.”

Physicist Hideki Yukawa’s work is marked by an interplay between isolation and outside influences. In his autobiography, Yukawa describes himself as lonely, introverted, and silent, especially as a child. This was in part due to the complicated relationship he had with his father, but to other reasons as well. In the Kyoto of Yukawa’s childhood, the houses were built so that their inhabitants were isolated from the world outside. Yukawa wrote that growing up in such a closed environment could foster a rich imagination and a romantic temperament in a child. As a student, it was not unusual for him to spend entire days reading periodicals, without exchanging a single word with anyone.

Yukawa’s window onto the world of science was opened by colleagues who had studied the new physics while in Europe. One of these, Yoshio Nishina, had spent much time in Copenhagen as part of Niels Bohr’s research group.

Yukawa’s work focused on the forces that hold together the nucleus of an atom. Scientists understood that the nucleus was composed of protons and neutrons, but the mystery of how they were held within the nucleus remained unsolved. One theory proposed that there was a third particle that bound them together. Various solutions based on this idea had been proposed, but none held up to scrutiny.

◀ The four Ogawa brothers: Shigeaki, Hideki, Tamaki, and Yoshiki. Hideki received the name Yukawa when he married.

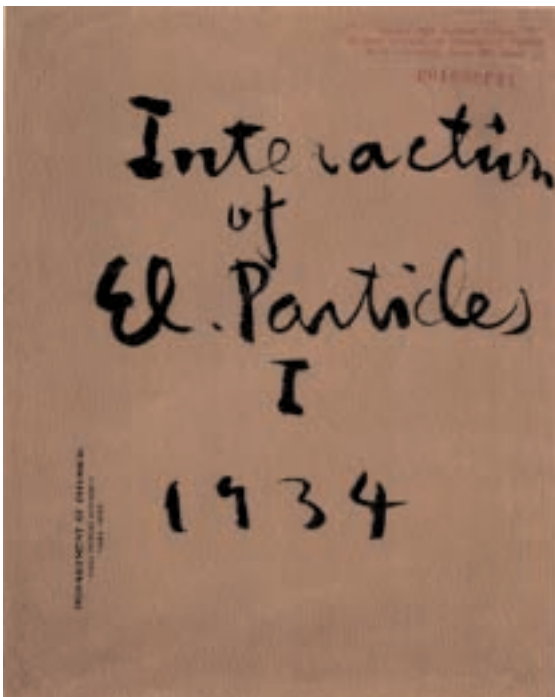


Yukawa walking with Albert Einstein and others.

During 1934, Yukawa often lay awake at night thinking about this problem. He had a notebook at the side of his bed, so that he could record any thoughts that he might have. Sometimes he believed that he was close to a solution, but when he thought through his ideas in the morning, they proved to be worthless. One night, however, an insight came to him—there must be a relationship between the intensity of the force and the mass of the binding particle. On the basis of this idea, Yukawa calculated that this binding particle would have a mass 200 times that of an electron. He called this particle a “meson.”

Yukawa’s theory mapped out binding forces within the atomic nucleus that are enormous. Today we know that releasing these forces may have dire consequences. Yukawa had no idea that his work would lead to problems of so many types. Despite this, Yukawa felt that it was best to allow scientific work to go on unhindered by the concerns of a complicated world. However, Yukawa also worked for peace, particularly in the Pugwash movement.

◦ Hideki Yukawa, Nobel Prize in Physics, 1949.



Envelope of one of Yukawa's scientific manuscripts.



Calligraphy by Hideki Yukawa with a painting by his wife Sumi Yukawa. Hideki Yukawa has written that he was never particularly good working with his hands when he went to school—this was one of his reasons for becoming a theoretical physicist. However, there was one handicraft he was good at—calligraphy. He had learned calligraphy at home from a teacher who had studied the art in China.



Hideki Yukawa, at the right in the top row, at Kyoto University. At the left in the top row is another future Nobel Laureate in physics, Sin-Itiro Tomonaga.



