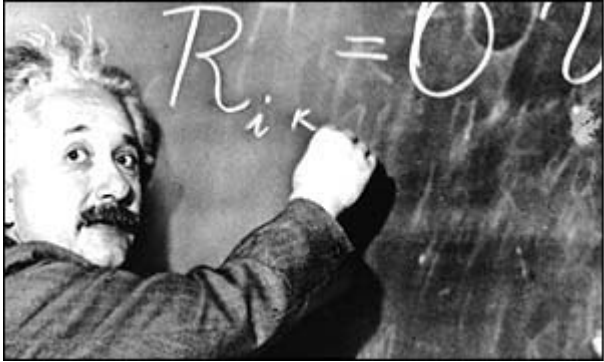


Einstein Proved Right on Gravity



It all adds up: Albert Einstein would be pleased

--Scientists determine the speed of gravity is equal to the speed of light, confirming Einstein's assumption.—

BACKGROUND:

Gravity is a force of attraction between all matter. It is the weakest known force in nature, but it still manages to hold galaxies like the one shown in this image and the solar system together. The ancient Greek philosophers thought that the motions of the stars and planets were totally unrelated to events on the earth. The heavens were the realm of the gods, where everything existed in perfection. One of these philosophers was called Aristotle. He thought that the stars and planets followed a "natural" motion, and that the force that made them move made contact between them.

This force is the force of gravity and today we know that it works without actually touching objects but the ideas of the ancient Greeks survived right up until the 16th century when our understanding of gravity was changed dramatically by scientists like Galileo and Newton.

Isaac Newton believed the influence of gravity was instantaneous. Newton used Kepler's laws and his own observations to derive the universal law of gravitation. His observations of

the motion of the moon, the tides and even comets helped him derive the law. There is another legend which states that whilst lying against a tree in an orchard Newton was struck on the head by an apple. What provided the acceleration for the apple to fall to the ground? Was this a force of the earth on the apple? If so, then the apple must exert a force on the earth according to Newton's law of action/reaction forces.

Newton extended these ideas to the planets orbiting the sun. He found by studying astronomical data that the force that held the earth in orbit around the sun was the same force that drew the apple toward the earth. This was the force of gravity.

Later, Albert Einstein assumed it traveled at the speed of light. Albert Einstein, who formulated basic theories about space, time and relativity, had assumed that gravity moved with the speed of light, about 186,000 miles per second, but until now, no one had measured it. He built his 1915 General Theory of Relativity around that assumption. This relates gravity to space and time. Among other astounding predictions, this theory predicted the bending of light by a massive object such as the sun. When this was confirmed in 1919 by scientists observing an eclipse, Einstein became an instant celebrity. To his last days Einstein worked on unifying gravitation and electromagnetism into one force, right up to his death bed where he died with the last few equations of his work resting alongside him.

If gravity traveled at the speed of light it would mean that if the Sun suddenly vanished from the Solar System, the Earth would remain in orbit for about eight minutes - the time taken for

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light to travel from the star to our planet. Then, in the absence of gravity, Earth would move off in a straight line.

STORY:

Taking advantage of a rare cosmic alignment, scientists have made the first measurement of the speed at which the force of gravity propagates, giving a numerical value to one of the last unmeasured fundamental constants of physics.

"Newton thought that gravity's force was instantaneous. Einstein assumed that it moved at the speed of light, but until now, no one had measured it," said Sergei Kopeikin, a physicist at the University of Missouri-Columbia.

"We have determined that gravity's propagation speed is equal to the speed of light within an accuracy of 20 percent," said Ed Fomalont, an astronomer at the National Radio Astronomy Observatory (NRAO) in Charlottesville, VA. The scientists presented their findings to the American Astronomical Society's meeting in Seattle, WA.

The landmark measurement is important to physicists working on unified field theories that attempt to combine particle physics with Einstein's general theory of relativity and electromagnetic theory.

"Our measurement puts some strong limits on the theories that propose extra dimensions, such as superstring theory and brane theories," Kopeikin said. "Knowing the speed of gravity can provide an important test of the existence and compactness of these extra dimensions," he added.

Superstring theory proposes that the fundamental particles of nature are not pointlike, but rather incredibly small loops or strings, whose properties are determined by different modes of vibration. Branes (a word derived from membranes) are multidimensional surfaces, and some current physical theories propose space-time branes embedded to five dimensions.

