FERMI NEWS

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Photo by Reidar Hahn

Science Returns to Meson Lab 12

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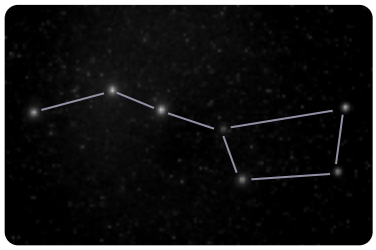
INSIDE:

Friends of Friends

Fermilab astrophysicists apply galaxy clustering analysis methods to genome research



by Mike Perricone

Is there really a Big Dipper?

That most famous of celestial signposts in the constellation Ursa Major, the Big Dipper is essentially a random distribution of stars that our eyes assemble into a pattern because that s what our eyes are designed to do. We see a string of lights across a dark background, and we draw a picture in the night sky.

In three dimensions, we would have a different image: seven stars at divergent distances. The light reaching our eyes at any moment has departed these seven sources at scattered times. While the middle five stars (Merak, Phecda, Megrez, Alioth and Mizar) are actually part of a cluster averaging 80.6 light-years away, the tip of the handle (Alkaid) is 100 light-years distant. And the pointer stars, showing the way to northern beacon Polaris, are 45 light-years apart: Merak at 79 light-years from earth, and Dubhe at 124 light-years. The numbers tell us our eyes have been deceived.

Separating apparent patterns from significant patterns is a specialty of the Sloan Digital Sky Survey, mapping one-fourth of the northern sky in three dimensions, working on a cosmic scale well beyond that of individual stars to sort out details of large-scale structure.

We think we have a good idea of what causes galaxies to cluster together, said Fermilab theoretical astrophysicists Josh Frieman. The universe may have started off in an inflationary stage, which produced quantum vacuum fluctuations, which were amplified by gravity to form galaxies which cluster together.

Clustering is the key concept that began a process linking the statistical tools of astronomy and astrophysics to another field of research conducted at a far different scale. The process culminated in applying algorithms called friends of friends and the autocorrelation function, commonly used in astrophysics, to the microscopic realm of genome research.

At Rush University in Chicago, researcher Gabor Firneisz and his colleagues were investigating structures within the recently-completed map of the mouse genome. Specifically, they were searching for gene clusters related to

Photo by Reidar Hahn

Theoretical astrophysicists Idit Zehavi (left) and Joshua Frieman have used astrophysics analysis techniques to investigate clustering in the mouse genome, as related to autoimmune arthritis. Said Zehavi: Josh and I were talking one day, and we both thought we were working on the two most important things we can imagine the universe and the genome.

autoimmune arthritis. But if they spotted a pattern, would the numbers back them up? Or would mathematics tell them that their eyes had been deceived? And what tool could they use for the test?

I got a telephone call one day, out of the blue, Frieman said. [Firneisz] had been able to map locations within the genome of genes associated with arthritis, and he had noticed that these particular genes didn t seem to be randomly distributed throughout the genome. They seemed to be clustered. He wanted a way to quantify that. He knew that in astrophysics, that s one thing we do: we quantify the clustering of galaxies. He found our web page, and called me. We talked for a while, he educated us in genetics, and we educated him in statistical astronomy.

The result of the mutual education was a distinctive collaboration: a small group (six members), combining two distant disciplines, genetics and astrophysics. That collaboration produced a paper, *A Novel Method to Identify and Quantify Disease-Related Gene Clusters* , which has been submitted to the journal *Bioinformatics*, published by Oxford University Press. The journal focuses on new developments in genome bioinformatics (information from molecular biology and genome research) and computational biology.

We re obviously not the first people to apply statistical techniques to the genome, Frieman said. But as far as we can tell, we were the first to apply this kind of analysis to this issue of gene clustering.

Frieman s colleague, postdoctoral researcher Idit Zehavi of Fermilab and the University of Chicago, took on the major responsibility for calculating the autocorrelation function and applying the friends-of-friends algorithm to the Rush researchers genome data. The latter technique is based in an area of statistical physics called percolation theory, and uses the same mathematical principles.

The great biological discovery of 50 years ago showed that DNA (Deoxyribonucleic Acid), the stuff of life, consists of two long strands twisted into a double helix. The strands are connected by bonds between the organic compounds adenine (A), cytosine (C), guanine (G) and thymine (T), which form these links by creating two base pairs: adenine with thymine (AT), and cytosine with guanine (CG). Relative distances along the helix are measured by counting the number of the base pairs, or mega base pairs (Mbp) between locations. The location in megabase pairs forms the basis of the statistical analysis of the genome, just as megaparsecs are used in statistical analyses of the universe.

The variable that you play with is the linking length, said Zehavi. You assume a length that has a physical meaning, or in this case, a biological meaning. We used scales from the correlation function, showing where clustering occurs. You connect one gene to anything within that linking length. Then you take that second gene and connect it with anything within the linking length, and then again, and again. Those connected belong to the same group, and are called friends of friends. You are close to me, so you are a friend. The next person is farther from me, but is close enough to you to be another friend. Friends within this linking distance stay within the group, so they are friends of friends.

