University of Minnesota
school of physics & astronomy
Newsletter

Spring 2005 Issue 5

A Letter from the Department Head

We were all greatly saddened by the untimely death from a heart attack, of Professor Paul Ellis on February 20th of this year. Ellis, a theoretical nuclear physicist and member of the School of Physics and Astronomy faculty for more than 31 years was a native of Northampton, England. He received his Ph.D. from Manchester University in England. After postdoctoral positions at Michigan, Rutgers and Oxford, Ellis came to Minnesota as an Assistant Professor in 1973 and was promoted to full professor in 1982. Until 1990, his work was concerned with the structure of nuclei. He made significant contributions to the many-body theory of nuclei and the study of nuclear matter at finite temperatures. More recently Ellis studied the dense matter in neutron stars and the composition and structure of protoneutron stars. Ellis was a superb teacher, receiving the Institute of Technology Outstanding Teacher Award in 1981. He was elected to a fellowship in the American Physical Society in 1998. Ellis is survived by his wife Alicja Ellis, his son, Aleksander Ellis, Aleksander's wife Yaara, and their son Kye.

Photo courtesy of Ellis family

Paul Ellis, 1941-2005

On a happier note, since the last newsletter, two young faculty members have joined the School. They are Professor Michael Zudov, who is an experimental condensed matter physicist, and Professor Daniel Cronin-Hennesssy, an experimental particle physicist. Also important strides were made in obtaining funding for graduate fellowships, with the establishment of the

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Celebration Commemorates Hoff Lu

A ceremony commemorating the life and accomplishments of the late Professor Hoff Lu, a distinguished Ph.D. alumnus of the School, was held on Thursday, June 17, 2004. Hoff Lu's sons Michael and Lester traveled from Houston, Texas and China, respectively. They were joined by a group of 20 of their family

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Photo by Patrick O' Leary

Sandra Huang, Michael Lu, Robert Bruininks, Lester Lu, Allen Goldman, Kathyleen Ma

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History on Display

The School of Physics and Astronomy had the first floor display cases remodeled into history displays during 2004. After several trips to the University archives and searching departmental records, Executive Assistant Bobbi Eich and student worker, Carrie Bufford, had enough historical material to fill the ten cases and tell the story of the School. With the help of Allen Goldman, they assembled the displays last spring.

The material in the displays spans from the earliest departmental faculty group photo in 1914 taken in front of Jones Hall, which was the physics building at that time, to examples of equipment used in some of the School's most important research, such as a model of a mass spectorgraph used in the Viking Lander moon mission in the 1970s. Physics events as well as social happenings like the 1942 physics picnic are covered in the displays. The exhibit also gives a sense of the context in which physics was done in the past. News stories about Professor Nier's isolation of the Uranium 235 isotope talk about "war possibilities" and stories about John Williams and the Van De Graaff accelerator tout the machine as an "atom smasher." The displays also feature treasured documents such as a letter to Nier from Enrico Fermi acknowledging that Nier's proposed approach to the U235 isotope was a correct way to proceed with the problem and the journal of Professor Henry Erikson which lists early faculty members with their salaries.

Courtesy UM Archives

Professors Alfred Nier (left) and Henry Erikson (right) take data for a physics experiment on Gunflint Lake in Northern Minnesota in 1932. The results were published in a paper "Light Intensity at Different Depths in Lake Water." The pair successfully found absorption constants for different wave lengths using a quartz prism in specially designed housing lowered into varying depths in the lake water. The photograph is part of a history display that covers events of the 1930s and early 1940s.

The history displays can be viewed in the atrium of the Tate Laboratory of Physics.

