Exploring the History and Science Of the Telescope

by Charles Hughes

The Telescope
by Geoff Anderson
Princeton, N.J.: Princeton University Press, 2007
Hardcover, 248 pp., $29.50

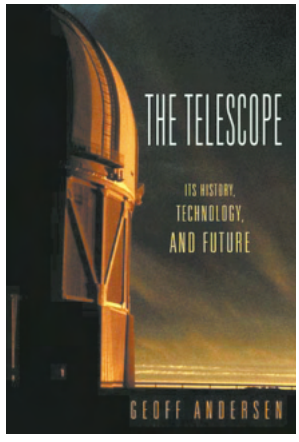
This book not only covers the history of the telescope but, more important, it describes the most recent breakthroughs in optical technology and engineering. It also describes the nature of light in detail, without having the disadvantages of a textbook on physics.

On the question of who exactly invented the telescope: Most books on telescopes say that Hans Lippershey, a Dutchman, was granted a patent by the Dutch government in 1608 for an instrument consisting of two lenses of glass which magnified distant objects. But author Geoff Anderson cites a reference by an Englishman, Thomas Diggs, who claimed that his father, Leonard, in 1571 had used a device to bring distant objects closer, saying that he could see what was taking place in private places. (Perhaps this was history's first spy glass?)

It is a popular misconception that the telescope was invented by Galileo Galilei of Pisa, Italy, born in 1564. According to Andersen, the story of how Galileo came to make his first telescope is as follows: Galileo was shown a telescope by a friend who happened to be a government official, who had custody of a telescope given to him by an inventor who wanted to be granted a patent for the device. Galileo borrowed the device and copied it, making some improvements in the instrument.

Galileo is well known for many original observations, such as the discovery of the four major satellites of Jupiter. But although he observed sunspots, he was not the first to report them; the ancient Chinese had beaten him to it.

At least one of Galileo's findings, Anderson reports, is suspect. His illustration published in a woodcut shows the Moon at the half phase, with the shadow splitting the lunar surface in half, and there is a large crater right in the middle, where no such large crater can be seen now. This crater is possibly Albattegius, but may also be a mistake, a fabrication, or perhaps the fault of the printer.



The Telescope and Light

Anderson does a thorough job of explaining the wave nature of light, and how it causes problems in precise telescope observations of the stars and celestial sights, in the two main categories of telescope, the reflector and refractor.

One major problem is that the wave nature of light causes light to be disrupted whenever it encounters an edge or obstruction in the light path. The edge of the telescope tube is such an obstruction, as is the diagonal mirror in a reflecting telescope, which directs the image to the side of the tube to bypass the observer's head.

The reflecting telescope has a mirror at the base of the tube to gather light and direct it up the tube to the ocular, which magnifies the image.

The early telescopes were refractors, in which the main light-gathering mechanism is a glass concave lens at the front of the telescope, which forms a real image. The light goes down to a small lens in front of the observer's eye, where the image is enlarged, and then to the eye.

Another problem is the non-homogeneous character of the atmosphere, which distorts light passing down from the star to the telescope.

Since the very beginning of the telescope, astronomers have attempted to enlarge the objective, either the front lens or the rear mirror to obtain a larger, unobstructed area of the main optic and thereby increase the resolution of the telescope; that is, the ability to see large, sharper details of a celestial object. That is the reason for the race in modern astronomy for ever more gigantic mirrors to gather more light from the celestial objects being observed.

As for the unsteadiness of the air, the only remedy (until the discovery of the technique of adaptive optics, which I will describe below) was to observe on those, often few, nights of the year when the atmosphere, or the seeing, was good.

Another recourse was to locate the observatory on a high mountaintop where the telescope was above most of the atmosphere, the most favorable sites also being near the ocean. (Two such prime sites are Chile and Hawaii.) With bad, turbulent air, however, the chances of someone at such an observatory seeing an object at sharp resolution, and with the limitations imposed by the diffraction effects of the light waves hitting the edges of the telescope tube, are little improved over those of an amateur instrument.

To see the wonders of the heavens, accepting the limitations of air turbulence and diffraction, Anderson states that a telescope of about 6-inches diameter is all that is needed. A refractor type is slightly superior, although more costly, with a long focal length that is, say, 15 times the diameter of the objective

lens or mirror.

