The North Star

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Table of Contents:

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BSU Professor, John O. Annexstad, to Retire

Professor Annexstad, Associate Director of the Minnesota Space Grant Consortium at Bemidji State University, will retire after teaching Geoscience (Geology) there since 1986. Annexstad's teaching assignments have included geophysics, planetary and space science, general geology, earth science, comparative planetology, oceanography, glacial and Pleistocene geology, astronomy, science technology and society, and honors integrative seminars. His research interests have included meteorites, Antarctic glaciology, geomagnetics, geophysical processes and cosmic materials.

Before coming to Bemidji State University, Annexstad was employed by the National Aeronautics and Space Administration at the Johnson Space Center in Houston Texas as a staff scientist. His last NASA assignment included engaging in future mission science planning, Antarctic research, and interagency/international cooperative science efforts.

Dr. Annexstad received numerous honors and awards beginning in 1958 and then throughout his entire career. Most recently, he received Special Recognition, Antarctic Exploration from the Explorers club in 1991.

In 1991 Dr. Annexstad became one of the original Affiliate members of the MnSGC. His contribution will be missed.

2001 Sverdrup Visiting Scientist Program

This past April, Augsburg College held the 2001 Sverdrup Visiting Scientist Lecture Program featuring Dr. Christopher P. McKay. Dr. McKay is a Planetary Scientist with the Space Science Division at the NASA Center in Ames. The lecture program lasted two days including formal presentations, informal conversations and lunch with Augsburg students and staff, and opportunities for the general public to hear and interact with Dr. Christopher McKay. Dr. McKay's lecture was titled "From Antarctica to Mars: The Search for Life in Cold and Dry Places." In his speech Dr. McKay stated that:

"There is good evidence that early in its history, Mars had liquid water, more active volcanism, and a thicker atmosphere. The main question in the exploration of Mars, then, is the search for an independent origin of life on that planet. Ecosystems in cold, dry locations on Earth - such as the Antarctic - provide examples of how life on Mars might have survived and where to look for fossils."

Hypervelocity Microparticle Accelerator

Concordia College located in Moorhead, Minnesota is home to one of the world's four and United States' only hypervelocity microparticle accelerators. This machine, brought to Concordia in 1975 by NASA scientist Otto Berg, has seen little use since the early 1990s, but that's about to change. Concordia College physics Professor, Heidi Manning, and California Institute of Technology graduate student, Daniel Austin, hope to use the accelerator to study dust. The accelerator will charge up dust particles and propel them at 4,320 to 43,200 miles an hour.

This dust Manning and Austin wish to study, however, is interplanetary dust. Dust described as "tiny, talcum-powder-sized bits of cosmic dust constantly encountering the planets and moons in the solar system" by Manning. This cosmic dust, presumably left over from our solar system's creation, has enough force to churn soil and create craters.

Prof. Heidi Manning

Austin spent the month of July at Concordia testing an instrument he built to analyze the composition of dust in space called a flight mass spectrometer with the accelerator. Austin's instrument is nicknamed the Dustbuster. Austin hooked up his 2-pound Dustbustuer to Concordia's dust accelerator and sent iron and copper spheres (five times smaller than a red blood cell) flying. When the iron and copper dust hit a surface in the Dustbuster, the impact transformed the elements of dust into charged ions, which were then separated by mass. The data, information on what elements were present and their quantity, was collected on a computer and will take months to analyze. On initial inspection it appears that the Dustbuster did its job. "It was even sensitive enough to pick up contaminants,"Austin said.

The Dustbuster is being considered for a comet fly-by mission in 2004. Because comets were formed at the same time as the solar system, data collected on dust from the tail of a comet would be "like taking a sample out of a 4 billion-year history," says Austin.