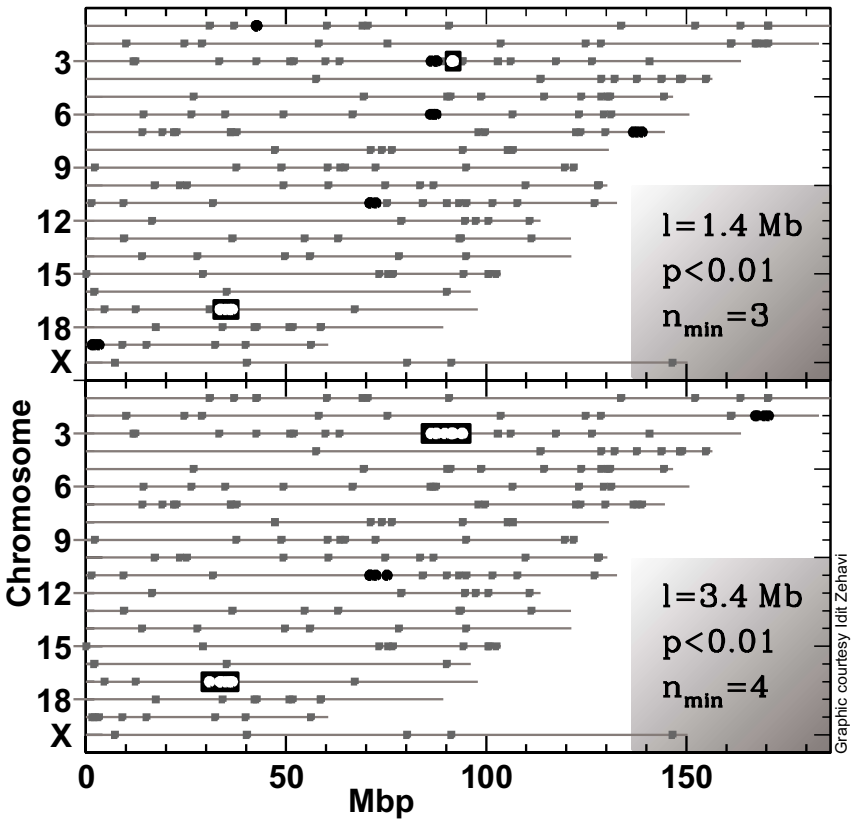
Simple in concept, but as in all science, that s just the beginning.

In the SDSS, these methods are applied to hundreds of thousands of galaxies in three dimensions, while in the genome study the methods were applied to approximately 200 genes in one dimension, as points along the chromosomes. The genome mathematics might appear less challenging, but the questions Zehavi and Frieman faced were whether the astrophysics methods would actually work and whether they could become tools in more extensive genome analyses.

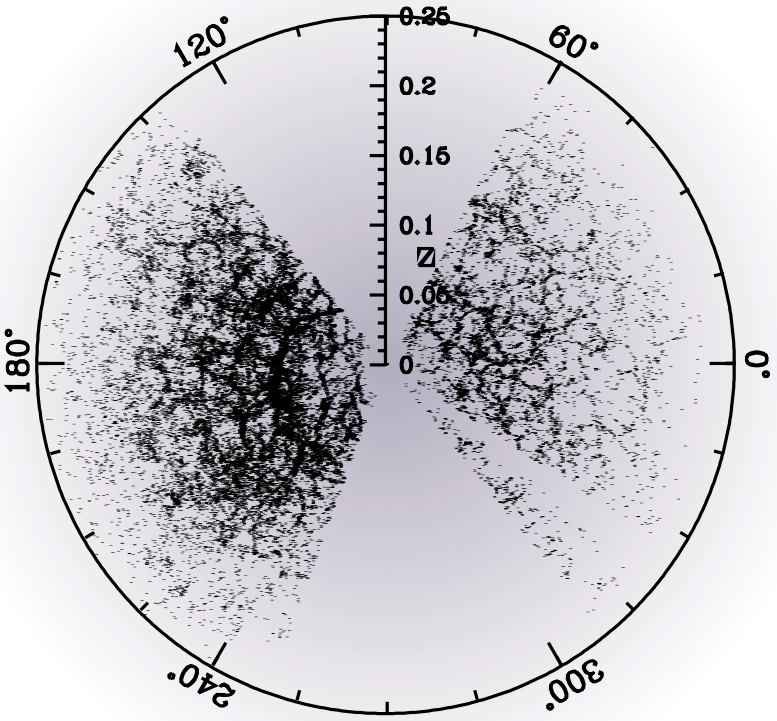
The first step was to measure what is called the autocorrelation function, comparing the structure of the sample to a completely random distribution. Is there more clustering in the sample than would randomly exist? It passed the first test: a significant non-zero autocorrelation function, ruling out randomness.

That first test is important, to see whether the distribution is random or if there really is some kind of clustering, Frieman said. When your eye looks at a number of random points, you will always see clustering because that s what evolution led us to do. We look for patterns. I could show you a completely random distribution of points in two or three dimensions, and you would say, Sure, it looks like these things are clustered. But this test established the reality of the clustering.

Once the reality of the clustering was established, Zehavi, who is originally from Israel and studied at the Hebrew University in Jerusalem, went to work with the friends-of-friends analysis. The linking length was applied to a location until it brought in no new friends-of-friends; at that point, the most prominent groups of genes were identified as clusters.



Distribution of the approximately 200 arthritis-selected genes (light boxes) in the mouse genome. Significant gene clusters are shown in dark circles for a friends-of-friends linking length of L = 1.4 Mbp (top panel) and L = 3.4 Mbp (bottom panel). The most prominent clusters on chromosome 3 and on chromosome 17 are marked in white. Note that some genes are located so close together that they appear inseparable on the plot.



Friends

Distribution in right ascension and redshift of roughly 44,000 galaxies near the celestial equator, in the Sloan Digital Sky Survey. (Taken from Zehavi et al., *Astrophysical Journal 571*, which presents the first galaxy clustering results from the redshift survey.) The survey, lasting five years, will ultimately obtain redshifts for about a million objects over a fourth of the sky.

Two developments made this astro-genome analysis possible. The first was the complete mapping of the mouse genome, an extension of the Human Genome Project. The second was the development, within the last five years, of an experimental tool called the cDNA microarray, or DNA chip.

This chip houses actual organic DNA material, similar in concept to a tissue sample being placed on a glass slide for examination under a microscope. The DNA chip is used to check for the expression of genes under specific conditions; for example, conditions of a specific disease. The chip contains short stretches of genes from a sequenced genome. The DNA and proteins are removed from the cells, and the remainder is RNA, the gene message the link between DNA and the protein encoded by the RNA. This RNA is reconverted to DNA with an enzyme, and the resulting material is used to probe the chip. The DNA finds its partner on the chip and certain genes are turned on which the researcher can identify, because the design of the chip is a known quantity.