Of course, a third method of eliminating bad air is to put the telescope where there is none—in space. The Hubble has given us fantastic clear images of the universe, to the very limit that the 90-inch mirror is allowed by the laws of physics. The problem here is the size of the load in the Space Shuttle and the extreme cost of putting a telescope in space.

New Techniques

Chapter 10 and those following are the most interesting part of the book, as they explain the new techniques that have caused a revolution in telescope imaging.

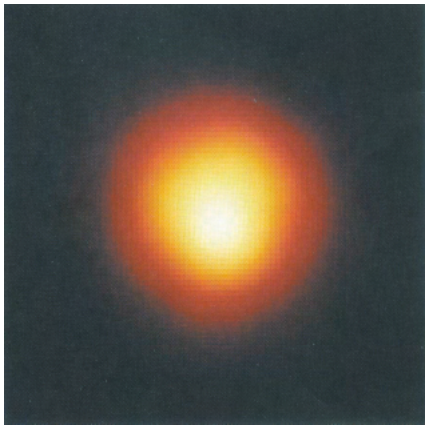
These new advances have come about through the use of advanced laser and light techniques linked to the ability of supercomputers, which were developed out of the "beam defense" technology of the last 10 years, and declassified at the end of the Cold War in the 1990s.

How these advances work require understanding how light forms images. Huygens and other scientists in the 17th Century proved that light was a wave, and not a particle, but this idea was contested by Newton. (Newton had many erroneous ideas about the nature of light, as noted below.)

One problem with early refractor telescopes was chromatic aberration, the tendency for different colors of light traversing the telescope objective to fail to focus at the same point. (Mirrors do not have this problem; all colors focus at the same point.) Newton taught that it was impossible to correct the objective of a refractor for this problem.

To correct this chromatic problem somewhat, telescope makers increased the focal length of the telescope while keeping the diameter of the lens small. But this method of correction caused telescopes to assume grotesque lengths. No doubt readers have seen illustrations of early instruments, such as the telescopes at the Paris Observatory in the 17th Century, that were 100 feet long, supported on high towers with ropes and pulleys.

In 1759, John Dolland proved Newton wrong by inventing the achromatic objective for the refractor, using two different types of glass sandwiched together to get most of the light to focus at a single point with only a moderate focal length. Unfortunately Newton's authority had kept the development of the refractor back 50 years or more.



Hubble Space telescope (STSci/AURA)

Betelgeuse, a red giant in the Orion constellation, in the first image resolving the disk of a distant star. The star is 20/1,000ths of an arc second in diameter.

Getting back to how the wave nature of light causes trouble for astronomers: If you observe a bright star through a telescope on a night that has good air transparency, or good seeing, you can not see the star's disc because it is too far away to be resolved unless you make use of the advanced laser techniques.

Instead, you will see a ring like a bull's-eye made up of light and dark concentric rings. The dark rings are caused by light waves interfering with each other, a wave crest cancelling out a trough. The bright rings occur when the waves coincide and reinforce each other. This is termed a diffraction spot or an Airy ring.

Without the boost in resolution provided by the new beam technology, even a large Earth-bound mirror cannot resolve the disc of a distant star. This type of telescope can resolve an angle of about 1 arc second.

To get an idea of what this means: A circle is divided into 360 parts, each part called a degree. The degree is divided into 60 parts, each one called a minute. The minute is split into 60 seconds. The Moon is about 1,800 seconds wide, and Mars is about 24 seconds, when it is closest to the Earth.

One of the largest stars closest to us is about 20/1,000ths of an arc second, which is why the disc cannot be resolved even in a giant telescope. The star in question is the famous red giant Betelgeuse in the constellation of Orion, 400 light years away. Astronomers did finally obtain an image of Betelgeuse, which is illustrated as a color plate in this book (see photo).

Optical Breakthroughs

One breakthrough was the discovery that if two or more telescope mirrors were separated, the lateral distance separating them acted as single mirror with amplified resolution. For example, two 100-foot mirrors separated by 1 mile and connected together electronically would be equivalent to a mirror with the resolving power of one mirror that was 1 mile plus 200 feet in diameter.

I say here "mirror," because large refractors were abandoned as an option in observatory telescopes a hundred years ago. The largest refractor ever built was the 40-inch refractor at Yerkes Observatory in Williams Bay, Wisconsin, in about 1890. Large, heavy glass lenses could not be mounted on the front of a tube beyond this size.