Manning also wants to use the accelerator to better understand the impact of dust. Her research includes developing experiments to test many different materials. The first experiment was with imploded copper wire. "The dust must be identifiable by size and make-up as we need electrical charges to establish a range," says Manning. All kinds of substances, including compounds found in over-the-counter inhalers, will

Hypervelocity Mircoparticle Accelerator continued on page 3

NASA Administrator Daniel S. Goldin Commencement Address

Augsburg College, Minneapolis, MN ~ May 20, 2001

President Fame, Members of the Board of Regents, Administration and Faculty, distinguished guests, friends and loving families, and most of all, the Augsburg College Class of 2001…

I am deeply honored by your invitation and the encouragement of Congressman Marty Sabo. It is a great privilege to be addressing you today. To the graduating seniors…let me start with two simple words: well done!

To be an Auggie means that you have wrestled…for national championships…and for that elusive parking space on campus.

To be an Auggie means that as first-year students you may have spent time in Urness Tower where you felt hot and cramped…And, like students at every other college in the world, you may have left your cafeteria feeling the same way.

To be an Auggie means that some of you, believe it or not, slept through an entire J-Terms…Thus making it easier to live with the Twin Cities' twin temperatures: cold and really cold.

Through it all you have been tested and you've triumphed. You have survived and succeeded. Be grateful…You are graduating. Well done.

Well done, but not mission accomplished.

Each and everyone of you is an explorer in the journey we call life…And yes, today's milestone is an important one. But commencement means a beginning, not an end. The bulk of this journey is still ahead of you. In fact, to use the NASA engineering terms I am most familiar with, I submit the following:

Graduation is a great accomplishment, but I look at it as just the end of the design and testing phase. It says we've completed all the system checks. Now, you are sitting proudly on the launch pad. And you--Augsburg Class of 2001--are ready for take-off.

It's going to be an exhilarating trip. But I'm not here to tell you what you are going to find. It's like one of NASA's missions. Everybody experiences something different. And to be honest, we don't know exactly what is out there. That's precisely why we go. Overcoming the unexpected and discovering the unknown is what ignites our spirit. It is what life is all about.

But if I can't tell you what's out there…hopefully, what I *can* do…is offer some advice to help you discover whatever it is you're looking for.

Simply put, my advice is this: always remember that life's lessons will not come from the guy delivering a speech in front of you…But they have been developed and nurtured by the people around you.

Your friends. Your professors. Your mentors. And, even though you may not realize to what extent now, life's lessons come mostly from what I like to call Mission Control--your family.

Especially your family. And never forget it.

Today I'd like to share one of the most important lessons I received from a very important part of Mission Control--my grandfather.

I figure I'm safe sharing a lesson that was *grandpa's*.

From what I hear, even those who favor Sergeant Preston's have learned a lesson or two at "*Gramma's*."

But before I do, let me say that I know exactly what some of you are thinking. Believe it or not -I'm still young enough to remember my commencement. An when I graduated I was thinking the same thing about my family:

"Free at last, free at last!"

Of course, there's some truth to that. After today, there will be certainly more expected of you…but you also have more tools and skills needed to meet those expectations.

You are leaving this wonderful place with more independence than you arrived with.

But there's an irony to that independence, especially the ***quality*** of that independence. It is the product of those you were once dependent on.

Until recently, at NASA, we accomplished our missions through brute force.

What I mean by that…is that for every mission…we would just pack everyone in the same room until we got the job done. That was it.

But now our missions are far too complex for brute force.

You see, at NASA, we've had many shuttle missions which have brought home many discoveries…

But now, we have a much more complex International Space Station and a permanent human presence in space.

We have satellites that give us fairly accurate forecasts two or three days out…

But now, we want and need more sophistication so we can forecast weather and climate months out. And then years out. And hopefully, decades out.

We've built some pretty amazing and intricate robots…

But now, we want to send them to every planet and we want to send probes to interstellar space.

We've built the most powerful telescopes known…And we have even had astronauts work on them while floating 270 miles above our planet.

But now, we are designing even more powerful telescopes--10X the power and 1/10th the weight--to see if there are earth-sized planets around other stars.

We've put men on the moon…And we've sent robots to the Red Planet.