When a medical researcher wanted to try something different with this tool, checked the web and phoned Fermilab, a new area of interdisciplinary science research opened up.

As Frieman pointed out, the statistical methods in astrophysics are used to test models and theories; in a sense, these statistical methods are being used to explore the genome and then to build models and theories.

Biologists have a lot of work ahead in explaining how the genome became structured, much more than we have to do in cosmology to explain how galaxies are distributed, Frieman said. So if anything surprised me, it s that in some sense we understand a lot more about how galaxies are formed and distributed in space, than we understand about the distribution of genes in our own bodies.

But research builds knowledge, knowledge offers possibilities, and possibilities especially in medicine offer hope.

I don t know the field well enough to appreciate all the things that might be done, Zehavi said. But if we find gene clusters that have significance in this disease I really hope this could develop into a new and unique tool to use in identifying gene clusters in other diseases. That s why I found this so rewarding. It s something that could potentially benefit humanity.

PROFILE IN
PHYSICS

Universal

Cristobol Lara uses science and math as bridges in bilingual education

by Gary Ruderman

Many of Cristobol Lara s students at Elgin s Kimball Junior High School may say they feel like strangers in a strange land, as they journey into adolescence. Cristobol Lara, however, has first-hand experience in the real world, literally as a stranger in a strange land.

Three years ago Lara was in the middle of teaching a physics class at a Jesuit high school in La Paz, Bolivia when his cell phone rang. The caller offered him a two-year bilingual teaching position in Elgin, Illinois.

I didn t know where Elgin was or anything about Chicago or Illinois or U.S. education, said Lara with a smile.

English was another hurdle. He wasn t even close to fluent. But he accepted the offer.

Photo by Jenny Mullins

While Cristobol Lara didn t have to learn Aymara, the language spoken by 1.6 million indigenous people near Lake Titicaca on the border between Peru and Bolivia, he did bring back some phrases from his time as a teacher there. For example: phonetically, kunas sutmaja, means What is your name? and Kamisaki means How are you?

Language

Today, Lara has a pretty good knowledge of the Chicago area and a more fluid command of the English language. He s completed the two years of teaching at Elgin s Kimball Junior High and has now taken up residence at Fermilab as the Sloan Digital Sky Survey s high school teaching fellow. Lara will use his background in mathematics and physics to prepare high school and university-level lesson plans based on the SDSS data. Fermilab is one of 12 institutions around the world making up the SDSS consortium.

Lara has experienced different kinds of education away from his native Spain. After receiving masters degrees in mathematics and physics from the University of Barcelona, Lara conducted string theory research and taught at the university and secondary level around Valencia, Spain before volunteering to teach in a lesser-developed country.

It is difficult to explain why he left the comfort of his homeland. It s something you just need to do, he said. I had a good job in Spain but I needed something different.

For a year, he coached basketball and taught science and computers to the indigenous Aymara community near Lake Titicaca in Bolivia. Then he was invited to teach mathematics at La Paz s *Universidad Mayor de San Andr s* in the mornings, and calculus at Catholic University in the afternoons. In the midst of this busy schedule, Lara heard about a program for bilingual teachers in the U.S. and he applied. Months later, the cell phone call came.

Arriving at O Hare International Airport in 2000 was the start of culture shock for Lara.

Often it s a shock dealing with the cultural changes as well as being prepared for the students, explained Doug Johnson, Lara s mentor and head of the bilingual education program at Kimball. It s a double whammy and then there s the need to know academic English, which he defined as the ability to use the science vocabulary in English.

I don t remember my first year, said Lara. It was all so new. I know we lived in a motel for two weeks while we got our apartments and a car and started lesson plans.

The rest is a blur. Getting a driver s license was easy, he explained; easier than getting one in Spain.

Bilingual education is a major undertaking in Elgin s school district. It is the main way to keep foreign language-speakers at grade level while they learn English. More than 12 percent of Kimball Junior High s 800 students take classes taught in Spanish. Lara s academic English teaching capabilities grew as his students English improved, Johnson observed. By the end of the first year, Lara was teaching one science or math course each day in English. Moving on to Fermilab last September was part of Lara s dream, said Johnson: He wanted to continue in research.

Since coming to Fermilab, Lara has completed four lesson plans about black holes: the physics of redshift, emission lines, measuring distance and velocity; and one mathematics lesson plan on error analysis.

The key to Lara s lesson plans is the ability to teach a complex subject using simple mathematics. In the first plan, for example, the student is given an object s spectra and is taught how to plot redshifts and learn velocities and distances. Students will learn astronomy the way Lara did by studying mathematics and physics.

Lara s next move comes at the end of August when his work visa expires. It s time to consider a Ph.D. degree, he explained, in either Spain or Mexico, and he has applied to the Spanish government for an education grant. But he is gratified by his contributions at Kimball and at Fermilab, helping strangers feel more at home.

In a lot of Mexican families that move here, the kids know no English and nothing about the area, Lara explained. It is very difficult. But a country is something that is living, [a place] where people re-start their lives. A country must help [immigrants] incorporate into society.

ON THE WEB:

More on Aymara at:
http://www.aymara.org/english/index.php

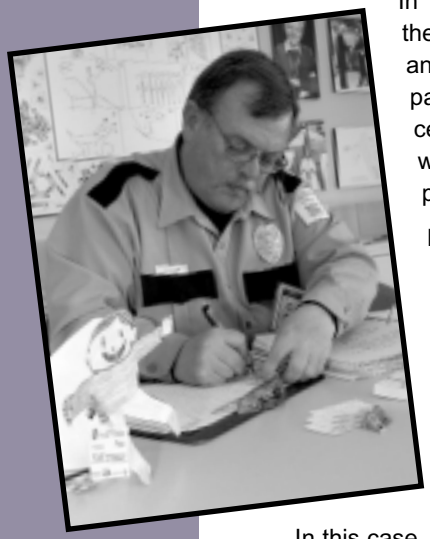
A Visitor From FLATLAND

Fermilab hosts two-dimensional visitor in the Flat Stanley Project

by Elizabeth Clements

On February 27, Fermilab had a unique visitor Flat Stanley.