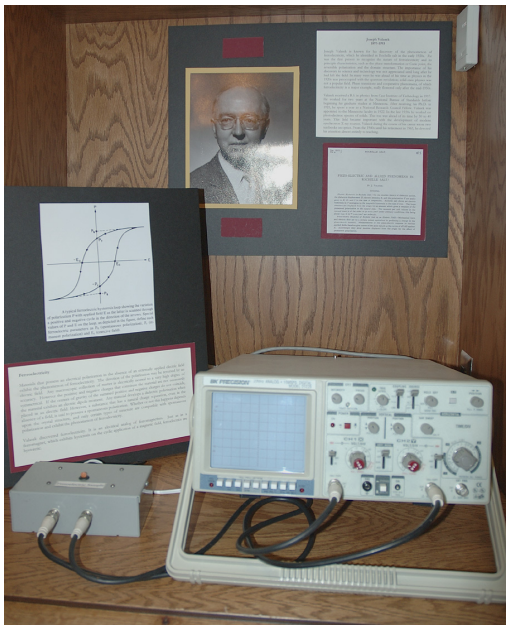

Photo by Allen Goldman

A display dedicated to Joseph Valasek's discovery of the phenomenon of ferroelectricity in Rochelle salts in the 1920s.

Photo by Allen Goldman

A display describing the scientific, teaching and editorial career of Professor John Tate.

Smoking Gun Discovered in Einstein Controversy

The late Professor John Tate, after whom the Tate Laboratory of Physics is named, was at the center of a controversy surrounding Albert Einstein and the *Physical Review*. After successfully publishing two papers with *Physical Review* in 1935, Albert Einstein submitted a paper co-authored with Nathan Rosen to editor John Tate at the University of Minnesota in 1936. The authors argued that, contrary to what Einstein had claimed in 1910, gravitational waves did not exist. Einstein assumed his paper would be published immediately. The world famous scientist was dismayed to find that the article had been sent out for peer review and returned to him with a polite note asking for his reaction to the various comments and criticisms made by the referee. His reply to Professor Tate, which Einstein historian Daniel Kennefick described as being written in "high dudgeon," reflects a lack of understanding of the peer review process.

> Dear Sir,
>
> We (Mr. Rosen and I) had sent you our manuscript for publication and had not authorized you to show it to specialists before it is printed. I see no reason to address the - in any case erroneous - comments of your anonymous expert. On the basis of this incident I prefer to publish the paper elsewhere.

Einstein then submitted the paper to the Journal of the Franklin Institute and it was accepted without the corrections suggested by the referee at *Physical Review*. However, when it was actually published, in early 1937, it had been dramatically revised. Instead of saying that general relativity does not allow any gravitational waves, it said that general relativity rules out plane waves but not cylindrical ones. The paper ends with the following acknowledgment: "I'd like to thank my colleague, Professor Robertson for his friendly assistance in the clarification of the original error. Howard Percy Robertson, a renowned relativist, had returned from a sabatical year at Caltech, to the Princeton Institute for Natural gravitational waves.

Kennefick speculated in an article "Controversies in the History of the Radiation Reaction Problem in General Relativity" (Hubert Goenner et al. eds.; *The Expanding Worlds of General Relativity*. Boston: Birkhäuser, 1999) that though the anonymous reviewer was still unknown, it might have been the very same Professor Howard Robertson who was mentioned in the article for the *Journal of the Franklin Institute*. The basis for Kennefick's suspicion was that the referee had also noted the possibility of cylindrical waves admitted in the published paper. Until recently there was little archival material pertaining to the controversy and there were no *Physical Review* records before 1938.

In March of 2005, Dr. Martin Blume, Editor-in-Chief of the American Physical Society, which currently publishes *The Physical Review,* discovered a cache of older papers belonging to Professor Tate from his days as editor of the journal. The 1936 log book for the *Physical Review* revealed the smoking gun, proof that Robertson was indeed both the "anonymous expert" whom Tate had asked to review Einstein's paper and the friendly colleague who Einstein credited at the end of the published article.

Blume also discovered that two of the previous papers submitted to the *Physical Review* by Einstein were sent on to be published almost immediately with no referee listed in the log book. This was and is a highly unusual occurrence in a peer review journal, which typically takes weeks if not months to review a paper. "Einstein was therefore not out of bounds in thinking that there was no refereeing," Blume said. Einstein's ignorance of the peer review process should be viewed in the context that he'd been used to publishing in European journals which had a very low rejection rate and then handled with kid gloves at *Physical Review*. Einstein did not submit another paper to *Physical Review* and his only

