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Career Cornerstone News

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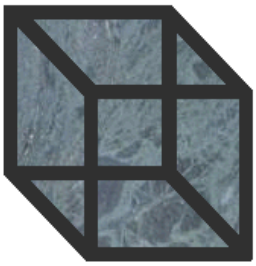


Career Cornerstone News is a Publication of the Sloan Career Cornerstone Center… the Premier Online Resource for Exploring Career Paths in Science, Technology, Engineering, and Mathematics.

Inside this issue:

Einstein Was Right (again): NIST and MIT Confirm $E=mc^2$

Albert Einstein was correct in his prediction that $E=mc^2$, according to scientists at the U.S. Department of Commerce's National Institute of Standards and Technology (NIST) and the Massachusetts Institute of Technology (MIT) who conducted the most precise direct test ever of what is perhaps the most famous formula in science.

In experiments described in a recent issue of Nature, the researchers added to a catalog of confirmations that matter and energy are related in a precise way.

Specifically, energy (E) equals mass (m) times the square of the speed of light (c^2), a prediction of Einstein's theory of special relativity.

By comparing NIST measurements of energy emitted by silicon and sulfur atoms and MIT measurements of the mass of the same atoms, the scientists found that E differs from mc^2 by at most 0.0000004, or four-tenths of 1 part in 1 million.

This result is "consistent with equality" and is 55 times more accurate than the previous best direct test of Einstein's formula, according to the scientists.

Such tests are important because special relativity is a central principle of modern physics and the basis for many scientific experiments as well as common instruments like the global positioning system. According to the basic laws of physics, every wavelength of electromagnetic radiation corresponds to a specific amount of energy. The NIST team determined the value for energy in the Einstein equation, E=mc2, by carefully measuring the wavelength of gamma rays emitted by silicon and sulfur atoms. For more details, visit www.nist.gov.

An instrument called GAMS4 was used in experiments that helped to confirm Einstein's famous equation $E=mc^2$

National Engineers Week 2006

National Engineers Week, a formal coalition of more than seventy engineering, education, and cultural societies, and more than fifty corporations and government agencies, is dedicated to raising public awareness of engineers' positive contributions to our quality of life. Engineers Week promotes recognition among parents, teachers and students of the importance of a technical education and a high level of math, science, and technology literacy.

The event motivates youths to pursue engineering careers in order to provide a diverse, vigorous, and informed engineering workforce. Each year, Engineers Week reaches thousands of schools, businesses, and community groups across the U.S.

National Engineers Week 2006 (February 19-25) is co-chaired by the Society of Women Engineers and Northrop Grumman Corporation. Find out more at www.eweek.org.

Physicists Describe "Fluid" State of Matter

Using nothing more than a container of loosely packed sand and a falling marble, a research team led by University of Chicago physicist Heinrich Jaeger has discovered a new state of fluid matter.

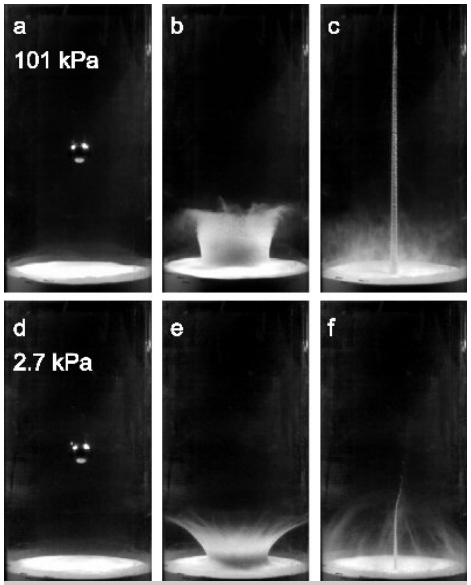
This new matter takes the form of a large, sharply focused jet of sand shooting upward from the impact point.

It looks much like the vertical jets that form when a marble falls into a pool of water, or some other liquid - except that in those jets, the rising column is held together by the liquid's surface tension. In loose-packed sand, notes Jaeger, there is no surface tension.

