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# *'Science at Its Best'* Gold Beam Circulates Readily for First Time in RHIC Blue Ring; Work Underway to Accelerate Beam, Commission Yellow Ring

At the beginning of Michael Harrison's 9:30 a.m. daily meeting on July 16, the accelerator physicists involved with the commissioning of BNL's Relativistic Heavy Ion Collider (RHIC) were depressed.

As they explained to Harrison, who is RHIC Associate Project Director for the Collider, by eliminating all other possibilities methodically, the commissioners could only conclude that their inability to get gold beam to circulate readily in the collider's Blue Ring was due to some sort of obstruction in the vacuum pipe before the 12 o'clock intersection region of the ring.

Working since June 24 (see Brookhaven Bulletin of July 2 and 16, 1999), the commissioning physicists had succeeded in threading the beam clockwise around the ring four times by that meeting. But, metaphorically, pushing it through the eye of the needle was hard work.

"We had systematically eliminated all other problems, but we were still left with the fact that, when the beam would just about get to IP [intersection point] 12, it would lose energy," explained Steve Peggs, who leads the Accelerator Physics Group. With each turn, the beam would lose more energy and begin to spiral off its trajectory; by the fourth turn, it would have so little energy and be so off course that it would dissipate.

"So we could only conclude that something — a dent or a chem-wipe or some other debris in the vacuum pipe — was in the way of our being able to circulate beam," added Peggs.

By talking their problem through among themselves and going back to the control room to implement their "bump" solution—that is, steer around the suspected obstruction— the commissioners turned their depression into elation that very day: at 11 a.m., they succeeded for the first time in circulating beam multiple turns around the Blue Ring, one of the two 3.8-kilometer-in-circumference accelerators making up RHIC.

"The beam pipe is big enough that the beam doesn't have to be straight down the middle," said Peggs. "So we steered for about half an hour, and, all of a sudden, the beam just went."

Last Friday, the first RHIC Blue Ring heavy-ion beam — a single bunch of gold atoms stripped of all their electrons — made thousands of laps around the RHIC track before being dissipated. Since each lap takes 12.5 microseconds, the first beam's total lifetime was less than a second. The gold-ion bunch had an energy of 11 billion electron volts (GeV) per nucleon and an intensity of approximately 10<sup>7</sup> ions per bunch.



At a gathering in the AGS-RHIC control room hosted by RHIC Project Director Satoshi Ozaki (standing by computer, center), RHIC Associate Project Director Michael Harrison (seated, center) celebrates the Blue Ring commissioning suc-

cess with, among others: Lab Director John Marburger (standing behind Harrison), (seated, front from left) Dejan Trbojevic and Steve Peggs, and George Ganetis (second person behind Trbojevic).

and most difficult goal to achieve with any nonlinear accelerator. With this milestone set for the Blue Ring, work

is underway to increase beam intensity and to accelerate the beam to higher energy. RHIC was designed to have gold-ion beam with an energy of 100 GeV per nucleon and an intensity of  $10^9$  ions per bunch.

In the meantime, the commissioners are also scheduled to turn their attention to the Yellow Ring on ment — something that the hundreds of employees of the RHIC Project have been working toward since its start in



1983 — corks popped in the control room twice that day.

Champagne was poured immediately after 11 a.m., and then again at 4:30 p.m., when RHIC Project Director Satoshi Ozaki hosted a gathering including Laboratory Director John Marburger, former BNL Director Nicholas Samios, Deputy Director for Science & Technology Peter Paul, Associate Laboratory Director for High Energy & Nuclear Physics Tom Kirk, AGS Chair Derek Lowenstein, the spokespersons or their representatives from RHIC's five experiments, the chairs of the BNL Departments working on RHIC experiments, and others.

