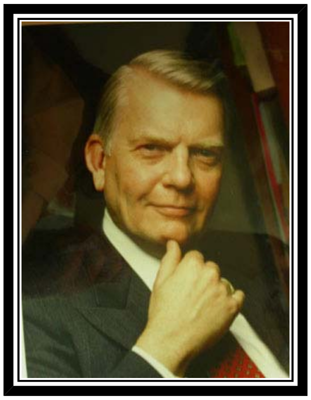
Spotlight



Interview with David Nelson

President and Founder, Savoy WebEngines
Ph.D., 1970

By: Karrie Sue Hawbaker, editor

Recently, I had the opportunity to speak with Dr. David Nelson (Ph.D., 1970), founder and president of Savoy Web Engines, Inc. He provided The Photon *with interesting insight into his research here at Maryland Physics and his career path into computer science research and entrepreneurship. He was also kind enough to offer some valuable advice to our current young scientists.*

Dr. David Nelson began his academic career at the University of Wisconsin, where he studied physics and mathematics. After earning his Bachelor of Science degree he came to the University of Maryland on a recommendation from one of his professors who had worked with Dr. Jerry Marion, then a professor of physics at Maryland. He was hired as a research assistant his first year and delved into the study of theoretical physics.

Under the mentorship of Professor Hogil Kim, Dr. Nelson had a very successful graduate career, gaining a valuable education in the field of particle dynamics and accelerator design and producing research that had an impact upon the field of physics and the research efforts here at the University of Maryland. He began his work in the Department's van deGraf laboratory. At that time, the van deGraf accelerator had been around for about twenty years and was a very popular tool for studying subatomic particles. The Department used a 10 MeV van deGraf for its nuclear physics research. Dr. Nelson used its design as a template to design and construct a smaller 2 MeV van deGraf, which was an effective tool for teaching students about this type of research. Then, around 1967, Maryland Physics received a grant from the Department of Energy (then the Atomic Energy Commission) that allowed us to launch MUSIC, the Maryland University Synchronous Isochroous Cyclotron. The cyclotron was a very significant part of Maryland Physics research at that time. At $8 million, the grant was one of the Department's largest. In fact, the physics building was expanded in order to house the equipment required for this type of experiment. A project of this size provided numerous opportunities for discovery and for student involvement in research. Dr. Nelson was one of MUSIC's first graduate students.

Spotlight

Search for Extra Dimensions
By: Professor Ho Jung Paik

The universe that we see and experience appears to have three spatial dimensions and one time dimension. But is this necessarily the case at the microscopic distances that we have not observed yet? In the past few years this has become a hot question among physicists.

String theory, which is the only self-consistent quantum theory of gravity so far, demands ten or eleven dimensions for the universe. The usual scenario is that the extra dimensions are curled up with very small radii (< 10^{-30} cm) and therefore not visible. Recently, however, it has been pointed out (Arkani-Hamed, Dimopoulos, and Dvali, 1998) that the extra dimensions could be as large as 1 mm. Below this scale, gravity would propagate in higher dimensions, its force falling off faster than $1/r^2$. This could naturally explain why gravity is so weak compared to the other forces, the so-called hierarchy problem.

Astrophysical constraints may limit the large gravity-only extra dimensions to < 1 mm. To date the $1/r^2$ law has not been tested directly at r < 100 μm. It is highly desirable to test Newton's law down to r less than or equal to 1 μm. At UM, we have designed a sensitive null test of the $1/r^2$ law at sub-millimeter distances based on superconducting accelerometer technology developed in our laboratory. The principle of the null experiment is illustrated in Figure 1.

According to the $1/r^2$ law, the field due to an infinite plane slab of uniform mass density is constant on either side of the slab. If one measures the difference of accelerations experienced by two test

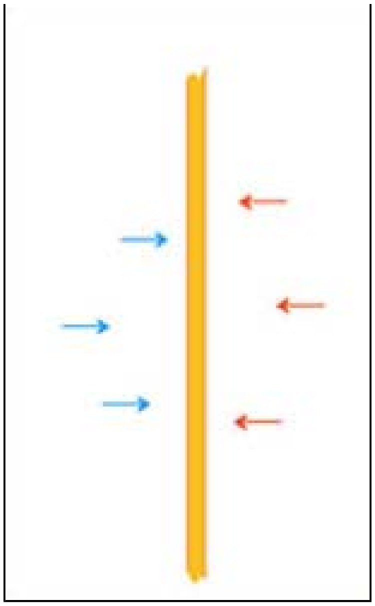


Figure 1. The Newtonian force due to an infinite plane slab of mass is constant on either side of the slab, independent of the position of the test mass.

masses located on the two sides of the slab as the slab is driven sideways, the differential acceleration should remain constant. Any non-zero signal would imply a violation of the $1/r^2$ law, or a possible detection of the extra dimensions.