Formally known as Stanley Lambchop, Flat Stanley is a character from the children s book, *Flat Stanley*, by Jeff Brown. Originally published in 1964, the book is about a young boy, Stanley Lambchop, who wakes up one morning to discover that he is as flat as a pancake or half an inch thick to be precise. Stanley and his family quickly realize that being flat can have its benefits such as the ability to travel in an envelope to visit friends.



In 1995, Dale Hubert, a third grade teacher from Canada, launched the Flat Stanley Project with the hope to improve children s literacy and communication skills. Students make their own Flat Stanley paper dolls and mail them to friends, family members or even celebrities. After a few days, Flat Stanley is returned to the student with a journal of his activities and even a souvenir, such as a photograph.

More than 3000 schools from over 25 countries participate in the project. If the number of participants isn t enough to demonstrate success, Flat Stanley s list of people and places visited certainly does the job. President George Bush, Secretary of State Colin Powell, and former President Bill Clinton have all shaken hands with the famous flat youngster. Flat Stanley has even made TV appearances on *E.R., West Wing* and *Everybody Loves Raymond*. And now Fermilab can be added to the list.

In this case, Sam Mantel, an eight-year-old from Wisconsin, mailed Flat Stanley to Fermilab, hoping to have him photographed with some scientists. Here is a peek of some of things Flat Stanley did on his visit, including a meeting with Fermilab Director Michael Witherell.

ON THE WEB:

Flat Stanley Project:
http://flatstanley.enoreo.on.ca

Flat Stanley's journal from his visit to Fermilab:
http://www.fnal.gov/pub/news03/flatstanley.html

Flat Stanley

Flat Stanley started his tour by exploring Fermilab s site map on the 15th floor (center). Other highlights of his tour include: (clockwise from top) shaking hands with Director Mike Witherell, visiting the Main Control Room, learning about the Neutron Therapy Facility with Radiation Therapist Brian Pientauk, eating lunch with physicist Chuck Brown, spending some time in the Leon Lederman Science Education Center, and meeting Wilson Hall receptionist Kathy Johnson.

Photos by Reidar Hahn

Opposite page: (bottom left) As Fermilab s first flat visitor, Flat Stanley had to get a special security clearance from Security Guard Robert Holle. (top right) Elizabeth Clements, Fermilab s official flat visitor tour guide, shows Flat Stanley the atrium of Wilson Hall.

Special Delivery

Chris White's goal is spreading the word on ICAR and UEC

ON THE WEB:

Illinois Consortium for Accelerator Research
www.capp.iit.edu/~icar/

Fermilab Users Organization/ Users Executive Committee
www.fnal.gov/orgs/fermilab_users_org/uec.html

SLAC Users Organization
www.slac.stanford.edu/grp/rd/sluo/SLUO.html

by Mike Perricone

Chris White is on a mission to deliver a message. In fact, White is on two missions, with two messages, and don t be surprised if you see him delivering one or both at a cafeteria table near you.

One message stems from his mission as the new Program Director of the Illinois Consortium for Accelerator Research (ICAR).

One of our problems is that we re just not well known, White said. If you go to the cafeteria in the High Rise and say, ICAR, I would guess that not many people would know what you re talking about. The first thing I m interested in doing is trying to get ICAR to be recognized within the community, and recognized for the fact that we re actually trying to make a difference. ICAR primarily is an effort to strengthen the university programs in northern Illinois in the area of accelerator research, and we re funded by the State of Illinois to do just that.

His other message comes from White s role as chair of the Users Executive Committee at Fermilab, and from the UEC s goals for the annual Users Meeting this summer.

This year, we re trying to bring it back closer to its roots, White said. The original point of the Users Meeting was to get together and talk about the future of the laboratory. We have to let users know, You d better care about the future, otherwise nothing is going to change. I see the need for mobilizing our forces, to be less complacent.

An assistant professor of physics at Illinois Institute of Technology and a neutrino experimenter at Fermilab, White likes to quote IIT s vice president for external affairs, David Baker, in describing Fermilab as an aircraft carrier: a big ship that also carries a lot of impact on its decks. In Fermilab s case, the impact is both scientific and economic.

It s not just the money that s being brought in to pay the employees, White said. It s the whole economic value to the wider community. People who are being trained here are going off to the high-tech areas of the Illinois economy to work. We re providing a talent pool for an economic engine that s larger than the scientific work being done here. We need to bring the message to business and governmental people in the State of Illinois, so they recognize the value of this facility, and work toward insuring a bright future for the lab.

White sees delivering that message as part of ICAR s role. With annual funding of $2.5 million from the state, ICAR is a consortium of five universities (IIT, Northern Illinois University, Northwestern University, the University of Illinois at Urbana-Champaign, and the University of Chicago) established as part of an initiative by former Governor George Ryan to continue attracting research funding to Illinois, specifically in accelerator research.

White also noted, as has Fermilab director Michael Witherell, that the U.S. Department of Energy s Office of Science sends 20 percent of its budget to

Photos by Reidar Hahn

The State of Illinois has a large stake in the [DOE] Office of Science, and part of our mission in ICAR is to have people in Springfield recognize that, said Chris White, new program director of the Illinois Consortium for Accelerator Research.

Illinois, mostly for research at Fermilab and at Argonne National Laboratory.

The State of Illinois has a large stake in the Office of Science, and part of our mission in ICAR is to have people in Springfield [the state capital] recognize that, White said. If they wish to keep that money flowing into the state, they need to participate as well.

