Albert Einstein Study Guide

Albert Einstein by Elma Ehrlich Levinger

BOOKRAGS

Contents

Overview

Albert Einstein emphasizes the human and personal side of one of the greatest scientists of the twentieth century, providing a good introduction to his life.

While several of Einstein's important theories, including the revolutionary theory of relativity, are explained clearly and simply, the book stresses his resistance to Adolf Hitler and the Nazis and his stubborn refusal to believe that atomic energy could be used for anything but peaceful purposes.

Although this book is immensely enjoyable, anyone researching Einstein should consult more recent publications as well. Subsequent works have uncovered new information and revealed some inevitable flaws in Levinger's study.

About the Author

Born in Chicago in 1887, Elma Ehrlich Levinger worked her way through the University of Chicago, quite an accomplishment for a woman of her time. Later she was awarded a fellowship to study drama at Radcliffe College, and she wrote a number of plays, several of which won prizes in national contests.

One of the best known is the biblical drama in one act, Jephthah's Daughter (1921). She also wrote short stories and two adult novels before turning to biography for young people. She was married to Lee Joseph Levinger. She died in 1958.

Plot Summary

Albert Einstein was born in Ulm, Germany. His father Hermann moved the family to Munich before his son was five to give him the best education possible. Einstein's first memory related to his father was a toy compass on Hermann's watch chain. His first memory of his mother Pauline was her playing Beethoven on the piano. Hermann moved the family to Milan after his business failed, but he left Albert behind to complete his studies in the German schools he detested. Albert did not graduate. He joined the family in Milan, Italy. He told his father he wanted to become a theoretical physicist and attend a technical school, like the Polytechnic in Zurich, Switzerland.

Although it took a year of preparatory study, Einstein was admitted to the Polytechnic, where he met his future wife, the brilliant Hungarian student Mileva Maritsch. They had two sons, and Mileva felt beaten down by domestic chores. In 1905, the 26-year-old Einstein published the four theoretical papers that would revolutionize modern physics.

Following these publications in the *Annals of Physics*, Einstein was offered a series of academic appointments (the University of Zurich, the University of Prague, his old Polytechnic, and finally three concurrent appointments in Berlin: at the Prussian Academy of Sciences, University of Berlin, and Kaiser Wilhelm Institute). Einstein and Mileva separated before he moved to Berlin, but they remained friends, and Einstein occasionally visited his sons.

Einstein remained in Berlin for 20 years. During World War I, he married his first cousin, Elsa. Then a Swiss citizen, Einstein was little affected by the war and content to stay in his lab. In its aftermath, however, Einstein joined War Resisters International and established the Einstein International War Resisters Union. In 1922, he traveled to the Orient and received the Nobel Prize for his work on photoelectric law and general contributions to theoretical physics.

During Hitler's rise to power, and after a bounty was placed on his head, Einstein resigned his Academy position in Berlin. He and Elsa moved to Princeton University in the United States.

Einstein heard the stories of Hitler's atrocities and decided pacifism was no longer an option. He wrote to President Roosevelt about the desirability and feasibility of developing an atomic bomb before Germany did. After the bomb was dropped on Hiroshima, he became the first chair of the Emergency Committee of Atomic Scientists. Einstein died in a Princeton hospital in 1955.

Chapter 1

Chapter 1 Summary

Walking his dog down Mercer Street on a cold winter morning, Einstein stops to greet another Princeton professor, the postman, and a young girl: She thanks him for last week's help with her long division, because she got a "100" on this week's test. She mentions her promise to pay Einstein an ice cream cone for his assistance. She promises to deliver that when she gets next week's allowance.

Before hurrying off to school, the girl notices that, once again, Einstein is not wearing his rubber boots. Another professor offers Einstein a ride, but he declines, saying he needs his walk. Between there and the railway station, he greets a milkman and a housewife. He decides to stop for a cup of coffee, and before he can do that, the newsboy accosts him. The boy is laughing, because someone had gotten off the train yesterday, asking directions to Einstein's home. Everyone in Princeton knows where their "Professor Einstein" lives.

The restaurant proprietor welcomes him and wants to ask a question, "If I went out to where space ceased, where would I go?" Einstein laughs and says, "You'll never get that far." He then realizes he left his money at home. After Einstein leaves, some boys mock him and the proprietor reproves them.

Walking home, Einstein is greeted by a steady stream of well-wishers until the final two blocks. Deep in thought, Einstein does not notice a young man on his porch, until he speaks. Recognizing the accent, Einstein responds in German. The young man, who has been waiting for an hour, asks for an interview.

Einstein does not consent to the interview, but invites the young man inside, since he is shivering. Then he realizes that he has forgotten his key. While they wait for someone to answer the bell, Einstein learns that the young man's parents, who were murdered by the Nazis, are from Ulm, Einstein's birthplace. His secretary notices that Einstein has also forgotten his wool socks. Einstein mentions his good fortune in escaping the Nazis with his furniture. The secretary insists that he change socks and catch up on his correspondence. She leaves the room, and Einstein offers the young man a seat.

Still refusing to be photographed, Einstein contrasts his own secure position with that of the young man. He relents, telling the young man to be quick, before his secretary returns, and take his photographs. He also instructs the young man not to ask the same old questions. Einstein describes his early memories in Munich: his mother playing Beethoven and his father's toy compass.

Chapter 1 Analysis

Time is the theme of Einstein's walk down Mercer Street. He helped a young girl last week; now she understands and received a "100" on yesterday's math test. Next week, he'll get his payment in ice cream. Einstein decides to stop for coffee, but, before he can enter the restaurant, the newsboy stops him: someone had arrived on yesterday's train asking his whereabouts. The restaurant proprietor had been waiting to ask Einstein a question for a week. On returning home, Einstein finds a young man who had been waiting for an hour. He shares his earliest memories, grateful that he left Germany "in time."

While Einstein took numerous walks down Mercer Street, the forward to this book has explained that this particular walk is fictional, contrived to bring together key aspects of Einstein's character and scientific work. It illustrates that he was known and respected by all, and that he had no sense of elitism.

Chapter 2

Chapter 2 Summary

In 1884, Hermann and Pauline Einstein discuss the whereabouts of their son, Albert, with the governess and his sister Maja. He doesn't play with the other boys and likes to walk in the garden.

When Albert returns, Hermann scolds him for being late again. Hermann holds up his watch to demonstrate how late he is. The toy compass charm on his father's watch chain catches Albert's attention.