In addition to lifting their waxedpaper cups to toast those involved in the immediate success, those assembled congratulated Michael Harrison, and the other groups and sections under his jurisdiction for their (continued on page 2)

Circulating the beam is the first

#### Glance at RHIC Beam

Beginning next Tuesday, July 27, BNLers can see a special edition of *GLANCE* in the video kiosk in Berkner Hall, featuring footage shot by Alex Reben on Friday, July 16 shortly after beam first circulated readily in RHIC's Blue Ring.



At the Blue **A plot an rf wall-current monitor signal showing the** Ring's controls at **first 620 turns of the first beam circulating readily in** golden hour was **RHIC's Blue Ring.** Dejan Trbojevic,

who heads the "D" crew, which is one of five teams of commissioners scheduled for 24-hour shifts and which, in addition to Trbojevic, is staffed by Andreas Lehrach and Vadim Ptytsin.

Working with the commissioners were staff of the Alternating Gradient Synchrotron (AGS) Department: AGS operations coordinator Charles Whalen and AGS operator Jennifer Kozak (see photo, page 2), plus the AGS operation support crew of Tim Costanzo, Charles Gardner, and Frank Scheifele. They supervise the gold beam from the time that it is generated in the Tandem Van de Graaff, accelerated by the AGS Booster, and accelerated again and stored by the AGS itself until it is injected into RHIC. In celebration of this accomplish-

Reviewing the "bump" strategy noted on a meeting-room board thatled to the first freely circulating beam in RHIC's Blue Ring are: (from left) Dejan Trbojevic, Steve Peggs and Satoshi Ozaki.

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#### **RHIC Blue Beam** (cont'd)

roles in building the machine and getting it to work.

'Today is a fantastic day, and the extraordinary effort of everyone working for the RHIC Project is very much appreciated," Satoshi Ozaki exclaimed that Friday.

The RHIC Project Director afterward added, "I give special thanks to Mike Harrison for his outstanding leadership of the collider aspect of the RHIC Project. He has spearheaded the collider effort from collider design, to installation and system shakedown, to instrumentation and controls development, and now — to this success in the commissioning of half of the RHIC collider.

"For this immediate success, I not only praise the talent and skills of all those who have been involved in collider construction, but also those of Steve Peggs and his Accelerator Physics Group, and of George Ganetis and his Electrical Systems Group. Without their ingenuity and perseverance, we could not have succeeded," Ozaki added.

The Project Director concluded, "On behalf of the RHIC Project, I thank the entire Laboratory for making RHIC its centerpiece, and the U.S. Department of Energy, particularly its Nuclear Physics Program Office, for its strong support." (See photo below, right.)

"I am just as excited about this milestone as those who have been involved in this project from the beginning," said John Marburger. "That a stable orbit was achieved so soon after completing construction is impressive, and I am very proud of the team that made it happen. After a long hot summer of frustration, I am sure that the time seemed much longer to the team."

He continued, "I am also impressed with the commissioning process itself. It is truly an empirical process, in which observation, hypothesis, experiment, and correction are carried out in a highly disciplined way. This is science at its best."

The Lab Director concluded, "My congratulations to everyone who helped bring RHIC to this point. I look forward to a long sequence of such celebrations.'

#### 'In Business'

Actually, the night, or owl, shift of midnight to 8 a.m. on July 16 taken by the "A" crew (see photo, above right) headed by Leif Ahrens and staffed by Wolfram Fischer, Pat Thompson, and Johannes van Zeijts set the stage for the D crew's daytime success.

On the owl shift, not only did Pat Thompson work over the phone with Tom Shea, who heads the RHIC Beam Instrumentation Section which de-



**Charles Whalen and AGS opera**tor Jennifer Kozak.

signed and built RHIC's monitors, to get beam position monitors working properly at the critical sector 11 just before the 12 o'clock intersection region. But also Wolfram Fischer succeeded making the beam's trajectory of the successive turns match that of the first turn.

Despite other efforts to improve beam survival as it is called, the A crew left the day shift staffed by the D crew with that "little challenge," as they noted in the log.

Around 10:30 a.m., D crew leader Dejan Trbojevic took up the challenge.