But now…now is the time for what has been burned in the back of my mind since I was seven years old and my father first took me to the Hayden Planetarium in New York City.

Ever since my parents taught me that anything is possible if you work hard…If you never let anyone else shoot down your dreams and aspirations…If you are willing to take risks…And if you are never, ever deterred by failure, because without failure you cannot have true success…

My dream has been the same.

A spacecraft lands; a hatch opens; a ladder drops.

Then, with the world watching, an astronaut in a white suit with an American flag on the shoulder…steps down and crunches ***her*** boot on the dusty surface of Mars.

I know with certainty that we can do this. I know my dream will come true. But I also know that we can't do it like we used to. We simply cannot accomplish goals so difficult and reach destinations so far away with brute force.

The science is too important…The engineering is too intricate…The shear number of lines of code--is just too immense.

That's why we are developing computers that work more like the human brain and body. They will be self-sensing, self-repairing, and self-adaptive.

If something is not exactly right, a spacecraft on Mars will not need a signal from earth…which may or may not arrive in time.

The spacecraft itself will decide what's best and then take the necessary action.

It's bold, it's revolutionary. But what does it have to do with each of you?

Well obviously, I hope each of you support our mission to explore new frontiers and pioneer the future. More than that, I hope you want to be a part of that mission.

But the main reason I bring this up is that for the unknowing, the new era of computing means the end of Mission Control's usefulness.

The opposite couldn't be more true. The reason those systems will be able to do the things we can hardly even fathom today, is in large part because of the creativity and care…The labor and love…The heart and hard work of those back in Mission Control.

These systems started as just an idea--a glint in someone's eye. Before they could do anything on their own there was--for lack of a better term--"research and development." Someone gave these systems their direction.

The same is true for all of you.

And that brings me to my grandfather, Joseph.

He had a great sense about people. He was my grandfather on my mother's side, and he was a very devout Jew.

My parents, like a lot of kids, both then and now, rebelled against that. But I struggled with it.

My dad was very tough on me. I like to say he didn't teach values…He inflicted them. But my grandfather was a little different. He didn't put on the pressure…But he was a presence. And I wanted--as much as anything--to make him proud.

When I was about 19, I thought I figured out how to do just that.

I bought a pendant--a star of David--that I would wear all the time. No one could question my commitment to religion and I couldn't wait to show my grandfather.

To this day, I remember his reaction.

His eyes bulged and his nostrils flared. He said that symbols would not compensate as a sign of devotion if the commitment is not inside of you.

I was crushed. I felt as though he looked right through to my soul, and I wasn't sure if he saw anything.

Until I realized what was inside of me. What gave me direction and purpose were the values my family, friends and community had been teaching me all along.

Your diplomas are symbols, too.

They are not meaningless--far from it. You worked hard and *earned* them. And because you did, they will partially define you. And they--and they alone--may get your foot in the door for that important job interview.

But whether or not you land that job, whether or not you will accomplish your goals and realize your dreams…*That* will be determined by what is inside of you and nothing else.

I think I know what is inside of you.

Within each of you resides the imagination and individual genius. And within each of you are the values instilled and reinforced by the people sitting around you.

Putting those things together…And within each of you is the capacity to change the world…And maybe even discover new ones.

So go for it.

Never be deterred by the fear of failure. In life, having no failures is rarely a sign of perfection…but rather that your goals aren't bold enough.

Find something you love. Have a dream. Pursue it.

Believe in yourself.

Whether it is in Minneapolis or on Mars--make your mark.

And one more thing, and I don't say this just because I'm a parent, at least once in a while…check in with the old Mission Control.

There's so much to explore. Sharing what you discover with friends and loved ones only makes it more special, more complete, more lasting.

So to the Augsburg College Class of 2001…

Go for launch.

Lift-off on this wonderful journey we call life.