Hermann explains that, although a charm, it is as accurate a compass as larger ones used to guide ships. Why, the young Einstein asks, does the needle always point north? Einstein's questions persist after dinner. He follows his father into the parlor where old family portraits hang on the walls. When his parents tire of Albert's questions and insist he go to bed, the boy declares he'd sleep better if the compass were beside him.

When his father checks on him hours later, Albert asks what "magnetized" means and declares that he'd sleep better if he were holding the compass. Pauline is astonished to hear of this bedside chat about magnetism. Hermann remarks that he is determined to give Albert the best education available. This is why the family moved from rural Ulm to urban Munich. Hermann says that a Jew needs a good education these days. What Albert does with his education will be up to him.

Chapter 2 Analysis

Time continues to be a theme. The toy compass was a charm on Einstein's father's watch chain. The second chapter begins "It was the year 1884." Similarly, the pictures hanging on the parlor walls are of ancestors, from an earlier time.

Additionally, while the young Einstein dutifully looked at his father's watch, he did not care what time it was. Einstein is shown to have a persistent character. He wants his questions answered now. He asks twice to be allowed to sleep with the compass.

Chapter 3

Chapter 3 Summary

Several months later, Einstein asks Uncle Jake to explain how the compass works. His uncle says they should begin with the Magnetic North Pole and drops a ball to illustrate gravitational attraction.

The young Einstein asks where gravity is. His uncle responds that it is in space and suggests he question his teacher. But the boy says he hates school, because it is like being a soldier that must march with officers shouting at him and lives away from his family. His teachers, 6-year-old Albert says, are concerned with rote recitation, not understanding, and they don't like being questioned.

His uncle suggests Albert save his questions for Uncle Jake, but right now he must return to the factory. The boy retreats to his space under the shrubs, wondering how space can be empty yet full of gravity and magnetism.

In addition to military discipline, the Munich schools taught the Catholic religion. Einstein found it not much different from what his rabbis taught. Einstein did not fit in easily among his classmates. His speech was slow, and his physical coordination awkward. Other children ridiculed and bullied him.

His favorite pastime is walking along the Isar River. He sometimes sits in the back pews of a Catholic church, fascinated by the flickering candles. He wonders whether God loved Jews as much as Christians, comparing what his religious instructor says with his parents and their Christian friends. He decides his uncle cannot help him with this question, and he won't ask his father, who is bored by religion.

He survives several more school years. Einstein insists that his former music teacher had been wrong to say he didn't love music. He really did, but believes that there is a difference between playing scales and playing music. Although shocked by his rebellious statements, Pauline thinks that her young son plays very well for his age.

When he is 10 years old, Einstein enters the Luitpold Gymnasium, which emphasizes Greek and Latin. Albert hates these, although he will later say he found his greatest inspiration in the Greek classics. What he hates is merely that they consume time that could otherwise be spent answering his questions. His teachers at the Gymnasium are similar to his earlier ones. They favor military drill, rote memorization, and no questions. One teacher, though, teaches him Schiller, Goethe, and Shakespeare. Albert finds poetry almost as enchanting as music.

Following the local custom, Hermann and Pauline invite a poor student to dinner one evening a week. Once of these, a medical student at the University of Munich, talks with Albert, whose grades worry his parents. The next week, the student brings Albert some books on natural science.

Young Einstein is so interested in these books about natural phenomena like plants and earthquakes that he stops eating. His mother reminds him it is not polite to read at the table and remarks to Hermann that the boy is as excited as when he first noticed the toy compass.

Uncle Jake declares himself a poor science teacher, but Albert says he is better at explaining things than any of his school teachers. Young Einstein also states that he likes geometry, because the proofs are part of the text. Pauline is pleased and thinks Albert could become a professor one day. Hermann says bitterly that that may pay better than business.

Einstein knows not to discuss the natural science books with his school teachers. He has already studied several mathematical texts ahead of what is being taught at the school. He thinks calculus and geometry are beautiful, like a musical symphony.

His father's business failed when Albert was 15. Hermann moves to Milan, but his son stays in Munich, living in a boarding house, to get the diploma that would gain him admission to the university. His mathematical brilliance further alienates his teachers and classmates. Although he is not formally expelled, his math teacher says he subverts the other students, and Albert joins his family in Milan.

Einstein's first two months in Italy are happy ones, but Hermann's new business ventures do not go well. He can no longer support his son.

Although Hermann retains his German citizenship, Albert plans to renounce his own. He informs his father that, although he does not want to attend a university, he does want to study theoretical physics. Hermann agrees with him that attending a technical school would be more useful than attending a university. Einstein says he wants to attend the Swiss Federal Polytechnic School in Zurich.

Chapter 3 Analysis

In this chapter, time speeds up: Einstein is 6 at the beginning and over 15 by the end. He has moved also in space, from hiding under the shrubs in Munich to telling his father he wants to become a theoretical physicist in Milan. This chapter also contrasts teaching with drill and recitation with learning. The military discipline of the German schools foreshadows what is to come.

Chapter 4

Chapter 4 Summary

A letter from a former teacher is insufficient to admit Einstein to the Zurich Polytechnic, so he studies for six months before sitting for exams. The director of the Polytechnic notices Albert's brilliant scores in mathematics and suggests he retake the exams in the subjects he failed. Albert resigns himself to attending another school to master the subjects he hated. To his surprise, he found the Swiss schools much different than those in Germany. The Swiss schools has less drill and more tolerance for his questions. Within a year, he earns the diploma which admits him to the Zurich Polytechnic.

He makes friends with his fellow students. Many of these are from lands ruled by tyrants and regard their diplomas as less important than learning. They want to return to their home countries and teach their less fortunate peers. Albert begins thinking of himself as a citizen of the world.

At this time, Einstein becomes less interested in mathematics, per se, but is more interested in it as a tool to study physics. He studies beyond the requirements of his courses, at first by himself and then with Mileva Maritsch. She is a a brilliant Hungarian woman who declares it absurd that women should be limited to kitchen, church, and children. From his small allowance, Einstein saves for an occasional concert and his application for Swiss citizenship. On his trips home to Milan, his mother scolds him for not committing to paper the music he has composed.