Instead, he says, the granular jet seems to behave more like ultra-cold matter at temperatures near absolute zero (-497.6 degrees Fahrenheit).

Although the sand grains are at room temperature, says Jaeger, "the jet acts like an ultra-cold, ultra-dense gas, in terms of how we define temperature via the random motion of particles. Inside the jet there is very, very little random motion."

To observe the basic effect at home, Jaeger says, take a cup of powdered sugar, pour it into another container to ensure that it is loosely packed, and then drop in a marble. "Once you drop that marble in there you see that jet emerging," he says, "but you have to look fast."

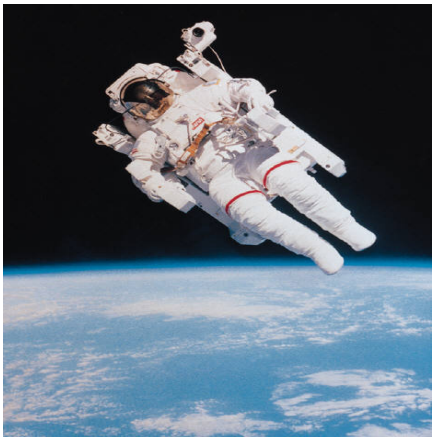


Credit: Heinrich Jaeger, University of Chicago

Degree Profile: Aerospace Engineering

Aerospace engineers create machines, from airplanes that weigh over a half a million pounds to spacecraft that travel over 17,000 miles an hour. They design, develop, and test aircraft, spacecraft, and missiles and supervise the manufacture of these products. Aerospace engineers who work with aircraft are called aeronautical engineers, and those working specifically with spacecraft are astronautical engineers. They develop new technologies for use in aviation, defense systems, and space exploration, often specializing in areas such as structural design, guidance, navigation and control, instrumentation and communication, or production methods. They often use computer-aided design (CAD) software, robotics, and lasers and advanced electronic optics. They also may specialize in a particular type of aerospace product, such as commercial transports, military fighter jets, helicopters, spacecraft, or missiles and rockets. Aerospace engineers may be experts in aerodynamics, thermodynamics, celestial mechanics, propulsion, acoustics, or guidance and control systems.

Aerospace engineers typically are employed in the aerospace product and parts industry, although their skills are becoming increasingly valuable in other fields. For example, in the motor vehicles manufacturing industry, aerospace engineers design vehicles that have lower air resistance and, thus, increased fuel efficiency.



Find out more about careers in aerospace engineering at www.careercornerstone.org.

Engineer Salaries Remain High Despite Concern Over Shortages

Despite recent concerns about a potential shortage of engineering graduates and the outlook for future engineering jobs, The Engineering Income & Salary Survey, sponsored by the National Society of Professional Engineers (NSPE) shows entry-level engineers commanding salaries above many of their peers in other professions.

"We've heard the horror stories about a potential shortage of U.S. engineering graduates due in part to a perceived decline of job opportunities for engineers," said NSPE Executive Director Al Gray. "But the truth is that engineering continues to be a viable and in-demand profession, and engineering graduates can expect good starting salaries and job opportunities well into the future."

According to the survey, the average salary for an engineer with less than one year of experience is $46,059. Engineers with one to two years of experience averaged $48,451.

Other factors, such as engineering discipline, geographic location, education, and licensure status can also affect entry-level salaries. Licensed engineers with less than one year of experience make an average salary of $51,383 while those licensed with one to two years of experience had starting salaries averaging $55,878.