And Godspeed to all of you. *(*Mr. Goldin steps down from NASA 11/15/01.)*

2001 ~ 2002 Consortium Wide $ Scholarship Recipients $

Alberto E. Baez	University of Minnesota
Matthew P. Borg	Bethel College
Jeffrey J. Doom	University of Minnesota
David C. Ebner	University of St. Thomas
Robert H. Grodahl	Bethel College
Elizabeth A. Hajek	Macalester College
Nicole L Keimig	University of St. Thomas
Randall R. Kleinman	Bethel College
Charlene M. Knealing	University of Minnesota
Aleksander Medved	University of Minnesota
Rebecca L. Mooney	University of St. Thomas
Bradley J. Motl	Augsburg College
Brian B. Naslund	University of Minnesota
Dianna J. Olson	Augsburg College
Kevin R. Rasmussen	Augsburg College
Eve A. Skoog	University of Minnesota
Charles W. Steidl	University of Minnesota
Patrick D. Tague	University of Minnesota
Leslie Wallace	University of St. Thomas
Ryan J. Wold	University of Minnesota
Julie E. Zogg	University of Minnesota

Hypervelocity Mircoparticle Accelerator, continued from page 1

be used as test materials. Planetary and lunar surfaces will need to be recreated to shoot the dust at. Manning wants to study how dust particles affect icy moons with no atmospheres. The magnitude of Manning's research has yet to be determined, but her goal isn't to become a famous scientist, just to have her students see and appreciate physics.

Although the dust accelerator has been sitting dormant for the past few years, Manning and Austin have changed that. NASA has also shown an increased interest in the accelerator. According to Carl Bailey, a physics professor emeritus at Concordia who worked with Austin in July, "the dust business is picking up."

Article excerpted from Hope Hanson's 'Concordia Alumni News' article, "Always in Awe" and Sarah Coomber's 'The Forum' article, "Out of this world."

Bemidji State University Updates:

32nd Lunar and Planetary Science Conference

Bemidji State University's Space Grant Program sponsored 10 undergraduate and 2 graduate students to attend the 32nd Lunar and Planetary Science Conference, hosted annually in Houston, Texas, March 12 - 16, 2001. Several undergraduate students participated in the poster sessions held on Tuesday and Thursday evenings of the conference. Diane Mason and William Caddy presented a poster on "The Beaches of Lake Agassiz, an Analog for Martian Shorelines." Luke Probst presented "A Prolific Meteorite Stranding Surface: The Allan Hills Revisited." John Chambers and Richard Hassing presented a poster that's been an ongoing project with several undergraduates at BSU, led by graduate student Brandy Toft, entitled "Are Cosmic Sherules found in Glaciogenic Sediments? A New View on an Ongoing Investigation."

2nd Annual Astrobiology Conference

Luke Probst, senior, attended the 2nd annual Astrobiology Conference in Washington D.C. on April 10-12, 2001. Luke had an internship this summer at Johnson Space Center, working directly with Kathie Thomas-Keprta and Carl Allen. Luke studied desert varnish. Luke is attending Rice University in Houston this fall to pursue a doctoral program in space physics and astronomy. Luke has done public outreach for the space studies program at BSU. This spring he lectured to Bagley elementary students about BSU's space studies program and space exploration. Good luck to Luke in the future as he hopes to participate in the astronaut program!

BSU's Annual Rocket Shoot Program

BSU's annual rocket shoot program with Solway Elementary has expanded its program this year to include two additional schools, Bagley Elementary and Nevis Elementary. TEAM Industries, MnSGC & BSU Space Studies Program corporate sponsor is also sharing in the duties of rocket assembly and launching. TEAM is donating employees to help along side of BSU students in helping students assemble rockets. The rockets were launched at all three elementary schools in May 2001.

NASA Aerospace Education Services Program AESP

The NASA Aerospace Education Services Program is a nationwide program designed to enhance educator awareness and understanding of scientific research and technological development.