What was the trick?" asked Deputy Laboratory Director Peter Paul, after he and Lab Director John Marburger were called to the control room upon the success at circulating beam in the Blue Ring.

Explained D crew member Andreas Lehrach, "We

in the beam pipe, make a bump.'

"Making a bump" means moving the beam first away from its more orless straight-line trajectory and then, after the obstacle is cleared, moving the beam back to its path around the Blue Ring (see photo, page 1, bottom right). "It is like driving your car around a road block and then back turns for the first time, Dejan Trobjevic declared, "We are in business."

Obstructions accidentally created within the vacuum pipe in which a particle beam travels in an accelerator are not new or unusual. In fact, the obstacle most talked about by accelerator physicists is a beer bottle that

had been left in the beam pipe during maintenance of the large electron positron (LEP) accelerator at the European particle-physics laboratory, CERN, in Switzerland.

"Whatever was in the way of the Blue Ring beam is trivial," stated Steve Peggs. "But we will attend to it later."

"Later" starts on September 1, when the Blue Ring will begin being warmed up. RHIC is made up of two rings of superconducting magnets installed in cryostats filled with liquid-helium coolant and chilled to 4.6 Kelvin, which is the magnet's operating temperature and is just above absolute zero (see Brookhaven Bulletin of July 16, 1999). As a result, opening up the Blue Ring to inspect the vacuum pipe is impossible until it reaches room temperature. All is to be fixed by November 15.

#### Name That Tune

With beam successfully circulating, one of the first things that the accelerator physicists wanted to determine was what are called the Blue Ring's transverse oscillation frequencies, or tunes. These are the beam's numbers of oscillations per lap horizontally and vertically.

Determining the Blue Ring's tunes not only confirmed that the strength of RHIC's magnets was correct, but also determined the winner of the "tune pool" — the accelerator-physics equivalent of a baby pool (see photo and graph on page 3).

Another frequency, however, was of interest to another set of physicists. While members of the RHIC Accelerator Physics Section alternately took a few minutes away from their computer consoles in the control room to

onto the main road," said "C" crew

With the beam trajectory in the

center, at position zero, the beam was

being lost just before IP 12. So the D

crew leader steered the beam +10 mil-

limeters (mm) in the horizontal direc-

tion, toward the outside of the ring,

but there were still beam losses. At

+15 mm, still losses. "So we went in

the other direction, and, at minus ten

millimeters, the losses disappeared,"

leader Todd Satogota.

said Andreas Lehrach.

'Maybe we should Ozaki, and Laboratory Director John Marburger. As the beam was making multiple July 23, 1999



Fischer, Pat Thompson, and (standing, behind Van Zeijts) A crew

leader Lief Ahrens, with AGS operations coordinator Charles Whalen.

The A crew: (seated, front to back) Johannes Van Zeijts, Wolfram





With Deputy Director Peter Paul (standing, second from left) are some of the members of the AGS-RHIC RF Systems Group: (standing, from left) Kevin Smith, Alan Campbell, Emmanuel Onillon, (seated, from left) group leader Michael Brennan, and Joe DeLong.



Commissioning the Blue Ring was made possible on June 24, when DOE gave the Lab permission to operate the ring, following an accelerator readiness review. At the review signing were: (standing, from left) Henry Kahnhauser, chair of BNL's Accelerator Readiness Review Panel; RHIC Associate Project Director Michael Harrison; Michael Holland, DOE Brookhaven Group (BHG); Michael Butler, BHG; AGS Chair Derek Lowenstein; (seated, from left) RHIC Project Director Satoshi Ozaki; BNL Director John Marburger; and **BHG Manager George Malosh.** 

celebrate, Michael Brennan and member of his AGS-RHIC RF Systems Group (see photo, page 2, bottom left) rushed in to sit down to determine what is called the Blue Ring's longitudinal frequency, which was measured to be 28.053581 megahertz.

Using that number enabled the RF group to "capture" the Blue Ring beam. That is, the rf system was able to maintain the beam in a tight bunch as it circulated. While RHIC will ultimately operate with 60 bunches, only one is now used for commissioning.

