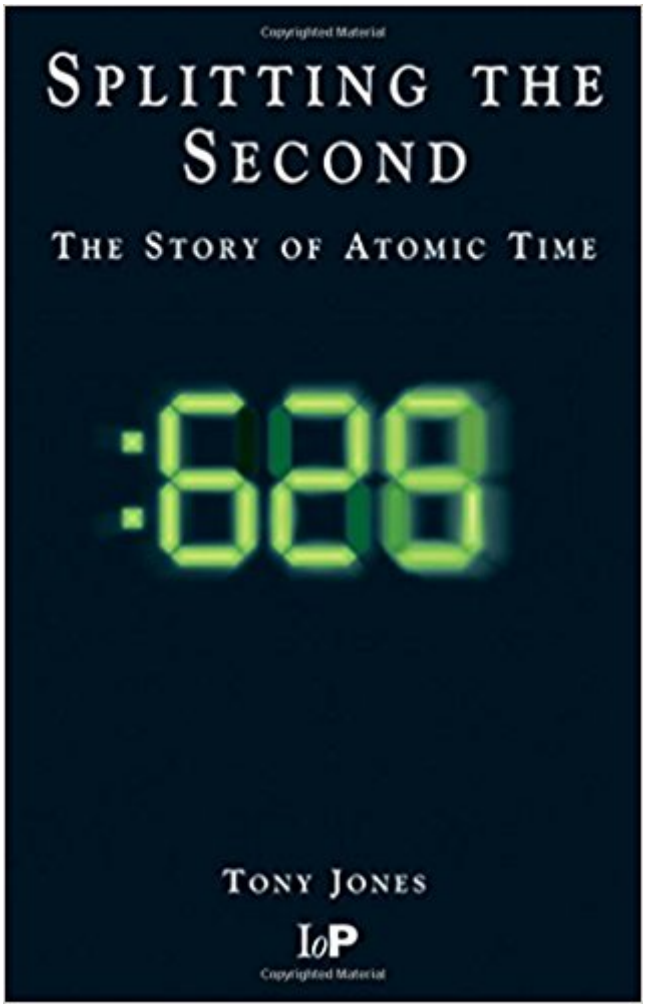
Splitting The Second: The Story Of Atomic Time



Synopsis

Until the 1950s timekeeping was based on the apparent motion of the Sun that in turn reflected the rotation of the Earth on its axis. But the Earth does not turn smoothly. By the 1940s it was clear that the length of the day fluctuated unpredictably and with it the length of the second. Astronomers wanted to redefine the second in terms of the motions of the Moon and the planets. Physicists wanted to dispense with astronomical time altogether and define the second in terms of the fundamental properties of atoms. The physicists won. The revolution began in June 1955 with the operation of the first successful atomic clock and was complete by October 1967 when the atomic second ousted the astronomical second as the international unit of time.Splitting the Second: The Story of Atomic Time presents the story of this revolution, explaining how atomic clocks work, how more than 200 of them are used to form the world's time, and why we need leap seconds. The book illustrates how accurate time is distributed around the world and what it is used for. It concludes with a look at the future of timekeeping.

Book Information

Paperback: 199 pages

Publisher: CRC Press; 1 edition (January 1, 2000)

Language: English

ISBN-10: 0750306408

ISBN-13: 978-0750306409

Product Dimensions: 8.3 x 5.5 x 0.6 inches

Shipping Weight: 10.6 ounces (View shipping rates and policies)

Average Customer Review: 4.7 out of 5 stars 8 customer reviews

Best Sellers Rank: #732,044 in Books (See Top 100 in Books) #88 inÃ Â Books > Science & Math > Physics > Nuclear Physics > Atomic & Nuclear Physics #159 inÃ Â Books > Science & Math > Experiments, Instruments & Measurement > Time #770 inÃ Â Books > Textbooks > Science & Mathematics > Astronomy & Astrophysics

Customer Reviews

In his book ,Jones covers the history of all aspects of timekeeping and introduces the reader to a host of related technical problems. His explanations do not involve undue technical complexity but give the reader a firm grasp of how the solutions were developed. -Historical Electronics Museum Newsletter… a very readable, popular account of the development of modern atomic timekeeping … [it is] an interesting, readable account of the state of modern timekeeping