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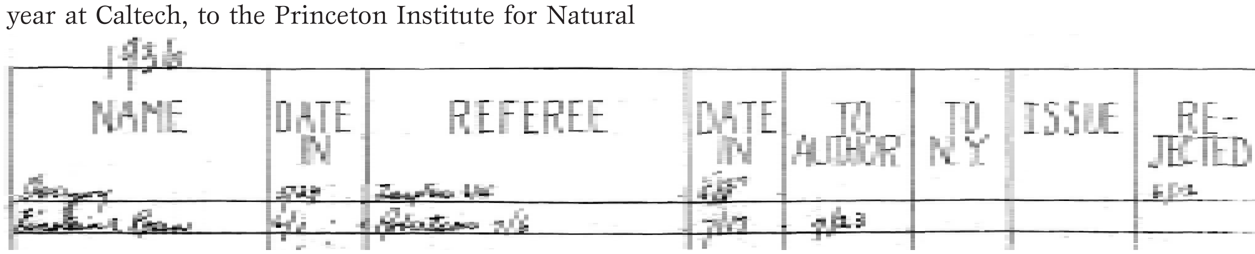

Courtesy of the APS

Section of the 1936 Physical Review logbook that shows that Robertson refereed the Einstein-Rosen article.

Tony Gherghetta

Photo by Jenny Allan

Tony Gherghetta

Physics Beyond the Standard Model

Tony Gherghetta is a new faculty member at the School of Physics and Astronomy whose area of research is supersymmetry, string theory, brane worlds and extra dimensions. All of these subfields exist beyond the Standard Model of particle physics, which was developed to understand the building blocks of the Universe. These building blocks are divided into two main types: fermions, which are matter particles, and bosons, which are force particles. Charged particles within the Standard Model vary from the electron, the lightest, to the top quark, the heaviest (350,000 times heavier than the electron).

The Standard Model has been verified to great precision, except for the Higgs boson, which is the yet-to-be-discovered particle responsible for giving particles their mass. Finding the Higgs Boson experimentally would be a major discovery, and fortunately for theoretical physicists, one that is within sight since the energies required to see such a particle will be achieved at the LHC (Large Hadron Collider) at CERN in 2008.

"However, the Standard Model has a fly in the ointment known as the hierarchy problem," Gherghetta says. The Higgs boson mass is unstable because of quantum corrections, and an extremely fine-tuned cancellation to one part in 10^{28} is needed to obtain the correct Higgs mass.

By 1981, theoretical physicists had taken the Standard Model as far as they could and began to apply the theory of supersymmetry (SUSY), developed in the preceding decade, to the hierarchy problem. SUSY posits that each boson (fermion) of the Standard Model has a fermion (boson) superpartner. "SUSY miraculously cancels the large quantum corrections to the Higgs mass," Gherghetta explains. Moreover, the addition of superpartners corrects a mismatch in the strength of the Standard Model forces and unifies them into one grand unified force.

Recently, Gherghetta's research has shown that grand unification can also occur in a model which is only partly supersymmetric. "Not all of the superpartners of the Standard Model particles are needed to solve the hierarchy problem." This is different from the conventional SUSY model, but a change that will be verifiable at the LHC experiment.

Gherghetta's research with SUSY combines it with other non-Standard Model tools that are offshoots of string theory. Simply put, in string theory, particles are imagined as glimpses of a vibrating string. In the Standard Model, particles are single points of zero size and infinite energy. By giving particles a size, string theory leads to finite numbers that can allow physicists to incorporate quantum gravity into the Standard Model. "String theory is the first and only theory to make sense of gravity in a quantum regime," Gherghetta says.

"String theory is an incredibly rich mathematical framework that is not always accessible to experiment," according to Gherghetta. At 10^{-33} cm the typical string length is well below the observable limit of 10^{-16} cm. "In fact, some predictions of string theory will probably never be provable because they deal with energies beyond what experiment has a hope of reaching." A new view of the concomitant extra dimensions of string theory has changed the theory's accessiblity to experiment.

Extra dimensions are a part of string theory that sound more like science fiction than physics, but recently they have provided a useful geometrical construct "The Brane World" which imagines the universe as an infinite wall placed in a higher dimension. Remarkably, living on a wall, also addresses the hierarchy problem by keeping the quantum corrections to the Higgs mass small. Part of Gherghetta's research is to understand the bizarre aspects of this "new Brane World order" that will soon be within reach of experiment. "When you look at a corner of a room, you do not see more than three dimensions, but that does not mean additional dimensions are not there," Gherghetta says. At least one of the tiny extra dimensions predicted by String Theory can be big enough to be either proved or disproved by experiments at the LHC. "The fifth dimension may be closer than you think."