In August 1900, Einstein, now aged 21, receives his diploma at the Polytechnic. A year later that he receives an appointment as a substitute teacher at the Winterthur technical school. By the time this appointment ends, Einstein has won the respect of his students. His next appointment is as a tutor. By the time it concludes, Einstein has his Swiss citizenship.

Einstein secures a lowly, but later famous, position at the Patent Office in Berne, where his job is to rewrite patent applicants' descriptions more concisely. He and Mileva Maritsch marry, but they quarrel. She hates the life of a housewife.She feels that even more acutely after the birth of their sons, Hans Albert and Edouard.

Although he finds his Patent Office job mere drudgery, his salary is sufficient to pay the bills. In 1905, he publishes his first revolutionary theoretical paper, on what will later be called the special theory of relativity.

Chapter 4 Analysis

This chapter begins with Einstein the teenager and ends with Einstein, in his mid-20s, publishing the first in a series of papers that would revolutionize modern physics. The

author points out that institutionalized education often hinders gifted people who later make tremendous contributions. She compares Einstein with Michelson, Verdi, and Darwin. All of these men share a history of academic "failure" and life success.

Chapter 5

Chapter 5 Summary

The narrator takes the reader back to 1887 in the United States. Michelson, an experimental physicist, and Morley, a chemist, were trying to measure how fast the earth travels through space. This was different from the speed the earth revolves around the sun, which was well known. They began with the premise, that the earth moves through space. They repeatedly measured the speed of light through two pipes placed perpendicular to each other (creating conditions analogous to swimmers of equal speed, one moving upstream and the other down). Their measurements were the same within milliseconds: light traveled at the same speed through both pipes. Michelson and Morley published their results, interpreting their observed results as a failure.

Einstein's 1905 papers recasts these results. He theorized that light travels at the same speed and that Michelson's and Morley's measurements, nearly 20 years earlier, had, although misinterpreted, been accurate. Einstein further theorizes that the speed of light is the only constant in the universe, that everything else is in motion, and thus that everything is relative to the conditions under which it is observed.

There is nothing new in the idea of the relativity of size and space. What is new is the idea that the facts of the physical world are relative, and the speed of light is the only constant. The author describes the classic example: Imagine sitting in a moving train. To those inside the train, the trees outside appear to whirl past, while the people inside appear stationary. To someone outside the train, however, those same trees appear stationary, while the train that whirls past.

Now, imagine the train going 60 miles per hour on the earth that's rotating around the sun at 18 miles per second, which is itself rotating within the solar system, which is moving around a yet more distant star. The central insight is that all observed motions are relative to the position of the observer.

After establishing the relativity of motion through space, Einstein also addresses the relativity of time. Newton had postulated that time was absolute, moving unchanged into the future, and that space extended infinitely in all directions, so that every object has three dimensions. Einstein adds a fourth dimension, time, to all objects. Put another way, Einstein theorizes that neither time nor space goes on forever. Both change relative to the position of the observer. For instance, clocks observed at a distance tick more slowly.

In another article, published three months after the first, Einstein further theorizes that the mass or weight of a body depends on how fast it is moving. The faster it moves, the heavier it gets. Since E = mc2, (energy equals mass times the square of velocity), an enormous amount of energy could theoretically be extracted from a singles gram.

Although the experimental physicists of the day do not have the apparatus to undertake such measures, Einstein's theory yields several empirical predictions, which experimental physicists around the world are able to test in their labs. Their results confirmed Einstein's predictions.

Within a few years, experimental physicists devise better ways to test the predications of Einstein's theory. They learn how to measure the weight of electrons and how to speed them up, to half the speed of light, which is 93,000 miles per second. The reason our sun hasn't burned itself out is that, at temperatures of millions of degrees, some of its atoms are always transforming their mass into energy.

Forty years later, scientists on both sides of the Atlantic will learn how to transform the uranium atom into energy.

Chapter 5 Analysis

At one level, this chapter is ironic, because Einstein's theories about light contribute to the "darkness" of the atomic bomb 40 years later. At another level, the chapter is simply descriptive. Einstein did publish his revolutionary theoretical articles in 1905, before he secured his first academic appointment. The chapter depicts the growth of knowledge through time, from Michelson and Morley's pipes to the more sophisticated equipment developed to test the predictions of Einstein's theory.

Chapter 6

Chapter 6 Summary

By 1909, Einstein has taken four different faculty positions, each more prestigious than the one before. He moves to Prague, back to Zurich, and then Berlin. The first position is at the University of Zurich, as a lecturer and the second as an assistant professor Upon this second appointment, Einstein writes to his mother that he has become what she wished, a professor.

While the glory goes to Albert, the burden falls to Mileva. The new appointment pays no more than the Patent Office, but requires more expenditures, like clothing. Additionally, Albert's new appointment means more demands on his time, while Mileva must take in student boarders to pay the bills.

Einstein treats these student boarders in the same egalitarian manner he treats other faculty members, while his wife cooks for them.

In 1910, he is invited to the University of Prague as a full professor. Since the university in Prague is under Austrian control, German is spoken there. Einstein makes friends with several Czech students, who recognize he is different from the professors who act like they belong to a superior race. In the interim, the Emperor Franz Joseph decrees that all those with university positions belong to one of the empire's recognized churches. Einstein registers as a Jew.

Long walks take Einstein to Prague's old Jewish cemetery. This makes Jewish history more real to him than it was as taught by the rabbis in Munich. He becomes interested in Zionism. He angers his fellow professors by visiting only those who live in parts of the city he wants to explore. He next receives an offer of full professor at the Zurich Polytechnic, which had earlier rejected him.

The family returns to Zurich in 1912. Shortly thereafter, Max Planck is quoted as saying, "If Einstein's theory should prove correct, as I suspect it will be, he will be considered the Copernicus of the twentieth century." Although only in his early 30s, Einstein begins receiving numerous invitations to speak.

Planck himself visits Einstein in Zurich and offers him three concurrent positions in Berlin, one at the Prussian Academy of Sciences to conduct research, another at the University of Berlin to teach when and what he wants, and the third at the Kaiser Wilhelm Institute, as director of its not-yet-created institute of physics. Einstein accepts and serves in these posts for 20 years.

Mileva does not accompany Einstein to Berlin. Although their marriage fails, the two remain friends, and Albert occasionally visits his children.

In his Berlin years, Einstein works on his general theory of relativity, an amplification and refinement of what he published in 1905. His father is dead, and his mother lives with his sister Maja and her lawyer husband.