Entry-level engineers are not the only ones enjoying stable salary numbers. A matched sample of over 3,000 engineers was compared from 2004 to 2005. This group experienced a 6.5 percent increase in average base salaries from $72,779 to $78,211. Total annual income figures (including bonuses and incentives) for the matched sample showed a 7.6 percent increase from $78,211 in 2004 to $84,130 in 2005. For the over 50 years in which NSPE has been conducting the salary survey, there has been a consistent increase in engineering salaries from year to year - a clear indication that engineering is indeed a viable and sustainable profession. Other findings:

- Engineers in South Central (TX, OK, AR, and LA) and Pacific Southwest (CA, NV, and HI) U.S. regions earn more than engineers in other U.S. areas.
- Nuclear engineers have the highest average annual salary at $119,643, followed by petroleum engineers at $117,004 and fire protection engineers at $93,343.
- The average salary of executive-level engineers declined from $134,194 in 2004 to $129,724 in 2005.

Career Cornerstone Explores Career Paths in...

- **Aerospace Engineering**
- **Bioengineering**
- **Biology**
- **Chemical Engineering**
- **Chemistry**
- **Civil Engineering**
- **Computer Engineering**
- **Computer Science**
- **Electrical Engineering**
- **Engineering Technology**
- **Geosciences**
- **Industrial Engineering**
- **Materials Science and Engineering**
- **Mathematics**
- **Mechanical Engineering**
- **Nuclear Engineering**
- **Physics**
- **And more to come...**

Mathematics and Genetics Research Win Top Honors in National Competition

Genetics and mathematics research won top honors in the 2005-06 Siemens Westinghouse Competition in Math, Science and Technology.

Michael Viscardi, a senior who is home schooled, won the $100,000 Grand Prize scholarship in the individual category for mathematics research with real-world engineering implications. His project, entitled "On the Solution of the Dirichlet Problem with Rational Boundary Data," develops exciting new approaches to a mathematical problem first formulated in the 19th century by the French mathematician, Lejeune Dirichlet. Viscardi's research, in an area of mathematics called complex analysis, shows solutions to the Dirichlet problem which are, in many important cases, what mathematicians call "rational functions." Elegant, simple and useful, "rational functions" are particularly amenable to computer implementation.

Anne Lee, a senior at Phoenix Country Day School in Paradise Valley, AZ, and Albert Shieh, a junior at Chaparral High School in Scottsdale, AZ, won the $100,000 prize in the team category, which they will share equally, for developing new software that more accurately analyzes genetic data. While interning at the Translational Genomics Research Institute in Phoenix, AZ, the students identified an opportunity to improve on a commercially developed software package designed to analyze high volume genetic data. They developed improved genetic analysis software – which their genomics lab now uses – that enables more accurate and efficient identification of the genes underlying inherited disorders in humans. The team then used their software to pinpoint the mutated gene that causes a childhood degenerative disorder.

Find out more about the competition at www.siemens-foundation.org/competition. And explore many other pre-college science, technology, engineering, and math programs and projects at www.careercornerstone.org.

Mathematics Helps Discern Immune Response to Infectious Diseases

The U.S. National Institutes of Health has awarded the University of Pittsburgh School of Medicine a five-year, $9.1 million, contract to develop sophisticated mathematical models for investigating how the immune system responds to the pathogens that cause flu, tuberculosis, and tularemia, an especially dangerous infection that some authorities believe could be used as a biological weapon.

Such models should help expedite the development of vaccines and therapies against these and other infectious agents and help researchers and public health officials to predict or prevent disease outbreaks as well as determine the best courses of treatment. "Mathematical modeling has tremendous potential to help improve the safety and efficacy of vaccines," explained Dr. Penelope Morel, principal investigator of the Pitt-based Immune Modeling Center.

Organizations Contributing Content to the Sloan Career Cornerstone Center:

- **American Chemical Society**
- **American Geological Institute**
- **American Institute of Chemical Engineers**
- **American Institute of Physics**
- **American Mathematical Society**
- **American Nuclear Society**
- **American Society of Civil Engineers**
- **ASME**
- **IEEE**
- **JG Perpich, LLC**
- **Mathematical Association of America**
- **NASA**
- **Society for Industrial and Applied Mathematics**
- **The Minerals, Metals & Materials Society**
- **US Department of Labor, Bureau of Labor Statistics**
- **Whitaker Foundation**