To produce the most interesting results when collided, the beam within both accelerators must be tightly bunched. To keep beam bunches tight, "The rf speeds up the slow particles and slows down the fast ones," explains Michael Brennan. "If you did this to cars on the LIE, all of them would be traveling in a bunch."

Located at 4 o'clock on the RHIC ring, the rf cavities, which were built under the leadership of Jim Rose, are the part of the system that supply energy to the beam, thereby accelerating it and allowing the ring to fulfill its role as an accelerator. Increasing the beam's energy while the strength of the magnets that focus the beam is being increased requires what are called feedback loops to be used. So the rf group is now putting them into operation.

Since rf capture, the RF Systems Group has increased the beam's lifetime to a few minutes by working the problems out of the hardware and software involved in the feedback loops. When RHIC is fully operating, beam will be stored in the collider's rings for ten hours.

While continuing to increase the beam's lifetime, the rf group has another goal: to exercise "the ramps," that is, to accelerate the beam to higher energy.

Brennan added, "It will be a bootstrap process: increase lifetime first,



Tune-pool winner Haixin Huang (pictured above)<br/>placed his dollar bill down on two very symmetri-<br/>cal numbers: 28.28 for the horizontal tune and<br/>29.29 for the vertical tune. RHIC's design tunesare 28.<br/>actual<br/>29.30 v<br/>dollar

# are 28.18 horizontally and 29.19 vertically. The actual Blue Ring tunes, 28.31 horizontally and 29.30 vertically, made Huang \$27 richer, one dollar for each pool entry (see graph above).

**BERA Bus Trips** 

# Karles Talk

#### On Peptides 7/29

Isabella Karle, U.S. Naval Research Laboratory, will speak on "Peptides: Conformations, Channels, and Nanotubes," on Thursday, July 29. Sponsored by Brookhaven Women in Science, her talk will be given at 3:45 p.m. in the Biology Department Seminar Room, Bldg. 463.

Known for her pioneering work in the field of x-ray crystallography, Karle won the 1995 National Medal of Science and the 1993 Bower Award of the Franklin Institute.

Karle will discuss the structures of hybrid molecules that contain peptide and organic components, and the insights these structures provide into the functions of hybrid molecules. Refreshments will precede the talk.

To join the speaker for dinner at a local restaurant afterwards, contact Louise Hanson, Ext. 5849.

#### On Basic Research 7/30

In addition to her Thursday talk, on Friday morning, July 30, Isabella Karle and her husband, Jerome Karle, 1985 Nobel laureate in chemistry, will, for the fifth consecutive summer, address the students in BNL's annual Community Summer Science Program. Isabella Karle will speak on "Mushroom Antitoxins," while Jerome Karle will talk on "Science and the Role of Basic Research." The lectures, which will begin at 9:45 a.m. in the Hamilton Seminar Room of the Chemistry Department, Bldg. 555, are open to the BNL community.

#### To mark the 20th anniversary of Brookhaven Women in Science (BWIS) in November, BWIS is holding a contest to find a new slogan.

Wanted: BWIS Slogan!

The slogans for BWIS's 10th anniversary were: "BWIS: Not For Women Scientists Only," and "BWIS: Ten Years Wiser."

The contest is open to BNL employees, retirees, facility users, guests, and their families. To enter, send your slogan plus your name, Bldg. number, and extension to Terri Kneitel, Bldg. 120, by Friday, August 6. The winner and all finalists will receive prizes.

# **Meetings on BGRR**

BNL and DOE are holding informal roundtable discussions on the decommissioning of the Brookhaven Graphite Research Reactor (BGRR).

Meetings have been scheduled as follows:

- Tuesday, July 27: 7-10 p.m., Bldg. 51 conference room.
- Thursday, July 29: 9 a.m.-noon, Bldg. 51 conference room.
  Tuesday, August 13: 7-10 p.m., Dowling Air
- Transportation NST Center, Shirley.