Chapter 6 Analysis

This chapter takes Einstein in time from 1909 to 1912.

Albert's fortune is in sharp contrast to Mileva's. He is able to pursue the glorious and noble role of a scientist. He quotes Faraday, "I have always loved science more than money . . . . I cannot afford to get rich." Mileva's own brilliance was sacrificed to her husband's career. He teaches and makes little money, and she does laundry and takes on extra work to pay the bills.

Chapter 7

Chapter 7 Summary

Since his theoretical articles challenge what Newton said two centuries earlier about gravity and light, Einstein is sometimes called the "Newton of the Twentieth Century." Einstein, however, does not refute Newton's paradigm. He merely recasts it as a special exception to his own general theory. Einstein theorizes that gravity is a field in space. Even a small planet like Earth influences its moon a quarter of a million miles away. Einstein theorizes that, with sufficient gravitational force, even light rays could be bent. Even more radical, he theorizes that space itself is curved, and the planets merely take the easiest routes available to them, just like a pilot flying between the United States and China would take a polar route instead of following a straight line. Einstein also theorizes that not only is space curved, but it is also finite. Einstein predicts that the next solar eclipse will provide the opportunity to empirically test one of his theoretical predictions, that with sufficient gravitational force, even light rays could be bent.

German scientists collect funds, form an expedition, and pack their telescopes during the summer of 1914. Will the 1914 eclipse in Russia prove Einstein correct or incorrect? Their mission goes awry. Not only is it cloudy, but also World War I has begun. Upon their arrival on Russian soil, the intrepid German astronomers are interred as war criminals and held for four years, the duration of that war.

Einstein has his Swiss citizenship, and Switzerland is neutral during the war. In 1914, Germany professes its treaty with Belgium a sham and invaded, slaughtering numerous innocents. The world asks how could the Germany of Goethe and Beethoven behave like a barbarian? Germany's response is to publish a document signed by 92 of its academics and intellectuals, approving the invasion. Einstein does not sign. Since Einstein is no longer a German citizen, the government can not accuse him of disloyalty, but his refusal to sign makes enemies nonetheless.

During this period of his life, he falls into a comforting routine with his Cousin Elsa, who cooks and sews for him and is not remotely interested in relativity. He is free to marry since his divorce from Mileva, and he asks Elsa to marry him. She does and thereafter devotes herself to his contentment, taking on the roles of both domestic servant and personal secretary.

In the spring of 1919, two English expeditions set out for Brazil and Guinea to observe the solar eclipse that would prove Einstein correct about the ability of gravity to bend light rays. Of 20 photographs taken, only one of them shows satisfactory images of the five stars pertinent to Einstein's prediction. After months of lab work and discussion, the British physicists announce that the deflecting of light as shown empirically is 1.64 seconds. Einstein had predicted 1.75. The physics community decided this was close enough to deem his theory correct.

Chapter 7 Analysis

If this chapter has a theme, it is the history of science from Galileo and Newton, to Faraday and Maxwell, Michelson and Morley, Max Planck, and Einstein himself. The movement is also from a world where Galileo was punished for his theory to one in which Einstein is richly rewarded for his.

Although the narrator sometimes depicts Einstein as a poor lad from the south of Germany, she also shows he had a relatively privileged childhood in that he was encouraged to pursue his dreams, instead of being swatted away or having no time to dream. In contrast to the impoverished scientists of the past, Einstein made three concurrent salaries while he was in Berlin. On one of his walks, he wonders to himself if it's possible to spend it all.

Nothing is said about when or whether Mileva's scientific aspirations died. The reader doesn't know whether Albert paid some sort of child support.

As much as the history of science, this chapter also tells the history of the German aggression that resulted in World War I.

Chapter 8

Chapter 8 Summary

Einstein had predicted, with great accuracy, how light from the stars would behave. He now becomes a popular hero, although not all his fellow physicists agree with him.

Einstein believes that, with the Kaiser in exile and Germany now a republic, the old militaristic spirit is gone. Similarly, he fails to see the seeds of the atomic bomb in his theories.

In 1921, Einstein sails to New York to do some fundraising in support of Hebrew University. While there, he lectures at both Columbia and Princeton Universities. On the return voyage, Einstein stops to lecture in London and lays a wreath on Newton's grave..

Chapter 8 Analysis

The inconveniences being famous are nothing compared to the suffering represented by cemeteries containing rows of the newly dead. Einstein uses his celebrity status to raise funds for Hebrew University and other causes.

His laying a wreath on Newton's grave is an acknowledgment of Newton's earlier work. Newton's old grave also contrasts with the new graves.

Chapter 9

Chapter 9 Summary

Einstein is shocked when a friend, an honest liberal statesman, is murdered. Berlin itself is in the same economic depression that grips all of Germany. Einstein accepts the invitation of the newly formed Commission for the Co-operation of Intellectuals, but resigns after a year. He sees that the League of Nations is being used only to further the ends of the already powerful.

He then joins War Resisters International and establishes the Einstein International War Resisters Union. Many of his Berlin colleagues do not join him. He remains a cult figure, with both babies and cigars named after him and his work. In contrast, Einstein's home life is serene.

In 1922, he decides to travel to the Orient. He is greeted by autograph- hunters in India, China, Japan, and Palestine. Einstein is enthusiastic to see Tel Aviv, although troubled by certain aspects of the Zionist dream being actualized in Palestine.

The return trip is a pleasant Mediterranean cruise. At a stop in Madrid, Einstein receives an honorary degree. It is also during this trip that Einstein receives word he has been awarded the 1922 Nobel Prize for physics.

Chapter 9 Analysis

In this chapter we see Einstein in a life outside of his lab. During the post World War I period, Einstein took on a larger public role as an outspoken pacifist. His seemingly well orchestrated and serene private life contrasts sharply with the outside world. It is ironic that Einstein is regarded as German everywhere but in Germany.

Chapter 10

Chapter 10 Summary

Einstein receives the Nobel Prize for his work on photoelectric law and general contributions to theoretical physics.

Einstein continues being a local and international cult figure. Elsa hires someone to help her sort his incoming correspondence. When he is 46 years old, he suffers a heart attack and takes four months to recover. On his 50th birthday, his admirers give him a yacht, which he enjoys sailing.

Einstein has Elsa purchase property and build a house in the countryside near Berlin. Einstein fears old grudges have not gone away with the signing of the Treaty of Versailles.