More recently, however, improvements in mirror fabrication to make telescope mirrors light, thin, and deformable have made it possible to make huge mirrors, which can be fitted together like tiles to build up a large mirror out of small, thin, very well figured segments. The overall optical properties of the whole can be controlled by computer-operated mechanical fingers behind each segment.

Several of these monsters can be interconnected electronically to make a super mirror, increasing the size of the diffraction spot for the observer. Thus it could give the observer the excessive resolution needed to image a star like Betelgeuse. However, the rough air is still a problem.

Anderson explains how the new technique known as adaptive optics solves the problems of turbulent air. It uses a laser aimed into the field of view of the telescope, which probes the air mass, feeding information into a very advanced computer. This produces a map or model of the air turbulence and feeds this model to actuators behind each mirror segment, so that the mirror shape is coincident with the air wave front, thus producing a well defined image of the star.

I recommend this book for anyone wishing to understand the latest advances in astronomical science, as well as telescope history.

Wilhelm Weber Defended

by Laurence Hecht

The Electric Force of a Current: Weber and the Surface Charges of Resistive Conductors Carrying Steady Currents
by Andre Koch Torres Assis and Julio Akashi Hernandes
Montreal: Apeiron, 2007
Paperback, 237 pp., $20.00 (Available in pdf format at http://www.ifi.unicamp.br/~assis)

Prof. Andre K.T. Assis of the State University of Campinas in Brazil is a fierce defender of Wilhelm Eduard Weber, the collaborator of Carl Friedrich Gauss in the determination of the absolute value of the Earth's magnetic force, and the author of the Universal Law of Electrical Action. On this orientation, we wholeheartedly agree. On other matters, related to the deeper significance of the Gauss-Weber-Riemann electrodynamics, we have maintained a friendly disagreement for some years.

In this new work, I find our points of difference reduced to a minimum, and have discovered much new material of interest. Dr. Assis has focussed this work on refuting the charge levelled by Clausius, Maxwell, and others, that the alleged failure to detect a force between a current-carrying wire and a nearby stationary charge invalidates Weber's fundamental law.

In a sharply formulated summary of the current dogma in Chapter 1, Dr. Assis answers the argument against Weber's force law, following the discovery at the turn of the 20th Century that the positive charge seems to remain connected to the lattice of a conducting wire, while the negative charge is put into relative motion.

In Chapter 3, "Experiments," the work of a great number of investigators, establishing the existence of the Weber force in the case in question, is brilliantly summarized. I found here material that was new to me, despite having paid close attention to developments in the area.

While the evidence shows that there are no grounds for denying the existence of a force between a conductor and a static charge, it remains a shame that, after all these years, a more decisive experimental demonstration of the existence of the force has not been achieved. Dr. Robert Moon's 1958 proposal, never funded by the University of Chicago Physics Department, remains exemplary of the sort of procedure that could provide a decisive proof (cf. *21st Century,* Fall 2004, p. 46).

Later chapters in the book are devoted to theoretical calculations related to the Weber force, including an original treatment of the resistive spherical shell. An appendix, "Wilhelm Weber and Surface Charges," contains a penetrating study of Weber's important paper in the *Electrodynamic Measurements* series, devoted to resistance measurement.

A second appendix, on Gustav Kirchoff's derivation of the telegraphy equation, in which he demonstrated that the propagation of current in a wire would be limited by the velocity of light, sets the record straight that both Weber and Kirchoff had preceded Maxwell by several years in this discovery. It might usefully have been added that Bernhard Riemann, in a paper dated 1858, had already recognized that the propagation of the electrical potential in free space is retarded at the same rate as the propagation of light. Riemann was the closest friend of Wilhelm Weber and prized student of Gauss.

What Is Left Out

Which brings us to our criticism. It is in matters relating to the historical development of the subject where the book's shortcomings appear, not so much in what is stated as in what is left out.

Weber's electrodynamic studies began as an effort, as chief assistant to Gauss, to establish the existence of the Ampère angular force. As Gauss had noted explicitly in his 1839 paper "General Propositions Relating to Attractive and Repulsive Forces Acting in the Inverse Ratio of the Square of the Distance," the existence of the Ampère angular force meant that the entire edifice of potential theory built upon the Newtonian structure would collapse.