Tony Gherghetta is originally from Australia, and he moved to Minnesota in 2002. He did his Ph.D. at the University of Chicago. He is married and has two children.

Fellowship Campaign Gets Boost

Raising private money to support graduate fellowships in the School of Physics & Astronomy has been a top priority for the past several years. Graduate students are the lifeblood of the School as they participate in research, serve as teaching assistants and become the next generation of physicists. In order to compete for the best students in the country, the University must continue to provide new financial aid opportunities. Several new fellowships have been established creating endowments totaling almost $1 million dollars in support of graduate students. Payouts from these endowments are matched by the graduate school through the 21st Century Matching Program which means that the total endowment will be closer to two million dollars.

Robert O. Pepin Fellowship

Spearheaded by former graduate student David Black, (Ph.D. 1970) a fellowship was created in honor of his former advisor Robert Pepin by Black and many of Pepin's former students and friends. Pepin is a Space Physicist whose distinguished career at the School began in 1964. He is the director of the IT Honors Program as well as the winner of the 2002 George Taylor Award for Distinguished Service, the 1999 Morse-Alumni Award for Outstanding Contributions to Undergraduate Education and a Fellow of the American Geophysical Union.

Pepin's research on noble gases and nitrogen in meteorites and lunar samples brought national attention to the School in the 1980s. His current research is in the composition of the primordial solar nebula, isotopic signatures of nucleosynthesis in primitive meteorites, the compositional history of solar wind and flares over the past 4+ billion years, and the origin and evolution of volatiles on Earth, Mars, and Venus.

Hoff Lu Fellowship

Created by sons Mike and Lester Lu, this fellowship was endowed in honor of their father, the late Hoff Lu (Ph.D. 1941 advised by Al Nier). There are full details of the Hoff Lu Fellowship on page one of this newsletter.

Wilfred Wetzel Fellowship

The School recently received a gift from the estate of the late Wilfred Wetzel of $820,000 to be used for graduate fellowships. Wetzel was born in 1904 and graduated with a Bachelors of Science from the University of Minnesota in 1928. He completed his Ph.D. at Minnesota under the direction of Edward Hill in 1933. Wetzel worked as a Research Associate first at the University of Minnesota and then at Colgate University and MIT. In 1937 he returned to Minnesota to work as an Assitant Professor of Physics where he stayed until entering the Navy in 1940.

Wetzel was assigned to be a physicist in the Navy Bureau of Ordnance during the Second World War working on a naval project to develop magnetic recording tape which the government wanted to use to record German U Boat transmissions. Wetzel and his team were assigned the task of creating the tape, despite the fact that no one in the United States had yet made a tape recorder. The team developed a coated tape with a smooth surface and uniform dispersion of ferromagnetic powder that would withstand being drawn over a magnetic head to record electromagnetic signals. Though the project was not completed before the end of the war, the commercial applications of magnetic recording allowed Wetzel to continue working on it for 3M (then Minnesota, Mining and Mineral Corporation) in 1944.

By 1945, the first workable magnetic tape product had been developed. Two years later, after recording equipment captured by the Allies from the German army, had been rebuilt, Wetzel heard, along with the rest of America, the first commercial applications of his work when the Bing Crosby radio show aired a program that had been previously recorded. Wetzel was among the first to realize the application could be extended to recording television pictures as well. He helped to bring this application to fruition in the 1950s culminating with the first commercial tests in 1956 when CBS used the tape to delay broadcasts of their news program for western time zones. Wetzel retired from 3M in 1969 and died in 1970.

Our Development Officer

Photo by Tom Foley

Jennifer Payne Pogatchnik

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Plans and questions regarding making gifts to the department will be kept confidential. In addition, Jennifer can insure your wishes are carried out and that a plan is in place for your gift today and into the

Awards and Announcements

Three New American Physical Society Fellows

Three School of Physics and Astronomy Professors Marvin Marshak, Alexander Yu. Grosberg and Robert D. Gehrz were named American Physical Society (APS) Fellows. Only one-half of one percent of the total APS membership ever become fellows. The School of Physics and Astronomy has 17 Professors and eight Professors Emeritus who are also fellows of the APS.