Chapter 10 Analysis

Two events are central to this chapter: Einstein was awarded a Nobel Prize and he had a heart attack. The former is not surprising. The latter was a surprise, given that he always walked regularly and lived doing the work that he loved.

Chapter 11

Chapter 11 Summary

In the winter of 1930, Einstein accepts an invitation to spend several months at the California Institute of Technology in Pasadena, California. Einstein is delighted at the thought of meeting Michelson, now in his late 70s.

On the voyage over, Einstein is shocked at the luxuriousness of his room. He demands to be moved to a more modest room, but is dissuaded by Elsa. When the ship lands in New York, he gives several interviews, despite having earlier adamantly refused to do so. He has similar problems with overly gregarious Californians.

Just prior to his return to Berlin, an American journalist asks him about Hitler. Einstein responds that Hitler's influence will wane when the Germany economy improves.

Chapter 11 Analysis

Einstein's lack of a sense of elitism and entitlement are contrasted with the luxuries bestowed upon him. It also may explain how wrong he was about Hitler. Because he didn't suffer from elitism and entitlement, he couldn't believe how many people did.

Chapter 12

Chapter 12 Summary

Einstein spends the summer of 1931 in Berlin and then returns to Cal Tech that fall. When he returns to Berlin in the spring of 1932, he is alarmed by the election news. Back at Cal Tech, in January 1933, he learns that Germany's President Hindenberg has named Hitler Chancellor of Germany. Although less than one percent of Germany's population is Jewish, Hitler blames them for Germany's defeat in the First World War and its economic depression.

Einstein's academic enemies join in, decrying "Jewish physics." First, the university ranks are purged of Jewish professors who did not fight for Germany in World War I. Then purged are all who are Jewish, then all who have Jewish wives, and finally anyone who disagreed with the Nazis. Only a few intellectuals speak out. Planck eventually meets with Hitler to speak for his coworkers.

In the spring of 1933, Einstein returns to Europe and takes refuge in Belgium. He tenders his resignation to the Prussian Academy of Sciences. Proclaiming loyalty to the state, the Academy accepts his resignation.

The German government seizes Einstein's home near Berlin and his savings. Hitler offers a $5000 reward for his murder. The Belgium government, however, guarantees Einstein's safety. He receives offers of new appointments to the Sorbonne and the University of Madrid, as well as Hebrew University in Palestine. In October 1933, Einstein and Elsa sail back to the United States, to take a position at Princeton University.

Chapter 12 Analysis

Einstein was condemned as an internationalist, a pacifist, and a Jew.

The papers representing his intellectual contributions to science and human knowledge fed the bonfires at the public book burnings in front of the Berlin Opera House.

A Dr. Lenard proclaimed it "unworthy of a German to be the intellectual follower of a Jew."

Chapter 13

Chapter 13 Summary

In the winter of 1933, Einstein begins work at Princeton's Institute for Advanced Study. He continues working on the general unified theory he began in Berlin. With a Polish scientist, Einstein publishes his tenth book, the *Evolution of Physics*, which becomes a best seller, outpacing even Dale Carnegie's books.

Einstein now has a new kind of correspondence, from those stranded in Europe who beg for his help to get them out. Einstein is able to help some. He also wrote and spoke publicly, denouncing Hitler.

When the World's Fair opened, Einstein is selected to speak for Palestine, which is thenunder British rule. He donates his original relativity manuscripts to the Hebrew University and is pleased that the Institute of Physics in Tel Aviv bears his name.

Elsa dies in 1936.

Chapter 13 Analysis

Einstein's life at Princeton is not that different than it was in Berlin. He continued working on the general field theory that was to forever elude him. His fellow scientists acclaimed him. He continued to enjoy music. Elsa tried to make the new home on Mercer Street as much like their old Berlin apartment as possible. He had no financial worries. He spoke out against the horror of Hitler and helped those few he could. After Elsa died, he retreated to his lab.

Chapter 14

Chapter 14 Summary

In 1939, Einstein's sister Maja comes to live with him. Regular visitors include Elsa's daughter Margot and his son Hans Albert. His other son, Edouard, studies medicine and remains in Switzerland with Mileva.

In 1940, Einstein becomes a U.S. citizen. He is shocked by America's silence about the atrocities being committed by Germany and Japan. He's even more shocked by the profit motive behind the silence. Einstein concludes it is no longer possible to be a pacifist.

In 1938, at the Kaiser Wilhelm Institute, Otto Hahn and Lise Meitner discover how to break down the uranium atom to release energy.

Since Meitner is Jewish, she flees to Sweden. Hitler later decides that his goals are better served by investing in munitions factories than continuing the work on the uranium atom.

Dr. Meitner confers with Neils Bohr, Director of the Copenhagen Institute of Theoretical Physics. Dr. Bohr finds her results the more exciting, because Enrico Fermi predicted that breaking one uranium atom would result in a chain reaction. Dr. Fermi confers with Leo Szilard, a refugee from the University of Berlin, at his Columbia lab: Drs. Fermi and Szilard later persuade Einstein to write United States President Roosevelt.

Although troubled by his own work's contribution to this project, Einstein reasons it is only a matter of time before the Nazis build their own bomb.

About five years after his letter to Roosevelt, the first atomic bomb explodes over the Alamogordo Reservation in New Mexico. The second explodes over Hiroshima. World War II ends. Einstein becomes the first chair of the Emergency Committee of Atomic Scientists. Although officially retired from Princeton, he continues working through his 70s.

The book concludes in the garden of the house on Mercer Street. Einstein is seated, reflecting first on the brisk walk earlier in the day and, earlier, the most recent conference of the Emergency Committee of Atomic Scientists. He is said to smile at the letter from his son Hans Albert, read after his interview by the young refugee waiting on his porch. Shortly thereafter, he falls ill and dies in a Princeton hospital in April, 1955.

Chapter 14 Analysis

Einstein credited the bomb to Dr. Meitner's communicating her results to Dr. Bohr, who knew of Dr. Fermi's work. No better summary for this concluding chapter can be found

than United States President Eisenhower's words that, "No other man contributed so much to the vast expansion of twentieth-century knowledge. Yet no other man was more modest in the possession of the power that is knowledge, more sure that power without wisdom is deadly."