It was no accident that Gauss devoted more than 10 years of his life to inquiring as to the existence of the angular force. The publication of the experimental proof under Weber's name in 1846, appeared, appropriately, in a volume marking the 200th anniversary of the birth in Leipzig of Gottfried Leibniz, Newton's opponent on matters underlying this fundamental point.

It was James Clerk Maxwell who first introduced into the field of electrodynamics the false dichotomy between theories of *action-at-a-distance* and theories of *propagation in a medium.* Under this false categorization, Ampère (who was virtual co-author with his dear friend Augustin Fresnel of the modern wave theory of light), Gauss (the untiring, if also circumspect, champion of Kepler against Newton), and Gauss's students Weber and Riemann, are all classed as defenders of the *action-at-a-distance* theory!

Unfortunately, most among that small circle of modern defenders of Weber and Ampère have allowed themselves to be trapped into Maxwell's false dichotomy. To oppose Maxwell, is thus, supposedly, to uphold Newton.

The proper treatment of the matter revolves around a crucial point made by Gauss in the 1845 correspondence with Weber, respecting the need for a rigorous *constructible representation* of the electrodynamic propagation, a representation which Maxwell failed to provide, despite what has been drilled into the heads of generations of physics and engineering students.

A rigorous solution to that problem still awaits discovery. The difficulty does not lie in the realm of formal mathematical representation, where most, including Maxwell, have looked. The solution revolves around the issue, identified by Lyndon H. LaRouche, Jr., of the real existence of the *ontological transfinite.*

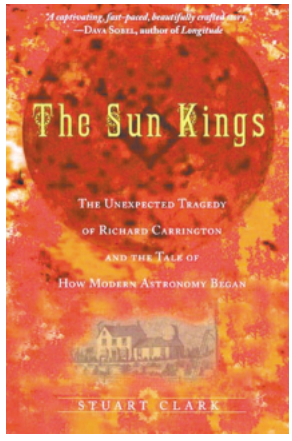
Riemann's remarks on the Newton problem in the posthumously published "Philosophical Fragments," and his attempts at formulating a theory of propagation of the *retarded potential,* come closest to the direction of a solution. A thorough familiarity with the work of Ampère, Gauss, and Weber is an essential prerequisite to fully comprehending those efforts.

Despite the noted shortcoming, this new work of Drs. Assis and Hernandes may usefully assist in that endeavor.

The Sun Rules the Planet

by Manuel K. Oliver

The Sun Kings: The Unexpected Tragedy of Richard Carrington and the Tale of How Modern Astronomy Began
by Stuart Clark
Princeton, N.J.: Princeton University Press, 2007
Hardcover, 211 pp., $24.95



What a delight! This is an enthralling account of the personal lives of the scientists who first demonstrated the Sun's dominant influence over Earthly affairs and laid the foundation for modern astronomy and astrophysics.

And what timing! Just when the attention of the world is focussed on global climate changes, Stuart Clark's book reminds us that the Sun is King of the Solar System, controlling events on planet Earth in ways that extend far beyond the daily benefits of visible sunlight, and its reflection at night from the Moon and other objects in the Solar System.

Stuart's book is rich in personal details of the pioneers who discovered that planet Earth remains closely linked with eruptions on the Sun, billions of years after this star gave birth to the Earth and its sister planets. This is a fast-moving, accurate, and fascinating story of diverse personalities, their families, ambitions, hopes, and struggles, their passion for knowledge, for awards, positions and recognition, and the inevitable roles that pride, greed, jealousy, and resentments played in deciding the tragedies, fame and fortune of the founders of modern astronomy.

The story covers a 209-year period, from William Hershel's lectures on Dec. 18, 1795, about the strange, planet-like features that he had observed on the surface of the Sun, until the eruption of a neutron star on Dec. 27, 2004 blasted Earth and the rest of the solar system with deadly, high-energy radiation from the supposed dead heart of a distant star.

It is probably no coincidence that Clark uses historical events closely related to a current controversy about the Sun as bookends for this gripping story. Clark is a master storyteller and, as the author of several astronomy books and the former editor of *Astronomy Now,* he knows how very little the scientific community really understands about the erratic star that controls most events on planet Earth.