Beyond a small reserve for administration and communication, ICAR s funding is distributed evenly among the five member universities for independently-directed research. IIT, for example, has a strong research effort in muon cooling rings, which could be used for a future muon collider or neutrino factory. NIU has a major focus on the photoinjector project at Fermilab, as well as other research related to a possible future linear collider. White sees ICAR s role as carrying out accelerator research that is precluded by tight budgets at the lab, as well as growing the presence of accelerator physicists in the region. He pointed to two new tenure-track faculty members in accelerator science at IIT, as well as two Ph.D. candidates.

If you enhance university programs in accelerator research in northern Illinois, you also enhance the ability of northern Illinois to attract future accelerator projects, White said.

The future is very much on his mind with the UEC as well. Again this spring, the users organizations of Fermilab and Stanford Linear Accelerator Center will coordinate a visit to representatives in Washington, D.C. White also said he will invite the Office of Science s High-Energy Physics Advisory Panel to take part in the annual users meeting at Fermilab.

If HEPAP represents the future of high-energy physics in the U.S., then the panel should be at our users meeting, White said. That s what our message to them will be.

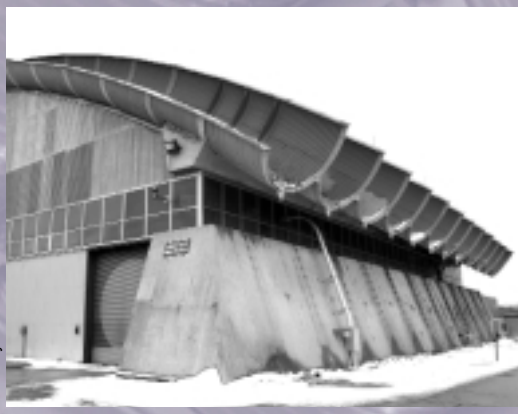


Photo by Reidar Hahn

Science Returns to Meson Lab

by Kurt Riesselmann

It seems like the best of places and the worst of places. Built 30 years ago, the Meson Laboratory is one of the architectural landmarks on the Fermilab site. Covering half the size of a football field, the building features a scallop-like roof created from half-sections of steel culverts. Visitors can easily spot this eye-catching structure, painted bright blue and orange.

Scientists have learned to cope with another feature of the industrial-type building: leaks. From its very beginning the fancy steel roof has been less than perfect at keeping rain out. Numerous attempts to seal the roof have failed, and scientists have learned to protect sensitive equipment by erecting waterproof enclosures within the building s vast interior.

The Meson Lab has hosted more than 130 experiments. Until 1999, operators could send beams of protons from Fermilab s most powerful accelerator through a 1.5-mile underground beam line to the Meson Lab, directing the protons to six different experimental areas within the building. The Main Ring started out with 200 GeV protons in 1972. Upgrades allowed scientists to use 400 GeV protons only three years later. The advent of the Tevatron accelerator in 1983 enabled physicists to direct 800 GeV protons onto targets at the Meson Lab. Physicists sifted through the resulting debris using many different types of detectors, discovering and studying the fundamental building blocks of matter. In particular, scientists produced and analyzed mesons, particles composed of a quark and an antiquark. Hence the building s name.

In the last couple of years it s been pretty quiet in and around the Meson Lab. The last experiments took place a few years ago. Since then, visitors to the building stood a better chance of meeting a raccoon than a scientist.

Scientists return

In recent months, the tide has turned. Physicists, engineers and technicians are reclaiming the Meson Lab as they are setting up new experimental areas. Ten years after the groundbreaking for the Main Injector on March 22, 1993, scientists are awaiting the final safety approval to shoot a beam of 120 GeV protons from the new accelerator to the Meson Lab.

It s the final step to take full advantage of the Main Injector s capabilities, said Erik Ramberg, who managed the revival of the Meson Lab. The Main Injector is going to fulfill its promise of supporting a fixed-target program.

ON THE WEB:

Fermilab Meson Test Beam Facility
http://www-ppd.fnal.gov/MTBF-w/

Radio Ice Cerenkov Experiment (RICE)
http://kuhep4.phsx.ukans.edu/~iceman/

BTeV experiment
http://www-btev.fnal.gov/

Main Injector Particle Production (MIPP) experiment
http://ppd.fnal.gov/experiments/e907/e907.htm

COVER PHOTO: The roof of the Meson Building, which hosts the new Test Beam Facility, consists of half-sections of steel culverts. The structure is as famous for its architectural style as it is for leaks.

Photo by Reidar Hahn

Detector components of the RICE and the BTeV experiments will be among the first prototypes to be tested in the new Meson Test Beam Facility at Fermilab. Lorenzo Uplegger, INFN Milano (left), and Brad Hall, Fermilab, get the test stand ready for BTeV pixel detectors.

Every three seconds, the Main Injector can deliver beam to the Meson Lab. Right before the particles reach the lab, scientists can direct the protons to different experimental areas. Placing various types of material, or targets, in the proton beam s path, experimenters can customize the beam by creating mesons such as pions and kaons.

One experimental area is the Meson Test Beam Facility. It will provide users with the infrastructure to conduct tests of detector prototypes. Ramberg, who heads the MTBF, knows what users want: particle identification system, gas delivery system, and data acquisition system. They all exist at MTBF.

There are not many of these test beam facilities around, Ramberg said. Ours is pretty fancy. Compared to the past, we now offer more support from the lab, better infrastructure and more versatility with regard to the test beam.

Photo by Reidar Hahn

The beam line to the Meson Test Beam Facility can deliver a variety of particles. A particle identification system, built by Erik Ramberg, informs experimenters about the types of particles delivered to their test stands.

D J ¸ VU

Fermilab will spend a total of $2.6 million to revive the Meson Lab. A large fraction of the money has already gone into rebuilding the 1.5-mile beam line, replacing superconducting magnets designed for 800 GeV beam with conventional magnets for the new 120-GeV beam.