Characters

Albert Einstein

He was born in March 1879, in Ulm, Wurttemberg, Germany, and he died in Princeton, New Jersey in April 1955. His mathematical genius was obvious in his youth, but it antagonized his peers and angered his teachers. In 1905, he published a series of papers that changed modern physics. His intellectual contributions then and thereafter earned him the respect of the scientific community and he became a cult hero.

Pauline and Hermann Einstein

These were Einstein's parents. Pauline was a pianist. Hermann's factory produced chemical and electrical supplies. Hermann moved the family from Ulm to Munich, determined that his son should have the best education possible. He moved the family from there to Milan when his business failed. Uncle to Einstein was Hermann's brother Jake.

Maja Einstein

She was Einstein's sister, two years his junior. After he immigrated to the United States, she joined him.

Mileva Maritsch

A brilliant Hungarian woman, she met Einstein while they were students at the Polytechnic School in Zurich. They married and had two sons. She moved with Einstein to Berne, Prague and then back to Zurich. She did not accompany him to Berlin. She wilted under the traditional domestic role forced on women. The author states she and Einstein remained friends after they separated and eventually divorced. Nothing is said about when or whether her scientific interests ended

Edouard and Hans Albert Einstein

These were the sons of Mileva Maritsch and Albert Einstein. Edouard studied medicine and remained in Switzerland with his mother. Hans Albert, who had a son and daughter of his own, eventually immigrated to the United States. He was on the engineering faculty at the University of California-Berkeley when he wrote the forward to this biography.

Elsa Einstein

Elsa was Einstein's second wife. She was also his first cousin and a childhood friend of his sister. She had been married and widowed before their marriage. She had two daughters, Ilse and Margot. In contrast to Mileva, Elsa relished domestic tasks and had no interest in science.

Objects/Places

Ulm and Munich, Germany

Einstein was born in Ulm and grew up in Munich. His father moved the family to Munich shortly after his son's birth: he wanted him to have the best education possible. At age 10, Einstein entered Munich's Luitpold Gymnasium.

Swiss Federal Polytechnic School (Zurich, Switzerland)

Einstein flunked all but the math portion of his entrance exams, studied for a year at another school, retook the exams and passed. He and Mileva studied together. He graduated in 1900 and was invited back as full professor in 1912.

State Patent Office (Berne, Switzerland)

When working here in 1905, Einstein published the theoretical papers that changed physics. It was after their publication that he received a series of academic invitations and honors.

University of Zurich, University of Prague (Switzerland and the current Czech Republic)

Einstein's first two academic appointments were here. In 1909, he was appointed lecturer and rose to the rank of assistant professor at the University of Zurich. In 1910, he was invited to the University of Prague as full professor.

Prussian Academy of Sciences, University of Berlin, Kaiser Wilhelm Institute (Berlin, Germany)

In 1914, Max Planck invited him to assume three concurrent positions. Einstein held these positions for 20 years. He formally resigned after Hitler came to power and put a price on his head. Einstein was a German citizen by birth; he renounced that to become a Swiss citizen. After World War I, when Germany was a republic, he reassumed German citizenship.

Princeton University (New Jersey, United States)

It was here that Einstein settled after leaving Europe. He became a citizen of the United States in 1940 and died there in 1955.

Setting

The biographical novel begins in late nineteenth-century Munich, where the young Albert Einstein lives happily with his affluent, loving family but hates the highly disciplined German schools. Emphasizing rote learning, the teachers discourage students from asking questions and confuse the young Jewish boy by teaching the Catholic religion in the same matter-of-fact manner in which they teach reading and arithmetic.

When Albert is a teenager, the setting shifts to Milan, Italy, where his father has gone to make a fresh start after a business failure in Munich. Albert stays in Munich for a while to continue his schooling but becomes so unhappy that he leaves and joins his family. In Italy he enjoys an atmosphere of freedom, hiking in the mountains, visiting art galleries, and attending concerts and operas. But his father's business does not prosper, and it is necessary for Albert to prepare himself for a career. Albert decides to renounce his German citizenship, continue his education at the Swiss Federal Polytechnic School in Zurich, and become a theoretical physicist.

The scene shifts many more times in the course of this biography: to Prague, Czechoslovakia; back to Zurich; to Berlin; and finally to the United States. But the setting plays a secondary role to the character of Einstein. Levinger never describes physical details of a street in Munich or a mountain in Switzerland; she describes the atmosphere in German schools, but never offers a single specific example of the rigid discipline.

Instead, the author characterizes a setting in terms of its effects on Einstein.

Thus, his surroundings play a vital role in bringing Einstein to life for the reader.

Social Sensitivity

The descriptions of Einstein's two marriages will undoubtedly offend many of today's readers. Einstein's first wife, Mileva Maritsch, is an ambitious student from Hungary whom Einstein meets at the Polytechnic in Zurich.

Levinger illustrates Mileva's dissatisfaction with the woman's role in German society: "Why devote one's life to the three K's (Kueche, Kirche, Kinder— kitchen, church, and children) which the silly old kaiser had declared should be the only interest of women? She had a man's brain and might someday make real contributions to science." Levinger does not explain why one needs a "man's brain" to make scientific contributions, and most readers will find this statement perplexing at best.

Einstein's marriage to Mileva breaks up after several years because it contains nothing for her but the "three K's."

He later marries his cousin Elsa, a widow with two children. She is much more compatible with Einstein because she has no intellectual needs of her own and is happy taking care of her husband, who seems to need more care than most men. These details are matters of fact; the problem is in the author's reporting of them. Elsa is made to seem much more attractive and caring than Mileva, whose only basic "fault" is that she wants to use her mind.

Perceptive readers will undoubtedly smile at the "brave new world" forecast in the last chapter, in which the author predicts the elimination of hunger and poverty as a result of atomic power: "Houses will be heated and lighted for a cent or two a day and coal mines will become a curiosity." Although this world would be a fitting monument to Einstein's love for humanity, it has not materialized. Nuclear accidents at Three Mile Island and Chernobyl have illustrated that, despite its many benefits, atomic energy is a dangerous force. Einstein gave the world a mixed blessing.

Literary Qualities

Levinger's most effective literary technique involves her use of the biographical novel's various settings. The settings reflect Einstein's emotions so that Levinger's description of a particular place often serves as a description of the main character's feelings as well. Although the settings' lack of physical detail is sometimes criticized, this absence allows the setting to act as a more direct medium through which Einstein's character is revealed. The setting also advances Levinger's theme of freedom as, for example, the liberating atmosphere of the Italian mountains contrasts the rigidity of the German schools.