The story is built around the seemingly good fortune of a 33-year-old astronomer, Richard Carrington, who was following a highly disciplined routine of observing and recording events on the Sun, when, at 11:18 AM on Thursday morning, Sept. 1, 1859, Carrington witnessed blinding white light from a monstrous solar eruption. At about the same time, the Kew Observatory had the good fortune to record a sudden recoil of the Earth's magnetic field, a finding that suggested an almost instantaneous link across the 93 million miles of void that separates Earth from the Sun.

(The personal tragedy that befell Carrington, which is mentioned in the title, I leave to readers of the book to learn.)

The Kew Observatory recorded an even larger disturbance in Earth's magnetic field the next day, when the full force of the solar storm reached the third planet after travelling about 5 million miles per hour from the Sun, and engulfed the Earth in a blood-red aurora, wreaking havoc worldwide as "telegraph systems crashed, machines burst into flames, and electric shocks rendered operators unconscious."

The story unfolds, not in simple chronological order, but with an event that is still fresh in the memory of many readers: A series of violent solar eruptions that occurred 44 years later near Halloween of 2003, soon after the *Journal of Fusion Energy* had published a paper on "Superfluidity in the solar interior: Implications for solar eruptions and climate."

The most obvious theme of *The Sun Kings* is this: Earth is intimately connected to the rest of the universe and our destiny is closely tied to that of the violent and unpredictable star that illuminates our tiny corner of the cosmos and sustains life itself.

I do not know Stuart Clark personally, but I gladly give *The Sun Kings* my highest recommendation, not only for its entertainment value, but also for the insight it provides into the foundations of modern astronomy and the fragility of our very lives on planet Earth.

Dr. Manuel is Emeritus Professor of Nuclear Chemistry, University of Missouri, Rolla, Mo.

The Joy of Fighting Dogma with Ideas

by Gregory Murphy

The Virtue of Heresy: (Confessions of a Dissident Astronomer)
Hilton Ratcliffe
Central Milton Keynes: AuthorHouse UK Ltd., 2007
Paperback, 409 pp., $22.95

Hilton Ratcliffe's book is a breath of fresh air in the stale confines of popular science. His book is full of ideas, which he does not ask you to believe on face value, but to read, study and, discuss. The current trend in science-based books, in contrast, is to focus on certain "facts," as opposed to ideas. The only thing that such books can by used for is as a preparatory text for competing on Jeopardy, or for for trying to sound smart at a cocktail party.

The Virtue of Heresy uses a great deal of humor to attack the current dogmatic ideas plaguing astronomy, such as dark matter, dark energy or force, Hawking radiation, and everybody's favorite formalism: the Big Bang. Ratcliffe comments on the notion of Hawking radiation, which is believed to be the radiation emitted from black holes, by saying that it only occurs in Stephen Hawking's head!

Ratcliffe's main target in the book is the Big Bang theory. This idea of the beginning of the universe, he says, is not true and could not have happened that way. Furthermore, he says, the Big Bang theory does not even come close to explaining how the really big stuff got out there in space. He also attacks the stranglehold of the Big Bang theory on the funding for astronomical research, which prevents any dissenting scientists from getting telescope time or funds.

One gets a healthy impression from the book that it is necessary to question current theories—a refreshing outlook, given that the current prevailing wisdom is to "go along to get along." Ratcliffe's book also encourages discovery, which goes well with his position as a fellow of the Institute of Physics in Britain, where he is in charge of getting high school and university students interested in science. In particular, he encourages youth to work through the orginal discoveries of science.

There are parts of Ratcliffe's book that I disagree with: those that concern his clinging to Isaac Newton's mechanics. I prefer the more pro-human mechanics of Gottfried Liebniz. Even with this disagreement, I found Hilton's book enjoyable, and so far it is one of the only science books published this year that really asks you to think about ideas, as opposed to repeating facts like a trained parrot.

An Ocean of Airheads: The Gossip Column Approach to Science

by Gregory Murphy

An Ocean of Air: Why The Wind Blows and Other Mysteries of the Atmosphere
Gabrielle Walker
Orlando, Fla.: Harcourt Inc., 2007
Hardcover, 272 pp., $25.00

If one were to read the book jacket for Gabrielle Walker's latest work, one would find promise of a interesting book dealing with the Earth's atmosphere. In reality, the reader finds a book that consists of seven discrete chapters that are in no way connected, giving the reader the impression that the atmosphere is made up of only discrete features and does not work as a whole—which any grade schooler knows is not the truth.