To attend, call Kathy Gurski, Ext. 7459.

On a fully equipped bus, all trips leave from the Brookhaven Center; if requested, an extra pickup will be made at the park and ride at L.I.E. exit 63.

Tickets are sold first come, first served. To make paid reservations for one or more of the following trips, go to the BERA Sales Office, Berkner Hall, Tuesday through Friday, 9 a.m. - 1:30 p.m. For more information, call Andrea Dehler, Ext. 3347, or M. Kay Dellimore, Ext. 2873.

#### *To Great Adventure on August 14*

On Saturday, August 14, BERA goes to Six Flags Great Adventure amusement park. The per-person cost is \$45, including admission. The bus will leave promptly at 7:30 a.m. and return at approximately 9 p.m.

#### To Shea Stadium on August 24

On Tuesday, August 24, BERA is going to Shea Stadium in Queens, to see the New York Mets play the Houston Astros in an evening baseball game.

The cost is \$45 per person for the bus and box seats. Participants are to arrive by 4:15 p.m., the bus will leave promptly at 4:30, the game starts at 7:30 p.m., and the bus will leave the stadium at approximately 10:30 p.m.

then increase energy, and so on." Before attempting to reach design energy, his group's goal is to exceed 24 GeV per nucleon. This energy is RHIC's transition energy, at which the effect of relativity makes acceleration difficult.

#### **Detector Challenge**

While commissioning work continues on the Blue Ring, George Ganetis and his Electrical Systems Group are testing power supplies — to ready the Yellow Ring for the start of its commissioning beginning Monday.

"With our experience with the Blue Ring, getting the Yellow Ring commissioned should be much more straightforward," concluded Steve Peggs. "The baby that is RHIC has been born, but raising it through childhood and getting it to function as an adult is still a ways away. The challenge is now for four detector collaborations to get their experiments up and running in time for the first physics run."

When operating, these experiments will sift through particles created in head-on collisions of gold beam traveling clockwise in the Blue Ring and counterclockwise in the Yellow Ring. The detectors will be searching for what is called quark-gluon plasma, a state of matter that last existed moments after the Big Bang. By studying quark-gluon plasma, nuclear physicists hope to gain new understanding of the particles making up the atomic nucleus and forces working on it. — Marsha Belford

## Welders Named

In last week's Bulletin, two welders from the Central Shops Division went unidentified in two of the pictures of RHIC Cryogenic System Section work, since their names were unknown at press time. They have now been identified as Steve Clerk, pictured on the bottom left of page 3, and George Meade, who was seen on on the top left of page 3.

## **IBEW Meeting**

Local 2230, IBEW, will hold its regular monthly meeting on Monday, July 26, at 6 p.m. in the Knights of Columbus Hall, Railroad Avenue, Patchogue. There will be a meeting for shift workers at 3 p.m. at the union office. The agenda includes regular business, committee reports and the president's report.

#### **Equipment Demo**

EMA Mid Atlantic, Inc., will be at BNL on Wednesday, July 28, 10 a.m.noon, to introduce a new Allegro Studio printed circuit board layout system by Cadence Design Systems. The presentation will be held in the seminar room of the Information Technology Division's Bldg. 515. For more information contact Pam Mansfield at pam@bnl.gov.

to return to the Lab.

# Road Paving 7/27 & 28 Amateur Radio Club

On Tuesday and Wednesday, July 27 & 28, roads around the site will be paved. BNLers are asked to comply with barricades indicating that a road is closed.

The BERA Amateur Radio Club will meet at noon on Thursday, July 29, in Berkner Hall, Room D (note change of day and room). For more information, call Ron Dobert, Ext. 4175.