Photo by J. Chapman

Grosberg

Courtesy of AIP

Gehrz

Photo by J. Chapman

Marshak

Kamenev Named McKnight Land-Grant Professor

Photo by J. Allan

Kamenev

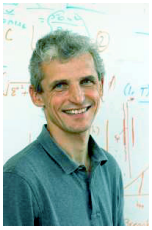
Professor Alex Kamenev of the School of Physics and Astronomy is a McKnight Land-Grant Professor for the years 2005-2007. He was officially presented with this professorship by the Board of Regents in a ceremony in March, 2005.

In 1987, the University of Minnesota Graduate School established the McKnight Land-Grant Professorship, a program of career development awards for junior faculty. The McKnight Land-Grant Professorship was named for a significant endowment gift from the McKnight Foundation that was then combined with a share of the Permanent University Fund (PUF). This fund, released to the University by the legislature in 1985, came from the original land grant to the University. The name of the professorship emphasizes this public-private partnership.

Kubota Named Director of Graduate Studies

Professor Yuichi Kubota is now Director of Graduate Studies for the physics program. Kubota took over from former DGS, James Kakalios, in the Fall of 2004. The DGS is in charge graduate curriculum and advising as well as playing an important role in the recruitment of graduate students.

Bose Einstein Condensation Topic of Van Vleck Lecture



Courtesy of Ketterle

Ketterle

Wolfgang Ketterle, John D. MacArthur Professor of Physics at the Massachusetts Institute of Technology and co-winner of the 2001 Nobel Prize, delivered the 30th Annual Abigail and John Van Vleck Lecture.

Ketterle's public lecture, "Bose-Einstein Condensates - the Coldest Matter in the Universe," described the Bose Einstein Condensate phenomenon and its importance. It was one of the most successful in the entire lecture series, with the audience completely filling the Van Vleck Auditorium.

Class Notes

Rodman Abbott (M. S. 1984) is currently working as a Science Advisor to the Directorate of Strategic Security of the Air Force at the Pentagon, Washington, DC.

Jim Babcock (Ph.D. 1981) been employed by Unisys Corporation for about 23 years working mainly in the semiconductor packaging area. About five years ago he helped start a new business unit located in San Diego designing and building semiconductor test equipment.

Paul Bedrosian (B.S. Physics and Chemistry 1996) recently began working as a Mendenhall Fellow with the US Geological Survey in Denver, CO. Bedrosian was married last year to Kavita Jeerage, also a UM alumnus (Chemical Engineering, 1996).

Benjamin Bousquet (Ph.D. 2003) is finishing his first year of a tenure-track faculty appointment at Wartburg College in Waverly, Iowa.

Tom Christensen (B. S. 1979) was recently named Dean of the College of Letters, Arts and Sciences of the University of Colorado at Colorado Springs.

Patrick Conley (B.A. 1994) will be beginning a 3-year
Bachelor of Theology program at Wycliffe Hall of the University of Oxford in September.

David Hayden (Ph.D. 1997) established and heads the "Reality Check Lab" for Intel, a custom instrumentation lab that addresses critical themal, mechanical and electical issues facing Intel's products by providing accurate, real-life measurements and developing robust methodologies.

Hoff Lu continued from 1

members from China, Texas and Canada, and by Hoff Lu's colleagues from China. The celebration coincided with what would have been the Chinese physicist's 90th birthday. It included a program of speakers from China and the University of Minnesota, as well as a tour for the visitors of campus and various places important to Professor Lu when he was a student in the late 1930s and early 1940s. The event culminated with a dinner hosted by the University.

Hoff Lu was the second Chinese Ph.D graduate in physics at Minnesota when he earned his degree in 1939. Working in Alfred Nier's laboratory at Minnesota, he built an 180^0 focusing mass spectrometer and studied thermionic emission from heated salts. He determined the abundance ratio of Lithium isotopes, which became the standard low temperature source for mass spectroscopic investigations.