In practice, we employ a tantalum disk of 15 cm diameter as the source mass. The test masses are also thin tantalum disks, which are located within 100 µm from the surfaces of the source mass. The differential acceleration between the two test masses is measured with a sensitive superconducting circuit.

A laboratory experiment, which will probe the extra dimensions down to several micrometers, is under preparation with NSF and NASA support. Eventually, we would like to fly an experiment based on the same principle in space. In zero-g, a much more sensitive superconducting accelerometer can be constructed using nearly free test masses. This will extend the search for extra dimensions to less than or equal to
1 µm. A side benefit of the space experiment will be a possible detection of the elusive particle, called the axion.

For more details, please visit the Gravitation Laboratory Website at
www.physics.umd.edu/GRE

Dr. Ho Jung Paik is full professor in the field of experimental gravity here in the Department of Physics at the University of Marylandinformation. If you have any questions, he can be reached at hpaik@umd.edu.

The cyclotron brought growth to this research area and several scientists began to investigate a number of ideas about how to build accelerators that would go to higher and higher energies. Dr. Nelson created a plan to develop a piece of equipment that would accelerate an entire ring of electrons through a long tube. It was this idea on which he based his thesis "The Formation of an Electron Ring in a Static Magnetic Field." Based upon this thesis, scientists on campus founded the Electron Ring Laboratory, which conducting this type of research for several years.

After Dr. Nelson earned his Ph.D. in 1970, he joined DEC, Digital Equipment Company, where he put his physics education to work as the lead for a research group that studied several computer science topics. He had always had an interest in the then-new idea of computer science. He found that the field inspired a great amount of creativity. In fact, he feels that, in many ways, computer science is a more creative area than those fields that are traditionally considered the "arts." He was also intrigued by the numerous capabilities of computers, which have surpassed even the most hopeful expectations he had at that time. However, universities did not yet offer computer science curriculums, so the computer scientists of the time held degrees in other sciences such as physics or mathematics.

He worked for DEC for seven years until he was offered the position of director of research for the startup Prime Computer. After three years with that company, he decided to try his hand as an entrepreneur.

In 1980, he founded Apollo Computer Inc., a computer company that, among other things, formed the idea of the workstation. While it may seem commonplace now, the notion of a single computer for each person with a graphics display, keyboard and mouse, was a novel idea back then. He successfully managed the company for nine years, after which he sold the company to Hewlett Packard. He then founded a new company that he named Fluent, which produced digital video technology. After four years, he successfully sold it to Novell, Inc.

Dr. Nelson's next and current endeavor was the foundation of Savoy WebEngines, which he has been operating for the last ten years. This company produces technology that provides video security surveillance via the Internet, a very hot topic and a cornerstone for the Homeland Security initiative.

In the 1990's, Dr. Nelson participated in a nationally televised Computer Bowl competition, modeled after the old College Bowl TV shows. Teams were comprised of computer luminaries from the East and West coast, and in 1992, he won MVP title for the East coast team. Then, in 1996, he won overall MVP title in a Super Bowl competition comprised of all previous year's MVPs that included Bill Gates and several other high tech gurus.

Throughout his adventures in entrepreneurship, Dr. Nelson has remained very "hands-on" and still very much considers himself a technical person. For that reason, he consistently employs his physics and mathematics education and finds that background very valuable in keeping up with the constant changes in the technology industry. This rapidly changing environment never fails to keep his interest and he looks forward to more developments in the industry, especially in the field of communications. Our society is already feeling the impact of technologies such as wireless communication and video conferencing and Dr. Nelson feels confident that the next 10 years will provide even more exciting innovations in the field.

When asked about his impressions of his graduate career at the University of Maryland Department of Physics, Dr. Nelson replied that he found it very rewarding. He attributes this primarily to the mentorship of his advisor, Dr. Kim. He found their friendship and partnership extremely rewarding. Dr. Kim returned to Korea, where he experienced an extremely successful physics career, a few years after Dr. Nelson graduated. However, the two were able to reunite later in life when Dr. Nelson took a trip to Korea.

While Maryland's large student body, which was populated by many commuters, did not provide the same close-knit college environment that he experienced during his undergraduate years at Wisconsin, he found other advantages of the campus. For example, the campus' proximity to so many government laboratories provided many opportunities for him and his classmates. For our current students, he advises them to make sure to gain a strong foundation in the fundamentals of science. It is easier to focus on the mathematics of physics when you are young and in an environment of learning. This knowledge can easily be applied to sciences such as computer science or engineering and that foundation will make success in those applied sciences much easier to achieve.

The Department of Physics sincerely thanks Dr. Nelson for sharing his experiences with us and wishes him and his family the best!

I you have questions for Dr. Nelson, please feel free to email the editor. She will be happy to pass on your inquiries to him.

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