I joined the lab in 1974, said Chuck Brown, who has managed the new installation. One of my first projects was to help upgrade the beam line to the Meson Lab from 200 to 400 GeV. Now we have reinstalled some of the same magnets that were used then after they ve undergone renovation and testing by the Technical Division.

Brown took over the project a year ago after the death of Thornton Murphy, who had led the project for about one year.

It was a big challenge to renovate and install all this old equipment, Brown said. Instrumentation, power supplies, electronics all needed to be renovated and updated. Yet we had very little manpower since Run II takes precedence.

After a decade of little or no increases in the Fermilab budget, projects not directly related to Collider Run II of the Tevatron accelerator have received low priority. Scientists had hoped to get beam to the Meson Lab in summer of 2002, but Paul Feyereisen and other technicians involved in the beam line upgrade were often needed in projects related to Run II. Now MTBF is almost operational. A second experimental area, dedicated to the Main Injector Particle Production (MIPP) experiment, might be ready before the end of the year. A third beam delivery area, intended for the Charged Kaons at the Main Injector (CKM) experiment, will be added in the future.

Experimenters ready to go

At present, six groups of scientists are preparing for R&D projects in the test beam area. Two of the groups have already signed Memoranda of Understanding with Fermilab: scientists from the University of Kansas will use the 120 GeV proton beam to study a new particle detection technique; and a group of BTeV experimenters from six institutions will test a prototype silicon pixel detector and its data acquisition system.

We ll use the 120 GeV protons to check the simulations that we developed for our detector, said KU Professor Alice Bean of the Radio Ice Cerenkov Experiment. We have this new detection method that uses radio antennas to identify particles passing through a transparent medium. The electric field emitted by fast, charged particles is like a pancake. That s what we are looking for.

In 1999, RICE experimenters deployed a first set of 16 radio receivers at a depth of 300 to 700 feet near the South Pole to study cosmic particles. Ideally, the foot-long antennas can pick up electromagnetic signals from particles traveling through the ice as far away as one kilometer. At Fermilab, the group will study the technique in more detail, embedding inch-long antennas in large tubes filled with wax rather than ice.

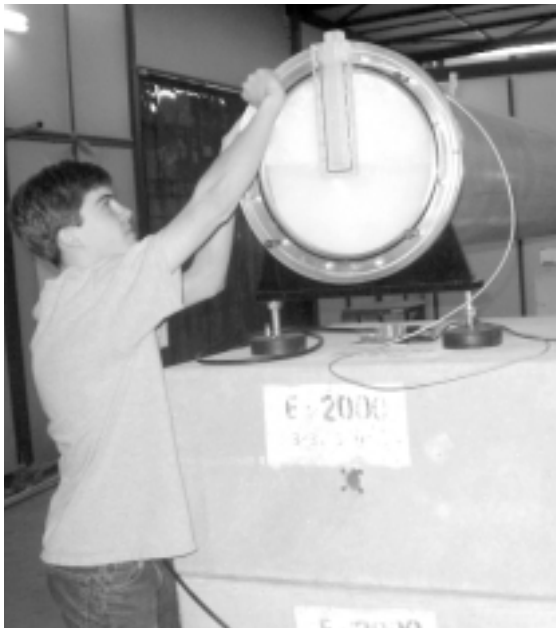


Photo by John Ralston

For testing purposes, James Snow, freshman at the University of Kansas, fills the interior of a RICE detector with wax. Sixteen RICE prototype detectors are also in place at the South Pole, surrounded by Antarctic ice.

Meson Lab

A sign indicates that the new beam line will soon receive beam.

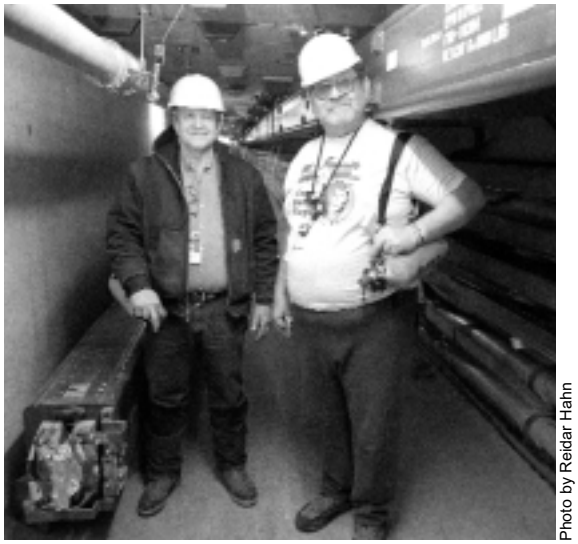


Photo by Reidar Hahn

A 2.5-kilometer beam line guides 120 GeV protons from the Main Injector accelerator to the new Meson Test Beam Facility. Paul Feyereisen (left) and Jim Holub were among the technicians who installed renovated magnets to direct the beam through already existing tunnels.

The BTeV group, which prepares for a large-scale experiment to take place several years from now, is analyzing the performance of its pixel detectors. The sensors consist of tiny rectangles of silicon that create electric signals when hit by charged particles. To record the signals, Fermilab engineers have designed chips that amplify and digitize the electric pulses. The chips then transmit the digital data to a data acquisition system.

The data acquisition cards plug directly into PCs, said Fermilab engineer Brad Hall, who worked on the new system design. We built the DAQ from ground up. We have designed a system that is more cost effective and flexible than in previous test systems, yet it still has the performance we need.

At the Meson Test Beam Facility, BTeV experimenters will test the new DAQ system under field conditions. In addition, physicists will analyze the performance of the pixel sensors after long-term exposure to showers of particles. Since the full-scale BTeV experiment will collect data for several years, the reliability of all detector subsystems is of great importance. Three other BTeV subgroups have submitted proposals to test different detector components at the Meson Lab as well.