The scientists used the National Science Foundation's Very Long Baseline Array (VLBA),

a continent-wide radio-telescope system, along with the 100-meter radio telescope in Effelsberg, Germany, to make an extremely precise observation when the planet Jupiter passed nearly in front of a bright quasar on September 8, 2002.

The observation recorded a very slight "bending" of the radio waves coming from the background quasar by the gravitational effect of Jupiter. The bending resulted in a small change in the quasar's apparent position in the sky.

"Because Jupiter is moving around the Sun, the precise amount of the bending depends slightly on the speed at which gravity propagates from Jupiter," Kopeikin said.

Jupiter, the largest planet in the Solar System, only passes closely enough to the path of radio waves from a suitably bright quasar about once a decade for such a measurement to be made, the scientists said.

The once-in-a-decade celestial alignment was the last in a chain of events that made measuring the speed of gravity possible. The others included a chance meeting of the two scientists in 1996, a breakthrough in theoretical physics and the development of specialized techniques that enabled the extremely precise measurement to be made.

"No one had tried to measure the speed of gravity before because most physicists had assumed that the only way to do so was to detect gravitational waves," Kopeikin recalled. However, in 1999, Kopeikin extended Einstein's theory to include the gravitational effects of a moving body on light and radio waves. The effects depended on the speed of gravity. He realized that if Jupiter moved nearly in front of a star or radio source, he could test his theory.

Kopeikin studied the predicted orbit of Jupiter for the next 30 years and discovered that the giant planet would pass closely enough in front of the quasar J0842+1835 in 2002. However, he quickly realized that the effect on the quasar's apparent position in the sky attributable to the speed of gravity would be so small that the only observational technique capable of measuring it

was Very Long Baseline Interferometry (VLBI), the technique embodied in the VLBA. Kopeikin then contacted Fomalont, a leading expert in VLBI and an experienced VLBA observer.

"I immediately realized the importance of an experiment that could make the first measurement of a fundamental constant of nature," Fomalont said. "I decided that we had to give this our best shot," he added.

To get the required level of precision, the two scientists added the Effelsberg telescope to their observation. The wider the separation between two radio-telescope antennas, the greater is the resolving power, or ability to see fine detail, achievable. The VLBA includes antennas on Hawaii, the continental United States, and St. Croix in the Caribbean. An antenna on the other side of the Atlantic added even more resolving power.

"We had to make a measurement with about three times more accuracy than anyone had ever done, but we knew, in principle, that it could be done," Fomalont said. The scientists tested and refined their techniques in "dry runs," then waited for Jupiter to make its pass in front of the quasar.

The wait included considerable nail-biting. Equipment failure, bad weather, or an electromagnetic storm on Jupiter itself could have sabotaged the observation. However, luck held out and the scientists' observations at a radio frequency of 8 GigaHertz produced enough good data to make their measurement. They achieved a precision equal to the width of a human hair seen from 250 miles away.

Most scientists, Kopeikin said, will be relieved that the speed of gravity is consistent with the speed of light. "I believe this experiment sheds new light on fundamentals of general relativity and represents the first of many more studies and observations of gravitation which are currently possible because of the enormously high precision of VLBI. We have a lot more to learn about this intriguing cosmic force and its relationship to the other forces in nature," Kopeikin said.

This is not the first time that Jupiter has played a part in producing a measurement of a fundamental physical constant. In 1675, Olaf Roemer, a Danish astronomer working at the Paris Observatory, made the first reasonably accurate determination of the speed of light by observing eclipses of one of Jupiter's moons.

The National Radio Astronomy Observatory is a facility of the National Science Foundation, operated under cooperative agreement by Associated Universities, Inc.

SIGNIFICANCE:

Modern researchers say that knowing the speed of gravity is important in the study of branches of cosmology where the Universe has more spatial dimensions than the usual three. Some of those theories suggest that gravity could take a short cut through higher dimensions and so appear to travel faster than the speed of light.

Knowing the precise speed of gravity is important to physicists testing such modern ideas as the superstring, which holds that fundamental particles in the universe are made up of small vibrating loops or strings. It also affects some basic space-time theories.