The NASA Center AESP Offices for Minnesota and Wisconsin are as follows:

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21000 Brookpark Rd.
Cleveland, OH 44135-3191
(216) 433 ~ 5572
FAX: (216) 433 ~ 5925
Email: Patrick Hurth at huth@aesp.nasa.okstate.edu

University of Minnesota Logo to Fly in Space?

Duane Carey, NASA astronaut, graduated with a Masters Degree in 1982 from the University of Minnesota. Mr. Carey has spent the past 19 years in the Air Force and is currently an astronaut at the Johnson Space Center in Houston, Texas. His first space flight is scheduled for January 17, 2002. Their mission will be to perform an upgrade of the Hubble Space Telescope. NASA allows the astronauts to fly small articles (pennants, flags, etc.) to space for organizations which have special meaning to the astronauts on board. Mr. Carey would like to fly something for the Aerospace Engineering department at the University of Minnesota! His wish is to give a little something back to the institution which provided him an education which “served him well over the years.”

Sports for the Mind.....Sports for the Mind

Minnesota FIRST™ LEGO® League

Information about Minnesota FIRST LEGO League (MFLL) can be found at: **www.hightechkids.org/fll.** Or contact the Minnesota FIRST LEGO League Director, Tim Jump at (952) 915-4358 ext. 193 or by email at: tjump@bsm-online.org. Minnesota FIRST LEGO League is sponsored by INSciTE (Innovations in Science and Technology Education). Other support comes from Honeywell Labs, Benilde - St. Margaret’s School, Honeywell Foundation, Medtronic Foundation, ADC Foundation, 3M Foundation, Retek, MTS Systems and alliant Techsystems.

Sports for the Mind.....Sports for the Mind

Announcements:

- Science Centrum has a new website!
  www.science.umn.edu
- Annual Space Science Conference is set for March 9, 2002 at the Science Museum of Minnesota!
  www.smm.org
- NASA Academy deadline is January 31, 2002!
  www.nasa.academy.gov

2001 Undergraduate Symposium Abstracts

MEASURING THE ELECTRON SCATTERING CROSS SECTION OF GASEOUS TARGETS

Dan Kaffine and Dr. Marty Johnston
University of St. Thomas, 2115 Summit Avenue, St. Paul, MN

The goal of our research is to use atomic theory and apply it to practical, industrial uses. Towards this end, we are measuring total electron-atom scattering cross-sections that are relevant to plasma etching processes used in microchip manufacturing. By using an electron gun apparatus, total scattering cross-sections of various species of gas can be found. Using those numbers as a baseline, theoretical physicists can subtract theoretical cross-sections, so those cross-sections that are impossible to measure or calculate can be determined. Before testing of unknown gases can be done, the system must be calibrated. By comparing results of neon cross-sections with previously published results, the calibration of the system can be ascertained. Now that the calibration of our system with neon gas is completed, the total cross sections of other gases important to the microchip industry can be found. We will be presenting on the total electron-atom scattering cross sections of neon gas and discussing our future plans.

INCREASING THE RESOLUTION OF TOTAL SCATTERING CROSS-SECTION MEASUREMENTS BY IMPLEMENTATION OF TIME-OF-FLIGHT TECHNIQUES

Jessica Klaers and Dr. Marty Johnston
University of St. Thomas, 2115 Summit Avenue, St. Paul, MN

The current work in our laboratory focuses on measuring total scattering electron cross-sections for plasma physics applications. In this poster I will present how we will improve the resolution of our system by implementation of time-of-flight (TOF) techniques. With the introduction of TOF methods, the error should drop to 3% with an energy resolution of 4×10^{-3} eV, as opposed to the current resolution of 0.5 eV. The bulk of this research was done in order to customize the TOF experimental design to fit our current set-up. Previous TOF methods were researched and ideals from a variety of sources are employed. Such ideas will be presented and include the design of the deflection plates, the beam-sweeping technique, the role of the system electronics, as well as the calibration of the energy scale.