Ramberg is quite excited about the future of the test facility. He toured similar facilities at other laboratories before drawing plans for a revived Meson Lab. Now, with first beam about a month away, he is convinced of the prospects.

I have used three other test beam facilities in the past, and can thus appreciate the need for them, he said. The user community will absolutely love this one.

FERMILAB ARTS, LECTURE AND FILM SERIES

To purchase tickets for Arts and Lecture Series events, or for further information or telephone reservations, **call 630-840-ARTS** weekdays between 9 a.m. and 4 p.m. Phone reservations are held for five working days, but will be released for sale if not paid for within that time. Will-Call tickets may be picked up, or available tickets purchased, at the lobby box office on the night of the performance beginning at 7 p.m. When coming to this event, only the Pine Street entrance to Fermilab will be open. *For more information, check out our web page at* **www.fnal.gov/culture.**

Quartetto Gelato

April 5, 2003

As the engaging innovators of a fresh approach to classical music, Quartetto Gelato has won the hearts of audiences worldwide since their remarkable 1994 debut season. The concert presentations combine supreme musicianship, irrepressible energy and charming wit, treating their listeners to an unforgettable musical event.

Tickets - $21 ($11 ages 18 and under)

Orquesta Aragon

May 10, 2003

Founded 60 years ago, Orquesta Aragon is recognized as the premiere charanga group in Cuban Music. In keeping with the charanga-style, Orquesta Aragon is a 13 piece band that does not feature a brass-section, but rather vocals, flute, and violins on top of a rhythm section of piano, bass, congas, timbales, bongo and clave.

Tickets - $26 ($13 ages 18 and under)

LECTURE SERIES

Friday, April 11, 2003, 8 p.m.

The Human Genome and Cancer

Professor Arnold Levine, Institute for Advanced Study

Dr. Arnold J. Levine is a leading authority on the role of the molecular basis of cancer, and the co-discoverer of the p53 gene, an important tumor suppressor gene. He will discuss the most up-to-date research on Friday, April 11 at 8 p.m. in Fermilab s Ramsey Auditorium.

Dr. Levine is the former President of Rockefeller University. Levine came to Rockefeller in 1998 from Princeton University, where he was the Harry C. Wiess Professor of Life Sciences. Between 1984 and 1996, he presided over a major expansion of Princeton s life sciences programs as chairman of the Department of Molecular Biology. Levine helped shape U.S. science priorities as chairman of an influential 1996 review panel on federal AIDS research funding. He also chairs the National Cancer Advisory Board, which advises the National Academy of Sciences and its Institute of Medicine on cancer policy. His work has won numerous awards, and he is a member of the National Academy of Sciences. He is currently at the Institute for Advanced Studies in Princeton, New Jersey. *Tickets- $5*

FILM SERIES

All shows are Friday nights at 8 p.m. in Ramsey Auditorium. Tickets are $4 for adults, $1 for children (under 12), and $2 for Fermilab students, and are sold only at the door. Please join us for refreshments and discussion after the film.

Friday, April 4, 2003

Bedazzled

UK (1967), 104 min., Dir: Stanley Donen.

Stanley sells his soul to the devil for seven wishes and uses those wishes to attract the one he loves. The devil twists the meaning of each wish. Peter Cook and Dudley Moore co-wrote and co-star in this classic screwball version of Faust.

Friday, May 9, 2003

Mulholland Drive

USA (2001), 145 min. Dir: David Lynch.

Lynch s atmospheric film noir intertwines the stories of Betty (Naomi Watts), a perky Hollywood hopeful, and Rita (Laura Harring), amnesiac from a car accident along Mulholland Drive, with strange and macabre doings in the world behind the scenes of showbiz. Originally a pilot for a TV series, the film weaves together disparate plot lines and characters in a way that may or may not ultimately make any rational sense...you decide.

Alvin Tollestrup Award for Postdoctoral Research

The URA is sponsoring a new award for outstanding postdoctoral research. The recipient must be in a non-permanent position and within six years of a Ph.D. The research must be performed in conjunction with a Fermilab experiment or accelerator physics project, or under the auspices of the FNAL Theory Group. Fermilab scientist Alvin Tollestrup will make the presentation of the $3,000 award during the annual Fermilab Users Meeting in June, and the winner will give a talk about the research involved.

The application deadline is short: a CV, cover letter, a short paper on the research, and two letters of recommendation must be received by 20 April 2003. Please see the web page for complete details: http://www.fnal.gov/orgs/fermilab_users_org/Tollestrup.html.

LUNCH SERVED FROM
11:30 A.M. TO 1 P.M.
$10/PERSON

DINNER SERVED AT 7 P.M.
$23/PERSON

Chez Léon MENU

FOR RESERVATIONS, CALL X4512
CAKES FOR SPECIAL OCCASIONS
DIETARY RESTRICTIONS
CONTACT TITA, X3524
HTTP://WWW.FNAL.GOV/FAW/EVENTS/MENUS.HTML

LUNCH
WEDNESDAY, MARCH 26

Quesadillas
of Bean Corn and Cheese
Latin Confetti Salad with
Lime Cilantro Dressing
Tropical Fruit Plate

DINNER
THURSDAY, MARCH 27

Zucchini Pancake with
Smoked Salmon and Yogurt-Dill Sauce
Grilled Veal Chop with Sun-Dried
Tomatoes & Capers
Bean and Fennel Puree
Amaretto Souffle with
Chocolate Sauce

LUNCH
WEDNESDAY, APRIL 2

Flank Steak
with garlic potatoes
Steamed Spring Vegetables
Flan w/blueberries

DINNER
THURSDAY, APRIL 3

Roasted Corn Chowder
with potatoes & bacon
Herb Crusted Beef Tenderloin
with cabernet sauce
Potato Gratin
Stuffed Tomatoes
Strawberry Tart

FERMI NEWS

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The deadline for the Friday, April 11, 2003 issue is Tuesday, April 1, 2003.
Please send classified ads and story ideas by mail to the Public Affairs Office, MS 206, Fermilab, P.O. Box 500, Batavia, IL 60510, or by e-mail to ferminews@fnal.gov.
Letters from readers are welcome.
Please include your name and daytime phone number.