My main complaint about *An Ocean of Air* is that it seems to be written more as a gossip column than a popular science book. Walker reports more about the personal lives of the scientists that she is writing about, than about their scientific discoveries. This was also the case for her first book, *The Snowball Earth,* in which the reader learns more about the running shoes of Dr. Paul Hoffman of Harvard, than about his discovery of the snowball Earth (the theory that the Earth was once covered from the poles to the equator in ice).

The real failure of this book, however, is that instead of uplifting and educating her readers with a real discussion of ideas behind the discoveries she writes about, Walker has chosen to present these discoveries as secondhand facts that might be the answers for one of President Bush's standardized tests. The only people who might learn anything from Walker's presentation, in fact, are those who think that Al Gore and President Bush are geniuses.

This book is a real disservice to the youth of today, who are thirsty for ideas and want to work through real discoveries. As an example to Walker on how to present ideas, I point her to the LaRouche Youth Movement website on Johannes Kepler: http://wlym.com/~animations/. She should visit the site and see that in this time of crisis people need big ideas not spoon-fed factoids.

Climate Blunders

In *An Ocean of Air,* the only two chapters in which Walker even attempts to explain anything scientific are those that deal with the global warming and ozone hole swindles—two of the most politically charged science frauds in the past three decades. (The reader should know that Walker is the Climate Change Editor for the British journal *Nature*.)

But in her rush to proclaim that the greenhouse effect is real and very dangerous, Walker makes a big mistake in her discussion of the work of Svante Arrhenius (1829-1957), the first scientist to calculate how much temperature would rise in relation to increasing carbon dioxide. She portrays Arrhenius as a wild-eyed global warmer, like Al Gore or James Hansen. But the truth is that Arrhenius miscalculated the temperature rise, saying that temperature would rise 3 to 6 degrees Celsius with the doubling of CO_2, and furthermore that he didn't think this was a negative event.

It is interesting to note that Arrhenius's miscalculated value is the same temperature rise quoted by the Intergovernmental Panel on Climate Change. In reality, the amount of temperature rise is only about .3 to .5 degrees Celsius for a doubling of CO_2.

Walker also doesn't mention that Arrhenius believed that the increasing CO_2 would be a *benefit* to mankind, by producing the warmer climate that would be needed to grow the food for an increasing human population.

At every point in Walker's book, she chooses to focus on the most nonsensical or irrelevant facts of the subject's life, instead of the ideas and discoveries of the scientist. The question Walker needs to be asked is, is her writing simply incompetent, or is this a deliberate effort to dumb down science.

At present Walker's book should be referred to as "bimbo science."

A History of Chemical Compounds

The 100 Most Important Chemical Compounds: A Reference Guide
Richard L. Myers
Westport Conn.: Greenwood Press, 2007
Hardcover, 326 pp., $85.00

Intelligently presented with effective graphics, the author succeeds in his stated intention of presenting the social and economic impact of chemical discoveries on human history. However, the concessions to green fascism on such controversial entries as carbon dioxide, DDT, dichlorodifluoromethane (freon), and even THC (the active ingredient in marijuana), are disappointing.

Not so long ago, chemistry was a required course in American high schools, because of the recognition of the subject's importance to an industrial society. Today, when we are no longer an industrial but an imperial/importer society, the attempt to teach an understanding of physical economic processes has given way to instruction in rules and procedures—even in our science courses.

The author has brought a thorough grasp of chemistry, as well as considerable knowledge of its history and present applications to bear on the subject. Had he also stuck to truth rather than popular opinion on the controversial areas, he would have produced a less flawed work. Nonetheless, it would probably make a net positive contribution to any school or personal reference library.

—Laurence Hecht

Enrico Fermi on Film

"The World of Enrico Fermi" and "People and Particles"
DVD format, 2007
Distributed by the American Association of Physics Teachers, www.aapt.org , $19.99

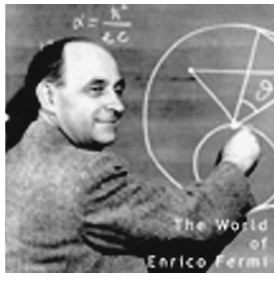
This DVD, distributed by the American Association of Physics Teachers, was originally created for use in high school classrooms in the 1960s, as part of Project Physics, a Harvard University program involved in curriculum planning. This is the first time the films have been made available to the public.