Among the weaker points of Levinger's writing is the inconsistency of her style, particularly her clumsy rendering of dialogue. While the invented conversations verge on simplistic, apparently composed with a grade school audience in mind, most of the text is written for a more sophisticated audience. The more advanced sections sacrifice color for the sake of clarity.

Levinger goes to great lengths to humanize Einstein, stressing eccentricities such as his lack of interest in clothing and his disheveled appearance.

But references to his "soft, shapeless hat," his "shabby coat," and the like occur so often that they become a stylistic nuisance. Surely there are more important things to say about one of the twentieth century's greatest scientists.

Themes

Science and the State

The solar eclipses of 1914 and 1919 are good examples of this theme. The 1914 eclipse was best seen from Russia and the 1919 eclipse, from Brazil and Guinea. The eclipses were important, because they offered experimental physicists the opportunity to test certain empirical predictions of Einstein's theory. German scientists journeyed to Russia and were immediately imprisoned by the Soviets for the entire duration of World War I. Since that war ended in November 1918, two British expeditions set out in early 1919, one team to Brazil and one to Guinea. Of all the photographs taken, one showed the needed information.

This biography includes many other incidents showing the influence of the state. In 1911, while he was at the University of Prague, Einstein registered as a Jew, because the Emperor Franz Joseph had decreed that all faculty belong to a state-recognized religion. In 1914, 92 German academics and intellectuals signed the Kaiser's justification of Germany's invasion of Belgium. Einstein did not sign. He was a Swiss citizen as the time. Under Hitler, the university ranks were purged of Jewish professors who had not fought for Germany in the First World War. Only a few intellectuals spoke out. Einstein resigned his Berlin position at the Academy.

Nowhere is the deleterious impact of the state better illustrated than in the story of how the United States developed the atomic bomb before Germany. In 1938, at the Kaiser Wilhelm Institute, Otto Hahn and Lise Meitner discovered how to break down the uranium atom to release energy. Since Meitner was Jewish, she fled to Sweden, later contacting Neils Bohr in Denmark. Bohr knew that Enrico Fermi, who had fled from fascist Italy, had predicted that breaking one uranium atom would result in others being broken down in a chain reaction. Fermi conferred with Leo Szilard, a refugee from the University of Berlin, in his Columbia lab. Together they persuaded Einstein to write United States President Roosevelt and encourage him to develop the bomb before Germany did.

The fact that Germany did not develop the bomb first is at least partially due to the effect of anti-Semitism on science. Dr. Meitner, who did the original work with the uranium atom, fled Germany, because she was Jewish. Thee academics remaining in Germany dismissed Einstein's theory of relativity as "Jewish physics."

The Growth of Scientific Knowledge

Despite the influence of the state, science is shown as the international conduct of inquiry. In 1887, Americans Michelson and Morley began with the premise that Italy's Galileo had long ago demonstrated, that the earth moves though space. In 1905, Einstein published four articles in a German journal. His Special Theory of Relativity

builds on the work of Newton (British) and Michelson and Morley (Americans). During World War I, the British Astronomer Royal reminded scientists that the next opportunity to test Einstein's theory would be the solar eclipse of 1919.

Education

Einstein grew up in a household that respected education. Einstein despised the drill and recitation that characterized his boyhood schools in Munich. He thought the Swiss schools superior, because questions were welcomed instead of punished. Einstein's Munich teachers initially thought him dull. The narrator notes that Verdi had been refused admittance to Milan's musical conservatory for "lacking aptitude." Michelson was rebuked by his teachers and went on to be a Nobel recipient. Darwin was dismissed from the University of Edinburgh. Einstein, of course, went on to receive the Nobel Prize and many other academic honors.

Themes/Characters

Albert Einstein emphasizes freedom of thought and inquiry. From the very beginning, the reader is impressed with the lack of these qualities in the German schools and the German society in which Einstein is raised. During the years of World War I, Einstein finds it particularly difficult to live in Germany.

Although not interested in politics, he embraces pacifism wholeheartedly while many of his colleagues contribute to the German war effort by developing poisonous gases and explosives. Because he is a theoretical rather than an applied scientist, Einstein is not expected to take part in the war effort, but he is expected to take the side of Germany. Encouraging its writers, musicians, and scientists to approve its actions, the German government prepares a paper for them to sign indicating their approval. Many of Germany's most famous intellectuals sign, but Einstein refuses. Technically, he cannot be considered a traitor because he is no longer a German citizen, but many patriotic Germans dislike him for his refusal.

Einstein's commitment to freedom is also exemplified by his interest in the plight of the European Jews, who suffer tragically during the war.

His Jewish heritage presents personal problems for Einstein, even though he is not religious. After World War I, others attack his scientific theories on nonscientific grounds because some German scientists hate him both as a Jew and as a pacifist. When Adolf Hitler comes to power in 1933 and blames Jews for the German defeat in World War I, Einstein's homeland is no longer safe. Deciding that he cannot stay in a country that lacks political liberty, tolerance, and equality for all citizens, he accepts a teaching position at the Institute for Advanced Study at Princeton, New Jersey, where he lives for the rest of his life.

Style

Point of View

This biography is told from the third person. The narrator occasionally interjects information of scientific relevance to Einstein's work. The Forward states that some of the described events are fictional. For instance, although Einstein took numerous walks down Mercer Street, the walk described in the first chapter is contrived.

Setting

This biography was written and published in 1949, in the United States, shortly after the end of World War II. The book chronicles Einstein's life in Germany, Switzerland, and the United States.

Language and Meaning

The language in this book is explicit: the moon is a quarter million miles away from Earth. The earth is rotating around the sun at 18 miles per second. Half the speed of light is 93,000 miles per second. E = mc2 . Newtonian physics predicted the precise orbits of the planets. Einstein's theory predicted Mercury's orbit better than Newton's. The deflections of light observed was 1.64 seconds. Hitler offered a $5000 reward for murdering Einstein. This whole book is as exact as possible, just like a scientist.

Structure

Albert Einstein is divided into a Forward, 14 chapters, a Bibliography, and an Index.

In the one-page Forward, Einstein's son Hans Albert, then on the Berkeley engineering faculty, commends the biographer for showing that Einstein was, in addition to an extraordinary scientist, also a human being. The three-page Bibliography lists primarily secondary and biographical materials. The four-page Index focuses on places and names.