SWIRLING WINDS: CREATING A TORNADO VORTEX CHAMBER

Todd Klein, Keith Ludwig, and Dr. Paul Ohmann
University of St. Thomas, 2115 Summit Avenue, St. Paul, MN

The tornado is one of the most destructive forms of Mother Nature's wrath. In the U.S. alone, multitudes of tornadoes annually devastate hundreds, if not thousands, of square miles of land. Yet, despite the fact that tornadoes are fairly common, the mechanisms and mechanics of these awesome storms are not well understood. In an effort to shed light upon the mysterious inner workings of tornadoes, we are constructing a laboratory tornado vortex chamber with a design adapted from the work of Church and snow. This device will be used to model the formation of tornadoes so as to study the atmospheric conditions associated with their development (such as shearing winds, updraft velocities, surface friction, etc.). The resulting data will be used to construct computational simulations of tornadoes in the hopes that, with a more complete understanding of the mechanics behind vortex formation, better detection and early warning devices can be developed.

2001 Undergraduate Symposium Abstracts

ULTRA HIGH VACUUM MOLECULAR BEAM EPITAXY CHAMBER

Bradley Motl
Augsburg College, Minneapolis, MN 55454

Augsburg College's first ultra high vacuum molecular beam epitaxy chamber, completed in July of 2000, was only the beginning. We next tested the chamber to pump down to a desirable pressure and then turned on the two thermal evaporators for the first time. This presentation will show the methods of expanding the chamber's capabilities and also the deposition of our first thin magnetic films.

ULTRA HIGH VACUUM CHAMBER

Taher Omar
Augsburg College, Minneapolis, MN 55454

Thin films are the underlying technology of all magnetic media, such as tape drive devices, magnetic RAM (computer memory) and hard drives. The goal of this project was to construct and develop an ultra high vacuum (UHV) molecular beam epitaxy (MBE) chamber. This chamber will provide the necessary clean, low-pressure environment for creating thin magnetic films.

Currently, we have achieved pressures of 1^{-8} Torr. Films can not be made until the pressure within the chamber of 10^{-10} Torr.

DEVELOPMENT OF A NOVEL COMPACT SOURCE OF POLARIZED ELECTRONS

Mike Preiner and Dr. Marty Johnston
University of St. Thomas, 2115 Summit Avenue, St. Paul, MN

In typical polarized electron scattering experiments, only one type of polarization (longitudinal or transverse) is needed. However, for a source of polarized electrons that is to be used with several scatteringexperiments, it would be advantageous to be able to create both longitudinal and transverse polarization. At the University of St. Thomas (in collaboration with the University of Nebraska, Lincoln), we have developed a source of both longitudinally and transversely polarized electrons that is ~ 1/10 the size of a convectional source. We have used a GaAs source combined with a unique electrostatic lens system tat allows the extraction of both types of polarized electrons. Details of the design, manufacturing and construction of the polarized electron source, electrostatic lens system, and necessary ultra-high vacuum system will be presented along with preliminary results.

SPIN-POLARIZED TETRAHEDRAL MAGNETO-OPTICAL TRAPS

Peter Steinhoff, Shane M. Tysk, Randall Schuh, and Dr. Paul Feng
University of St. Thomas, Dept. of Physics - OWS 153, 2115 Summit Avenue, St. Paul, MN

We discuss our experiments with a spin-polarized atom trap. The apparatus consists of four converging laser beams in a region of non-uniform magnetic field inside an ultra-high vacuum chamber containing a tenuous rubidium vapor. The lasers are slightly detuned below the resonant frequency of rubidium. Atoms in the trap are bombarded by light from all directions, but to a moving atom, light from the head-on direction appears Dopper-shifted up toward the resonant frequency. Thus, it is more probable for that atom to absorb those on-coming photons, causing its momentum to decrease. Through this "Doppler-cooling," we reduce the temperature of our atomic sample to about 100 microKelvin. In a conventional magneto-optical trap (MOT), this ~ $1mm^3$ cloud of about 10^6 atoms is unpolarized, but we are developing variants of the MOT in which the spins of the trapped atoms are aligned.

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