Fermilab is operated by Universities Research Association, Inc., under contract with the U.S. Department of Energy.

Batavia Road Closed, March 24-April 6

The City of Warrenville is closing a section of Batavia Road, near Fermilab s East Gate, from March 24 through April 6 for repairs. During that time, Fermilab s East Gate will be closed. Please use the West Gate at Pine and Kirk Roads to enter the lab during that time. The lab apologizes for the inconvenience.

CLASSIFIEDS

FOR SALE

■ 94 Chrysler Concorde 3.5L, AC, cruise control, moon roof, radio and all mod-cons. Runs very well and is a very comfortable car in good condition. Asking price $3,300 o.b.o. Contact 630-840-2433 or sineadf@fnal.gov.

■ 90 Nissan Maxima, gold, 125K miles, fully loaded, auto transmission, sunroof, runs great, $2,000 o.b.o. Contact 630-399-0029 (cell phone) or gkuznetsov@fnal.gov.

■ 99 BMW R1100S Motorcycle, 1.5k miles. Special edition, fully loaded. $10,500. Page Robert at 630-722-7591.

■ Pair of Gemini speakers, 320 watts, 15″ woofers, 7″ x 4″ midrange, 3 Motorola tweeters, $150/pair. Contact 630-505-0276.

■ Nintendo 64 game system, two controllers, games. Very good condition. $100 o.b.o. Contact 630-505-0276.

■ Scandinavian queen-sized bed, rosewood, good condition $250; queen-sized mattress, one year old, $100. Contact 305-7769.

■ FE Olds trumpet, 4-1/2 years old, used 3-1/2 years, excellent condition, $400 or best offer (cost $750 brand new). Contact 630-505-0276.

■ Marvin interior French doors with glass panels, 30″ wide by 79-1/4″ tall, one right hinge, one left hinge. DOORS ONLY, $150 or best offer. Contact 630-505-0276.

HOUSES FOR SALE

■ Two-story home near the Fox Valley area. 15-20 minutes to Fermilab. 3 bedrooms, 1.5 bath, covered patio and 2 car attached garage in kid friendly development. Neutral decor with light oak woodwork. Many upgrades. Built in 2001. $152,000. Contact Patrick at 630-840-2977, donahoe@fnal.gov for more info.

■ Beautiful brick front Georgian story home in the Fox Valley area. Built in 1999 with 9 spacious rooms. 4 bedrooms and 2.5 baths. 1st floor den. Formal dining, family and living room with fireplace. Hardwood floor in 2-story foyer, kitchen, dinette. 6 panel pine door. Spacious kitchen with island, oak cabinets and eat-in area. Luxury master bedroom suite with tray ceiling and fan. Large basement with 2 water heaters and with radon mitigation system installed. Huge backyard with 15x20 wooden deck, 10 minutes to lab, 5 minutes to mall, park and school. $327,900. Contact 630-851-7244.

SERVICES

■ Need help preparing your taxes? Save at least 20% off last year s preparation fees. Contact Jack 630-840-5674 or 815-577-8450.

BIBLE STUDY

■ Bible Study group meets every Wednesday at noon (12-12:30 pm) in the Huddle (by the Control Room). The current study is entitled *Journey Into Happiness*. Check out the #1 best seller of all time for yourself with no strings attached. All are welcome. Info at 630-840-3607 or dykhuis@fnal.gov.

CALENDAR/LAB NOTES

Website for Fermilab events: http://www.fnal.gov/faw/events.html

FERMILAB CHILDREN'S SUMMER DAY CAMP

■ Registration begins March 1. Deadline is March 28. A lottery drawing is held March 31 for acceptance into the camp. Information can be found in the Recreation Office, WH15W, x2548, x5427 and on the Recreation web page at http://fnalpubs.fnal.gov/benedept/recreation/dependent.html.

NALWO

■ NALWO (National Accelerator Laboratory Women s Organization) cordially invites Fermilab women to a Low/Fat Russian Cooking Demonstration and Tasting/Luncheon, April 4, 2003, 10:30am at Chez Leon in the Users Center; please contact Sue, x5059 or mendel@fnal.gov for more info http://www.fnal.gov/orgs/nalwo/030404Cook.htm

CALL FOR ENTRIES

Fermilab Arts and Craft Show

May 1, 2003 to June 2, 2003.

■ Open to all Fermilab employees, visiting scientists or graduate students, retired employees, contractors and any member of his or her immediate family. Pick up applications at Atrium Desk. Questions?? Contact 630-840-6825 or Georgia@fnal.gov.

GOLF LEAGUES

■ Fermilab offers several golf leagues that begin play in April. Everyone is welcome to join one or more of these leagues. Anyone at Fermilab can play: men and women, beginners and seasoned veterans, lefty s and righty s, etc. There are five different leagues, and they meet on Tuesday, Wednesday or Thursday evenings. For details, visit our web site at http://mccrory.fnal.gov/golf.

MILESTONES

NAMED

■ Bob Tschirhart (ID 08973N), as deputy head of the Computing Division

BULLETIN:

LUMINOSITY RECORD AT TEVATRON

Fermilab s Tevatron collider achieved a luminosity record of 40.6 E30 on Sunday, March 16, continuing a 15-month surge dating back to January 2002. Luminosity, a measure of particle interaction, is now nearly five times higher than in January 2002. The higher the luminosity, the greater the chance of particle production, discovery and new physics. The previous record had been 37 E30, set November 8, 2002.

http://www.fnal.gov/pub/ferminews/

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