Quotes

"I appeal to all . . . to declare that they will refuse to give any further assistance to war or the preparation of war. I ask them to tell their governments this in writing and to register this decision by informing me they have done so . . . I have authorized the establishment of the 'Einstein War Resisters International Fund.'" Chapter 9, pg. 96

"This morning after an absence of ten years, when I am once more about to set foot on the soil of the United States, the thought uppermost in my mind is this: This country has through hard labor achieved the position of undisputed pre-eminence among the nations of the world . . . . Your political and economic condition today is such that you will be able to destroy entirely the dreadful tradition of military violence . . . . It is along these lines of endeavor that your mission lies at the moment." Chapter 11, pp. 120-121

"There is no higher religion than human service. We are all on this earth with the same mission in life. The general welfare of mankind is the trust of white man and black, rich and poor, Christian and Jew, Mohammedan and Hindu . . . True religion is real living—living with all one's soul, with all one's goodness and righteousness." Chapter 12, pp. 131-132

"I will stay in a country only where political liberty, toleration, and equality of all citizens before the law are the rule. Such conditions do not exist in Germany at the present time." Chapter 12, pg. 133

"Some recent work by E. Fermi and L. Szilard which has been communicated to me in manuscript leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future . . . . This would lead to the construction of . . . extremely powerful bombs. A single bomb of this type carried by boat and exploded in a port might very well destroy the whole port, . . . together with the surrounding territory." Chapter 14, pg. 159

Topics for Discussion

What different models of education and learning are presented in this biography?

Did Einstein's careless outward appearance result from practicality, not wanting to clutter his mind?

How did Einstein's outward appearance contrast with his scientific work and ethical convictions?

What do the quotations in the preceding section—all statements by Einstein—suggest about his ultimate legacy?

What would you characterize as the most critical part of Einstein's life: 1905 when he published the theoretical papers that revolutionized physics? The period between World Wars when he became more outspoken as a pacifist? The period between the beginning and end of the Second World War when he advocated building the first atomic bomb?

How do any of these three different periods contrast with his life and work after the conclusion of the Second World War?

How do Einstein's educational experiences in both the German and the Swiss schools compare with your early academic experiences?

This biography focuses as much on Einstein as a teacher as it does on him as a student. How are teaching and learning related?

When Hermann Einstein moved his family to Milan, he left his son behind in Munich: Albert Einstein was not formally expelled from his school there, but his math teacher asserted he had subverted the other students. Had he? How?

Einstein's parents valued education and wanted their son to succeed. Do you think their attitudes influenced his adult beliefs and behaviors, directly or indirectly?

How does Einstein's personal life differ over time: between when he was a child, student, and an adult? Are there common threads throughout his life?

Could Einstein's 1905 papers have resulted in part from his intellectual collaboration with Mileva Maritsch, his wife the "brilliant Hungarian student"?

The history of the development of the atomic bomb is a history of scientists like Meitner, Fermi, Szilard, and Einstein who fled fascism. What does that suggest about the nature of the modern world?

Atomic energy has a number of practical peacetime applications. Since the "Cold War" between the U.S. and the former U.S.S.R. is over, can we stop worrying about nuclear annihilation?

1. Do you think you understand Einstein's theory of relativity? Try explaining it to your classmates.

2. Is Levinger's portrayal of Mileva fair?

What do you think of Levinger's comment that Mileva has "a man's brain"?

3. Why does Einstein have difficulty establishing himself in a career as a teacher? Would a young person today be likely to encounter such problems?

4. Why does Einstein prefer Switzerland to Germany or Czechoslovakia?

5. Do you think you would enjoy having Einstein as a teacher? Why or why not?

6. What is a pacifist? How does Einstein's view on pacifism gradually change?

7. Why does Einstein urge President Roosevelt to have the United States begin work on the atomic bomb?

8. How do Einstein and President Truman differ in their ideas about how the bomb should be used to shorten World War II?

9. Do you think that Levinger spends too much time describing Einstein's unkempt physical appearance?

10. At one point, when asked to explain the theory of relativity, Einstein offers to play the violin instead. Why?

Ideas for Reports and Papers

1. According to Levinger, Einstein is sometimes called the Newton of the twentieth century because his theory of general relativity challenged the ideas of gravity and light that Sir Isaac Newton had given to the world two centuries earlier. What were Newton's ideas about gravity and light? How are Einstein's ideas different?

2. How have more recent scientists, such as Stephen W. Hawking, amended some of Einstein's theories?

3. What are some of the advances in medical science that have resulted from the development of atomic energy?

4. Some of the advances in the quality of life that Levinger predicted would result from atomic energy have not come about in the forty years since the book was written. Do you think they will ever take place, or was Levinger overly optimistic?

5. Disposal of nuclear waste is one of the greatest drawbacks to the development of nuclear power. What would Einstein think about this problem? Do you think he would have a solution?

Further Study

Einstein, Albert. The World as I See It.

1949. Reprint. Secaucus, NJ: Lyle Stuart, 1979. Out of My Later Years.

1950. Reprint. Secaucus, NJ: Lyle Stuart, 1973. These two famous collections of essays, letters, and speeches cover a wide range of public and personal issues.

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Goldsmith, Maurice, Alan Mackay, and James Woudhuysen, eds. Einstein: The First Hundred Years. New York: Pergamon Press, 1980. Fairly difficult to read, this work addresses Einstein's impact on science, society, world affairs, and the arts.

Hawking, Stephen W. From the Big Bang to Black Holes: A Brief History of Time.

New York: Bantam, 1987. A physicist at Cambridge University, Hawking is regarded by some as the successor to Newton and Einstein. This is his version of the origins and destiny of the universe.

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Princeton: Princeton University Press, 1979. This nontechnical collection, based on materials in the Institute for Advanced Studies archives, provides information on Einstein's personal life.

Kaku, Michio, and Jennifer Trainer.

Beyond Einstein: The Cosmic Quest for the Theory of the Universe. New York: Bantam, 1987. Newer theories presented in a semi-popular style.

Richards, Alan Windsor. Einstein as I Knew Him. Princeton: Harvest House Press, 1979. Experiences of the official Princeton photographer during Einstein's later years.

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Putting General Relativity to the Test.

New York: Basic Books, 1986. Discusses Einstein's theories in the light of later discoveries.

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