Microsoft and CA Plaintiffs Settle CA Class Action Lawsuits Settlement to Benefit Consumers and CA Schools

-- Microsoft Corp. jointly announced today that a \$1.1 billion settlement has been reached in a series of coordinated class action lawsuits alleging that Microsoft violated California's antitrust and unfair competition laws.--

BACKGROUND:

Harvard University student Bill Gates, and his friend Paul Allen, were present at the birth of the personal computer. MITS, a company from

Albuquerque, New Mexico, produced the world's first commercial mini-computer, the Altair 8800. Gates, who entered Harvard in 1973 as a freshman (and lived down the hall from Steve Ballmer) and Allen read about its creation in a magazine and set about developing an interpreter of the computer language Basic to run on the machine.

The computer maker was impressed by their work after Allen flew across the country to demonstrate it. MITS promoted their computer language. Allen joined MITS, although he left in 1976 to work full time with the company he and Gates had formed, Microsoft, joining Gates who dropped out of Harvard in his junior year. Microsoft's first registered offices were in Albuquerque, and Basic was licensed to General Electric, Citibank and NCR.

Microsoft negotiated a flat fee of \$21,000 for its version of Basic to run on Apple. The machines loaded with Basic sold like hotcakes. In the end the flat fee worked out at just two cents per copy sold. It was a mistake they would not make again.

In November 1977 Microsoft shipped its second language product, Fortran. The following year the company's revenues topped \$1m for the first time. In 1978 Microsoft launched its third language product, Cobol 80, started selling in Japan, while also up-roots and moves to Seattle, Gates and Allen's home city.

STORY:

San Francisco law firm of Townsend and Townsend and Crew LLP, lead counsel for two certified classes of California consumers, and Microsoft Corp. jointly announced today that a \$1.1 billion settlement has been reached in a series of coordinated class action lawsuits alleging that Microsoft violated California's antitrust and unfair competition laws. Trial was scheduled to commence in San Francisco before California Superior Court Judge Paul H. Alvarado on Feb. 24, 2003.

Settlement, which is subject to court approval before becoming final, benefits consumers and businesses who purchased

Microsoft® operating system, productivity suite, spreadsheet or word processing software between Feb. 18, 1995, and Dec. 15, 2001, for use in the state of California. The settlement proceeds will be distributed to class members in the form of vouchers that may be used to buy any manufacturer's desktop, laptop and tablet computers, any software used with those computer products and specified peripheral devices for use with computers. Two-thirds of any unclaimed settlement proceeds will be donated to California's most needy public schools in the form of Microsoft educational and productivity software as well as vouchers for the purchase of computer equipment, professional development services and non-Microsoft software. Details of the settlement are outlined in a term sheet that has been signed by the parties. A final Settlement Agreement will be filed in the San Francisco Superior Court later this month.

"This is one of the largest settlements ever reached under the antitrust or unfair competition laws of California," said plaintiffs' lead counsel Eugene Crew. Co-lead counsel Richard Grossman elaborated: "This settlement represents a significant portion of the amount that Californians paid to Microsoft for its operating system and key applications software over a seven-year period. It is a tremendous result for California's businesses and consumers, and will also benefit our schools at a time when that help is desperately needed."

"This is a good resolution for all sides, and we're especially pleased by the opportunity to help thousands of schools all across California get the computers and software they need," said Microsoft General Counsel Brad Smith. "This settlement allows us to focus on the future and building great software, and avoids the cost and uncertainty of a lengthy trial."

"Coming at a time when California is in the middle of a significant budget crisis, these funds and software will help to ensure that California's schoolchildren get technology they can use," said Jack O'Connell, State Superintendent of Public Instruction.

THIS WEEK IN HISTORY / BIOGRAPHY:

January 13, 1941

JAMES JOYCE DIES

James Joyce, widely regarded as Ireland's greatest author, dies in Zürich, Switzerland, at the age of 58. One of the most brilliant and daring writers of the 20th century, Joyce's masterpiece *Ulysses* is ranked among the greatest works in the English language.



Born in Dublin in 1882, Joyce grew up in poor surroundings and was educated at Jesuit-run schools and the University College in Dublin. He wrote poetry and short prose passages that he called "epiphanies," a term he used to describe the

sudden revelation of the true nature of a person or thing. In 1902, he went to Paris but returned to Dublin in the next year when his mother fell ill. There he began writing the experimental *Stephen Hero*, a largely autobiographical work. For the *Irish Homestead*, he also wrote several Irish-themed short stories, which were characterized by tragic epiphanies and spare but precise writing.