The Fermi film is very well done, with intelligent commentary and fascinating footage of Enrico Fermi, his wife, and his students (many of them eminent physicists). Unlike many of today's films for students, the music is unobtrusive and the presentation presumes a thinking viewer.

Fermi comes to life in photos and through the comments of his wife and colleagues. You also hear Fermi's own voice explaining a point in a lecture.

The films give a taste of what it was like to be a scientist at a time when there was more enthusiasm for ideas and science, and when a national mission, the Manhattan Project, pushed individuals of all ages to come up with new solutions to technical problems—in a hurry. My only complaint is that this film was not longer!

"People and Particles" is a very different sort of film. It chronicles a Harvard Physics Department team at the Cambridge



Electron Accelerator that designs and builds an an electron beam experiment over a two-year period. The objective of the project is to see how electrical charges interact at close distance. The camera follows the people on the team candidly as they talk about the equipment they will need, make a floor plan, build a large spark chamber, write the computer program for analyzing the results, put the equipment in place (including an enormous magnet, which is dubbed the "Green Giant"), talk with a visiting Armenian scientist, and, finally, break out the champagne, after the first shot shows that the experimental design works.

This film is also a slice of history, this time from the late 1960s, and it gives a good sense of scientists at work on a problem to see if the evidence matches the theory. It is telling that in the film notes, physicist James Rutherford mentions that the Accelerator later had to be dismantled for lack of money to run it.

—Marjorie Mazel Hecht

BOOK NOTES

Geographic Family Reference Atlas of the World
Washington, D.C.: National Geographic, 2006
Hardcover, 384 pp., with 510 maps and 430 illustrations, $65.00

National Geographic's *Family Reference Atlas* is lavishly illustrated, as you would expect from a publisher known for its photographs and illustrations.

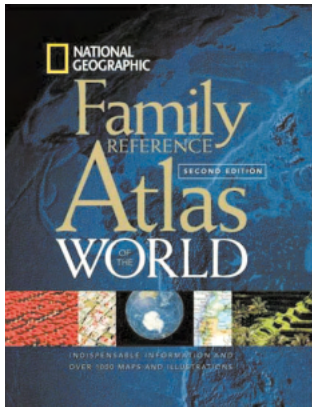
It provides detailed maps—geographical, topological, political, mineral, and agricultural. Like the atlases I remember from elementary school, it has little symbols for the agricultural products that characterize each area. But unlike the atlases of my childhood, it provides maps of political "hotspots," so that you can easily find Abkazia or Chechnya, to name two such hotspots in the news.

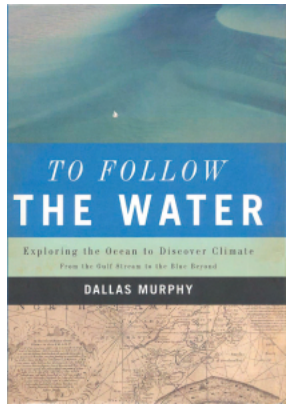
And like most "educational" items today, it provides the same conventionally "correct" opinions about global warming, biodiversity, and other such environmental issues in its topical introductions.

There are also some telling omissions and bloopers. In the energy descriptions, for example, there are symbols for other forms of energy—but not for nuclear plants. There is no map of world railroads, or even U.S. railroads, a standard infrastructure item and a crucial measure of economic development. In the blooper department, the Atlas's section on the poles makes mention of the British expedition to Antarctica, but, remarkably says nothing about the monumental U.S. Exploratory Expedition, 1839-1842, headed by John Wilkes and promoted by John Quincy Adams, which got to Antarctica first!

With these caveats in mind, this is a usable atlas.

—Marjorie Mazel Hecht





To Follow the Water, Exploring the Ocean to Discover Climate
Dallas Murphy
New York: Basic Books, 2007
Hardcover, 278 pp., $26.00

This is a cynical and sophistical book, trying to ride the wake of Al Gore's global warming hoax. Don't waste your time or money, unless you want to read a book by someone who says that Chaucer taught astronomy to John of Gaunt's daughter, Philippa, who was to become the mother of Henry the Navigator, because he needed a "survival gig to make ends meet before he hit it big with the *Canterbury Tales*."

—Rick Sanders