

Returning to Berlin as a Living Mummy

One hundred years ago, **Albert Einstein** completed his general theory of relativity – a revolutionary description of gravitation as an inherent property of space and time. During this landmark phase of his life, Albert Einstein was supposed to take over as Director of the newly founded **Kaiser Wilhelm Institute for Physics** in Berlin. However, the plan was delayed by the outbreak of World War I.

TEXT **THOMAS BÜHRKE**

On November 25, 1915, Albert Einstein held his seminal lecture before the Prussian Academy of Sciences in Berlin. It ended with the words: “Thus, the general theory of relativity as a logical edifice has finally been completed.” This was followed by days and weeks full of exuberant enthusiasm. Einstein remarked to friends that the theory is “of incomparable beauty,” and that his wildest dreams had been fulfilled. He confided in physicist Arnold Sommerfeld that it was “the most momentous discovery I’ve made in my life.”

His audience, however, didn’t share this view. Even Max Planck and Max von Laue, who had always supported Einstein, remained skeptical. “A free, unprejudiced view is not at all a characteristic of (adult) Germans,” Einstein had written to his friend Michele Besso several years before. Was a new theory of gravitation really needed, given that Newtonian physics had served so well for a quarter of a millennium and appeared to explain everything?

Isaac Newton described gravity as action at a distance: two bodies, like the Earth and moon, are joined as if by invisible threads. But the mechanism by which the force is transmitted was unclear. In addition, Newton’s formulas conveyed the impression that gravity reaches another body instantaneously – with no time lag – no matter how distant. This was contradicted by Einstein’s special theory of relativity from 1905, according to which no physical effect can propagate faster than the speed of light.

Einstein’s description of gravity, known as physical gravitation, is entirely different. He concluded that gravity is a property of space and time: matter bends space around it, and space forces

matter to describe specific motions. The moon orbits the Earth not because invisible lines of force connect the two bodies, but because the Earth and the moon distort the fabric of space like steel balls on a rubber sheet, and they move around each other within the resulting distortions.

Gravity is a property of space and time or, more precisely, space-time geometry. In this respect, it is unique. All other forces of nature act within space and time. Gravitation is space and time. Max von Laue, who was initially unconvinced, later wrote that curved space “is by no means a mathematical construct, but a reality that is inherent in all physical processes. This discovery is Albert Einstein’s greatest achievement.”

Almost as astonishing as the result itself was the process of discovery. Einstein developed his theory of gravitation almost single-handedly. Only once did he need the help of his friend Marcel Grossmann, when he was unable to find his way through the mathematical thicket. Luckily, Grossmann surmised what Einstein needed: the mathematics of curved space, which Bernhard Riemann had developed in the mid-19th century.

In the mid-1990s, together with colleagues from the US, Jürgen Renn and Tilman Sauer of the Max Planck Institute for the History of Science in Berlin traced Einstein’s convoluted process



Two giants of science: Fritz Haber (left) and Albert Einstein in Berlin in 1914. Haber had advocated a physics institute within the Kaiser Wilhelm Society early on. It was finally set up in 1917 – with Einstein serving as its Director.

Director in the attic: Albert Einstein headed the Kaiser Wilhelm Institute for Physics from 1917 to 1922. His daily trip to work wasn't a long one – the institute was housed in Einstein's apartment in Schöneberg.



of trial and error. Their work was based on notes that Einstein had kept in Zurich between the summer of 1912 and the spring of 1913. The notes showed that Einstein had already found the correct field equations toward the end of 1912 – but erroneously discarded them. He did so because of his stipulation that the new theory must contain Newton's formulas as a limit for very weak gravitation. In determining this limit, Einstein made a simple mathematical error that he didn't discover until 1915.

As early as July 1913, Max Planck and Walther Nernst asked Einstein, who at the time was a professor for theoretical physics at

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A new giant in world history: Albert Einstein, whose research has completely revolutionized our view of nature and is on a par with the discoveries of Copernicus, Kepler and Newton.»

ETH Zurich, whether he would be interested in taking up a post at the Prussian Academy of Sciences. He was also slated to become the Director of the Kaiser Wilhelm Society, which was being set up at the time. Einstein agreed, as he was attracted by the prospect of a research post without teaching obligations. Another major factor in his decision was the possibility of living near his cousin Elsa, whom he had fallen in love with during an earlier visit to Berlin.

His colleagues hoped that Einstein would give fresh impetus to the quantum theory, which promised great opportunities for scientific and technical progress. Einstein, however, let it be known that he wasn't at all sure whether he would be able to "lay a golden egg" in this field. Above all, he didn't want to focus on quantum physics at all, and his colleagues soon realized this. As mathematician David Hilbert once noted with resignation, "Einstein is evidently so engrossed in gravitation that he's deaf to everything else."

The Kaiser Wilhelm Society had been founded just a short time before, in June 1911. The aim of its institutes was to pursue research exclusively, for which they were generously funded by such donors as entrepreneurs and financiers, among others. The first facilities included the Institute for Physical Chemistry and Electrochemistry and the Institute for Chemistry, both in Dahlem. The time was now ripe to set up a physics institute as well.

Luminaries like Fritz Haber, Walther Nernst and Max Planck advocated such an institute, and on March 21, 1914, the Senate of the Kaiser Wilhelm Society resolved to found one. Their decision was greatly facilitated by a promise from banker and indus-

trialist Leopold Koppel to provide the building and assume one-third of the costs. Another third would be provided by the Prussian government.

But not long afterwards, the plans were scrapped: On July 31, 1914, the Ministry of Finance rejected any further funding. The next day, World War I broke out, and the project was put on hold. Albert Einstein nevertheless travelled to Berlin: "At Easter I'm traveling to Berlin as an academic individual without any obligation, as a living mummy, so to speak. I'm looking forward to this trying profession!" he wrote to his friend and colleague Jakob Laub.

A stroke of luck then occurred that led to the foundation of the Kaiser Wilhelm Institute for Physics on October 1, 1917, when Berlin-based industrialist Franz Stock offered a donation of 540,000 marks. However, Einstein didn't move into a grand building, but resided in his flat at Haberlandstrasse 5 in Schöneberg, where he lived next door to his cousin Elsa.

The organization of this institute differed considerably from that of any other Kaiser Wilhelm Institute. It was managed by two boards: a six-strong Board of Trustees and a Board of Directors, of which Einstein was a member. However, Einstein tried to reduce meetings to a minimum. During his term of office from 1917 to 1922, the Board of Directors met only eleven times.

Unlike other institutes, the annual budget was to be used mainly to fund research projects at external institutes in as many areas of physics as possible. It was hoped that Einstein would give fresh impetus to the solution of theoretical questions, but he was unhappy with this arrangement. Einstein had little financial freedom, and the Board of Directors wasn't willing to support projects to test general relativity.

Overall, around three-quarters of the projects funded by the Kaiser Wilhelm Institute for Physics in the period from 1918 to 1922 dealt with the refinement of quantum theory in some form. "It's clear that the KWI for Physics made important contributions to advances in physics," concludes Giuseppe Castagnetti of the Max Planck Institute for the History of Science, who chronicled the history of the KWI for Physics several years ago.

Ultimately, Albert Einstein wasn't the right person to head such an institute. He had no interest in launching new projects and bringing together scientists to carry them out. He therefore stepped down as Director of the Institute in 1922, and the post passed on to Max von Laue. Just a few months later, the former "Institute Director without an institute building" was awarded the Nobel Prize for Physics.