In 1904, Joyce left Ireland with companion Nora Barnacle and lived in Poland, Austria-Hungary, Trieste, and Rome, where he fathered two children with Nora and worked. He spent his spare time writing and composing several other short stories that would join his earlier works to form *Dubliners*, first published in 1914. The most acclaimed of the 15 stories is "The Dead," which tells the story of a Dublin schoolteacher and his wife, and of their lost dreams. During this time, he also drastically reworked *Stephen Hero* and

renamed it *A Portrait of the Artist as a Young Man*.

With the Italian entrance into World War I, he moved to Zürich with his family. Faced with severe financial difficulties, he found patrons in Edith Rockefeller McCormick and Harriet Shaw Weaver, editor of *Egoist* magazine. In 1916, Weaver published *A Portrait of the Artist as a Young Man*, which received significant critical acclaim. Soon after, the American *Little Review* began to publish episodes from *Ulysses*, a novel that Joyce began in 1915. The sexually explicit work was banned in the United States in 1920 after only a few installments. Two years later, Sylvia Beach, a bookstore owner in Paris, published it in its entirety.

Ulysses brought Joyce international fame, and the work's groundbreaking literary forms, including stream-of-consciousness writing, were an immediate influence on novelists the world over. The action of the novel takes place in Dublin on a single day but parallels the epic 10-year journey described in Homer's *Odyssey*. Although colored with numerous allusions, the strength of *Ulysses* rests not in its intellectual complexity but in its depth of characterization, breadth of humor, and overall celebration of life.

Joyce spent more than 17 years on his last work, published in 1939 as *Finnegans Wake*. His most difficult work, Joyce carried his literary experimentation to its furthest point in this novel, which uses words from different languages to embody a cyclical theory of human existence. Because many find it difficult and inaccessible, *Finnegans Wake* is not as highly regarded as his earlier works.

Joyce lived in Paris from 1920 to 1940, but he moved back to Zürich after France fell to the Germans. In addition to his three major works, he also published several collections of verse and a play called *Exiles*.

SPORTS:

2003 NFL Draft Underclassmen

The following is a list of underclassmen who have announced thier intentions to forgo their remaining eligibility and enter the NFL draft (Deadline to declare: January 15):

- Anquan Boldin, wr, Florida State (junior)
- Chris Brown, rb, Colorado (junior)
- Nate Burleson, wr, Nevada (junior)
- Peter Christofilakos, k, Illinois (junior)
- Chris Clemons, lb, Georgia (junior)
- Jeff Faine, c, Notre Dame (junior)
- Rex Grossman, qb, Florida (junior)
- Brandon Lloyd, wr, Illinois (junior)
- Teyo Johnson, wr, Stanford (sophomore)
- Shawn McDonald, wr, Arizona State (junior)
- Clint Mitchell, dl, Florida (junior)
- Charles Rogers, wr, Michigan St (junior)
- Dewayne Robertson, dt, Kentucky (junior)
- Ian Scott, dl, Florida (junior)
- Musa Smith, rb, Georgia (junior)
- Onterio Smith, rb, Oregon (junior)
- Johnathan Sullivan, dt, Georgia (junior)
- LaBrandon Toefield, rb, LSU (junior)
- Terrell Suggs, de, Arizona State (junior)
- George Wrihster, te, Oregon (junior)

- # of players that are leaving early in 2003: 20
- # of players that left early in 2002: 36
- # of players that left early in 2001: 39
- # of players that left early in 2000: 26
- # of players that left early in 1999: 35
- # of players that left early in 1998: 32

NFL PLAYOFFS: THIS WEEKEND

San Francisco vs. Tampa Bay	6	F
Oakland	31	F
Philadelphia	10	F
Tennessee	30	F
Philadelphia	6	F
Tennessee	20	F
Tennessee	31	F
Tennessee	34	F

ENTERTAINMENT:

Raids Recover Original Beatles Tapes

Police raids in England and the Netherlands on Friday recovered what could be about 500 original Beatles tapes that were stolen in the 1970s, including some never-released tracks. British police said the tapes were "priceless," and that the only such recordings that have been heard before were bootlegs.