… a good introduction and well worth reading by those interested in this rather poorly documented area of modern science and technology. -Dennis D. McCarthy (U.S. Naval Observatory, Washington D.C.), Physics Today, October 2001With great clarity, the author describes highly technical concepts and the devices used to implement them. I would especially recommend this book to scientists and engineers who want to learn the most recent developments in this intriguing field. I would also strongly recommend the book for nontechnical individuals because it is so readable. -William J. Klepczynski, Rittenhouse-Journal of the American Scientific Instrument EnterpriseAs a lifelong student of clocks, to me this book could not have been more welcome. The book is highly technical, yet for the nonphysicist it is eminently readable. The author unravels the arcane mysteries of the structure of the atom and its particles, with readily understandable text. Throughout we are kept fully aware of the impact of this new technology on the outside world of timekeeping and measurement. -Alan Smith, Astronomy Now, June 2001Anyone who is intrigued by fantastic precision or curious about how we really know the time, or simply likes tales of science and technology, will enjoy Splitting the Second. -Nature… a splendid book for the inquiring layman, sixth-form student, and undergraduate and it’s excellent value for money. -The Observatory… no astronomer, however amateur, should be without. -Astronomy NowThe book will appeal to a wide range of readers from physical scientists to the man-in-the-street. -Aslib Book GuideA fascinating account of how time has been measured and the problems with the timekeeping methods that drove the development of better clocks …. Jones’s book is a quick and interesting read. He succinctly presents physical explanations for the workings of different kinds of atomic clocks and weaves a compelling, detailed account of the difficulties of keeping accurate time.Donavan Hall, History of Physics Newsletter, Vol. IX, No. 1cinating account of how time has been measured and the problems with the timekeeping methods that drove the development of better clocks …. Jones’s book is a quick and interesting read. He succinctly presents physical explanations for the workings of different kinds of atomic clocks and weaves a compelling, detailed account of the difficulties of keeping accurate time.Donavan Hall, History of Physics Newsletter, Vol. IX, No. 1

This book is a fun, semi-technical but accessible, read about the second as a standard unit of measure. It covers the history of the importance of time to civilization and explains that evolution, culminating in atomic time and more recent developments in standardized timekeeping. This book is excellent, but could have been more comprehensive, hence 4 stars. Regardless,the author does a great job of weaving the tale of time through the lens of atomic time.

Excellent presentation of the advent and development of atomic clocks.

Having become interested in timekeepeing and astronomical time, this has been the best work I've read on the subject. There's a large amount of fascinating information and detail presented in an almost story-like fashion. Not very long, but I definitely enjoyed every page.

Excellent horology tome and has my sincere praise.

I had trouble putting this book down because it does such an excellent job of conveying the epic accomplishment of modern timekeeping while so clearly explaining how and why we got there.As other reviewers have commented, Tony Jones does an excellent job describing the operating principles of atomic clocks as well as the system by which those atomic clocks are used to determine time in the modern world. Many non-mathematical technical books are either convoluted and confusing in their attempt to explain with metaphors instead of math or they leave me feeling dissatisfied with the shallow level of coverage. This book splendidly avoids both these pitfalls. I found the descriptions of technical topics such as the operating principles of different types of atomic clocks, types of time transfer, experimental demonstrations of relativistic time dilation, and detected deviations in Earth's rotation to be extremely lucid and satisfying.The only source of dissatisfaction I felt with this book was that it was published for the new millennium, and progress in atomic timekeeping has proceeded briskly in the intervening years. I wish I could have Tony Jones's enlightening explanation of developments since the original edition was released.

Tony Jones did an excellent job starting at the beginning of time measurement and guiding the reader through to the newest methods in development. The first principle discussed is: What is a clock? A clock requires two components 1) an oscillator and 2) a counter. Starting with simple pendulum clock Jones examines the oscillator and counter, then advances to atomic time. The transfer of time from location to location is just as important and discussed in detail with a simple clock on a bell tower and residents of a nearby town. Finally Jones talks about why we care... Why are leap seconds important and problematic? Who uses precise time anyway? How can difference in time scales be resolved? Why isn't the second really constant?Overall this is a quick, non-technical read that should satisfy any curiosity you have about the history of timekeeping.Contents:1 - Astronomer's Time2 - Physicists' Time3 - Atomic Time4 - World Time5 -

The Leap Second6 - Time Transfer7 - Uses of Accurate Time8 - The Future of Time

I think a better subtitle would have been, "The Constant Search for Time," because only a third of the book is devoted to atomic clocks. The development of increasingly stable and accurate clocks is covered in detail, thankfully without dwelling on Harrison's efforts (already well covered in other books).As better clocks were built, measurements showed increasingly subtle causes for variations in the length of the day ranging from a non-circular orbit, to tidal effects, to crust movements, and down to atmospheric effects on the rotation rate. All these are covered in detail.The most convenient source of time with nanosecond accuracy is now the GPS satellites. Jones describes how special and general relativity affect their timekeeping and how these effects are compensated.He also goes into great detail about the international organizations responsible for managing UTC and the complex methods used to average the time from the primary standards and hundreds of secondary standards to produce UTC. Jones manages to do this without losing the reader's attention.Although the book avoids any math or advanced physics, it does not condescend in any way, and is directed to the mature reader. There are explanations of cesium and rubidium frequency standards, hydrogen masers, and also the latest developments: laser cooling and cesium fountains.It would have been nice if the author had included a bibliography, but this is compensated by providing the URLs for all the major world timekeeping organizations and also links to a number of web sites devoted to time.

Tony Jones has crafted an excellent history of time keeping from basic astronomy to pendulum and quartz clocks to modern atomic clocks. The problems and successes at each level are clearly explained. The text is at the early undergraduate level and is unencumbered with mathematics. Precision time has become imbedded in the activities of modern civilizations and it is interesting to see how the determination and dissemination of time has become complex as the accuracy has improved.

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