From 1939 to 1941 Lu developed a Boron Source for mass spectroscopic investigations. His doctoral dissertation was entitled, "A new type of high intensity mass-spectrometer and its use for the separation of isotopes."
Lu returned home to China in 1941, to a country which had recently been invaded by Japan. He spent the war hiding in remote parts of China.

After the war, Professor Lu was faced with the difficulty that there were no experimental physics facilities in China. He was versatile enough to make the rare and difficult transition from experiment to theory and begin teaching theory after the war ended at Fudan University. Later in the decade, he left for Shanghai to help found the Nuclear Institute, the first training center for nuclear physicists in China.

One of the speakers, Dr. Wang Sheng-Hong , President of Fudan University in Shanghai, where Lu worked in the 1950s, called him "one of the great minds in China of the Twentieth Century." Professor Lu continued to research a variety of subjects from the physics of the atomic bomb to hydrodynamics during the fifties. His article entitled, "On Neutron Emission from Thermal Neutron Induced Fission of Uranium 235," was the first publication on the calculation of the number of neutrons emitted upon fission of Uranium 235.

Professor Lu continued to do research, teach, translate articles and monographs into Chinese during the course of his fifty year career. He took on responsiblities within the scientific community, such as serving as president of Shanghai Physical Society for ten years. Hoff Lu died in February, 1997, remaining active in research to the last in the field of particle physics. Professor Hoff Lu's students represented the first generation of Chinese physicists.

When Professor Lu was a student at Minnesota, it was a major center for physics. Nier's famous work on U235 and U238 was completed while Hoff Lu was a student. The Physical Review was then being edited from Tate Laboratory and a future Nobel laureate, John Bardeen, was on the faculty. Professor Lu exported some of this thriving scientific culture to China. Professor Lu's brother, Dr. Lu He Xuan, said that his elder brother credited his success to his having lived in the U.S. and having attended the University of Minnesota.

Michael and Lester Lu received plaques from University President Robert Bruininks who thanked them for their "deep commitment to the University of Minnesota" and their endowment of a physics fellowship in Professor Lu's name.

Professor Tang Jia-Yong, Professor and Dean of Modern Physics at Fudan University and a former student of Hoff Lu's, said that his teacher worked tirelessly for Chinese Education. "Hoff Lu will live forever in our hearts," Professor Tang said.

Photo by Patrick O' Leary

Bust of Hoff Lu on display in Tate Lab of Physics. The sculpture is part one of several new history displays on view for the public.

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Robert Pepin and Hoff Lu Fellowships. The Pepin Fellowship was created through gifts from his former students and friends, and the Hoff Lu Fellowship through the generosity of his sons. There are stories in this newsletter about events associated with both of these fellowships. Along the same lines, we recently we received a major bequest from the estate of Wilfred Wetzel, a 1933 Ph.D. graduate of the department who was the first third generation theory student in the United States with a thesis involving quantum mechanics. John Van Vleck advised Edward Hill, who was Wetzel's research advisor. Wetzel went on to a distinguished career at 3M, where he was a major figure in the development of magnetic recording tape. These new fellowships will greatly aid us in the competition for graduate students of the first rank.

This year was also marked by a change of the guard in the Institute of Technology Dean's Office. Professor Ted Davis stepped down at the end of 2004 to rejoin the faculty of the Department of Chemical Engineering and Materials Science. Professor Steven Crouch of the Civil Engineering Department, who had been Associate Dean for Finance and Planning, replaced him. Peter Hudleston remains as Associate Dean of Students, Roberta Humphreys of the Astronomy Department continues as full time Associate Dean for Academic Affairs, and Professor Mos Kaveh, Head of the Electrical Engineering Department, the new Associate Dean for Research and Planning.

-Allen Goldman

Smoking Gun continued from Page 3

subsequent publication in the journal was a letter to the editor in 1953.

The timing of Blume's discovery is particularly remarkable as 2005 is the 100th anniversary of Einstein's "Miraculous Year." In 1905, while working as a patent clerk in Switzerland, Einstein published two seminal papers and proposed what came to be known as his Special Theory of Relativity.

University of Minnesota
school of physics & astronomy

Newsletter

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