Dutch police, who recovered all the tapes in the Netherlands, agreed, but said they were still analyzing the material. "We're currently

investigating whether they are the originals, but it appears to be so," said prosecutor spokesman Robert Meulenbroek in Amsterdam. "There are about 500 tapes, so there's quite a bit to research."

The tapes contain what are known as the "Get Back" sessions, which were to become an album in 1969 before the project was shelved. Some of the songs, including "Get Back" itself, became part of the "Let It Be" album.

For many devoted fans and collectors, the original reel-to-reel tapes would be a valuable recovery by Apple, the Beatles' record company. Over the years, pirate copies had turned up in Britain, continental Europe and the United States.

Five people were arrested in separate police raids in England and Holland. Their names were not immediately released. The International Federation of the Phonographic Industry led the investigation with help from London detectives. They first identified suspects who were thought to have been involved in the theft and handling of the tapes. Further inquiries across Europe led to the joint operation by British and Dutch police.

FEATURE:

Skipping Ads? TV Gets Ready to Fight Back

The leading television producer and two major advertisers have joined forces to present a live variety show with no commercial interruptions. Instead, the advertising messages will be incorporated into the show.

The advertisers, which so far include Pepsi and Nokia phones and will include four more secondary sponsors, are buying six hours of air time to create what the program's producer, Michael Davies, called "a contemporary, hip Ed Sullivan show" for the youth-oriented WB Network, part of AOL Time Warner. The hourlong program, to be broadcast for six weeks this summer, will try to highlight the companies' products in various ways, like putting singers on a set dominated by a logo or building comedy routines around a product.

The experiment reflects growing anxiety among many advertisers and network executives about the rise of personal video recorders, like TiVo's, which make it easy for viewers to skip commercials. Although the network commercial is far from extinct — advertising spending increased for television in the last year — many executives are concerned that a decline in the effectiveness of the 30-second commercial could rock the economic foundation of television, which depends on advertising as its main source of revenue.

While the move is billed as a forward-looking response to a technological threat to the business, it actually harks back to television's earliest days, when a single sponsor bought a time period and presented a show, like the "Kraft Television Theater" or "The Philco Television Playhouse," and featured only its own products in its commercials. The roots go even deeper, all the way back to the beginning of soap operas, a genre that owes its name to the laundry detergents that began sponsoring them on radio. Early soap

operas incorporated scenes that had characters do the washing while praising the product.

Networks eventually became troubled by the arrangement, partly because they wanted more control over the programming and partly because they expected to make more money by using 60-second commercials with multiple advertisers.

Final details have not been completed. For example, deals must be struck with the local television network affiliates, which are allowed to sell a small percentage of a program's commercial time. WB executives say they believe that they can persuade the stations to place their commercials immediately before and after the show so it can be viewed without any breaks.

The penetration of the digital recorders is slight thus far, at only about one million homes. But as satellite and cable companies and television-set manufacturers increasingly build such recorders directly into their equipment, the amount of viewing done through the devices is certain to grow. Even now, with the penetration so small, many advertisers are looking for ways to go beyond the commercial. So far that has largely meant "product placement," inserting companies' products into the action of prime-time shows — but often in clumsy ways. Some shows have made the incorporation of sponsors more overt, as on "The Best Damn Sports Show Period" on the Fox Sports Net cable channel. That show signed up Labatt to provide the beer on the show's bar set.

Among other possibilities he cited was a permanent Pepsi display behind every music performance on the show. He said the producers had also come up with suggestions like having some rap artists, like Method Man and Redman, go to the Nokia headquarters in Finland to take part in their internship program. Mr. Davies added that the show could charge a movie company, for example, for an appearance by one of the stars of a new film. It could also charge for guest hosts.

But experts say that the 30-second commercial is not doomed, certainly not in our lifetimes. Somebody is going to pay for TV. But advertisers have to be more and more creative.

Quote of the Week:
The die is cast.

Fact of the Week:

$$F_{gravity} = \frac{Gm_1m_2}{r^2}$$

Word of the Week:
Jacta est alea. (L.) The die is cast.

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And
Have a Great Week!

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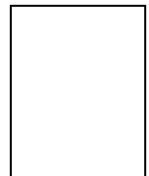
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