# **Computing Corner**

The Information Technology Division (ITD) will offer the following software classes in August. See the ITD training page at www.ccd.bnl.gov/ bnl/training for registration information and course outlines. For more information, contact Pam Mansfield at Ext. 7286 or pam@bnl.gov.

date	class	level
8/3	Windows	introduction
$8/4\&5^{*}$	Access	beginner
8/11	Excel	beginner
8/16&18*	Projects	beginner
8/16-18**	C <sup>++</sup> programming	
8/24	Front Page	beginner
8/31	Front Page	beginner

\* Two-day class; \*\* Three-day class

# BULLETIN B

Published weekly by the Media & Communications Office for the employees of BROOK HAV EN NATIONAL LABO RATORY

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# **BNL: TIAA-CREF's Internet Institution of July**

For more information about TIAA-CREF and the other financial institutions through which eligible employees participating in the Lab's retirement plan can invest, contact Muriel Pfeiffer, 8:30 a.m. to 1 p.m., Monday through Thursday, in the Benefits Office, Human Resources Division, Bldg. 185, Ext. 2877.

Through the end of July, Web surfers visiting the TIAA-CREF home page at www.tiaa-cref.org may click on a photograph of the National Synchrotron Light Source. This will take them to http://www.tiaa-cref.org/iiom/, which is a page featuring the Lab as TIAA-CREF's "Internet Institution of the Month."

In addition to describing BNL's mission, research facilities and history of discoveries, the page has many links to the Lab's Web site.

Since BNL was founded in 1947, BNL employees have been investing toward their retirement in TIAA-CREF accounts.

# **Pick a Student**

Completed applications for the fall 1999 Energy Research Undergraduate Laboratory Fellowship (ERULF) Program will be available for review on an electronic database until August 2. The address and passwords are available from the Office of Educational Programs (OEP) or departmental education coordinators.

The undergraduate program will run for 16 weeks from approximately August 23 until December 10. OEP will pay for the student's round-trip travel and their stipend of \$350 per week. The sponsoring departments are asked to pay \$125 weekly for their housing.

For more information, contact OEP at Ext. 4503 or cathyo@bnl.gov.

## **BERA Book Fair**

BERA will sponsor a book fair in Berkner Hall lobby, Thursday and Friday, July 29 & 30, 10 a.m.-3 p.m. Bigger and better than last year's, the selection of in-stock hardcover books will include children's books, cook books, and best-sellers at up to 70 percent off list price. Some gift items will also be available. Credit cards and checks will be accepted.

Also, a drawing will be held for a book of the winner's choice. For more information, call Andrea Dehler, Ext. 3347, or M. Kay Dellimore, Ext. 2873.

# Cricket Match 7/31

The BNL cricket team will play a match against an arch rival, Columbia University, on Saturday July 31, starting at 1 p.m. on the official BNL cricket pitch between softball fields 1 and 4 — farthest from the National Synchrotron Light Source. The Lab community is invited to attend.

BNLers who have played before are welcome to join the team. For more information, contact Tony Begley, acting captain, 591-4073 or begley@aps. org, or www.nais.com/ ~rbegley/cricket.



#### **Placement Notices**

LABORATORY RECRUITMENT - Opportunities for Laboratory employees.

DD7448. HELPER A (temporary opening) - Under general supervision, performs a variety of tasks in a shop or building trade that require a substantial knowledge of a skill in that trade. Possession of the knowledge or skill expected of a journeyman is not necessary. Duties will usually include handling minor assignments in the trade, with a minimum of supervision, and assisting one or more journeymen in more complex assignments. Central Shops Division.

**OPEN RECRUITMENT** - Opportunities for Laboratory employees and outside candidates.

MK2227. ASSISTANT SCIENTIST - To work in the Neutron Scattering Group. Will participate in the design and construction of a state-of-the-art three-axis spectrometer on the new cold source to be installed at ORNL's HFIR. Seeking a creative and motivated scientist to take a leading role in this and related efforts. Will be expected to develop an independent research program utilizing the unique capabilities of neutron

# Summer Sundays '99 Visualize This on Sunday, 7/25



If you have ever wondered what tumors look like, or how drugs interact with cells, or how particles collide, then this Sunday's facility tour of BNL's Information Technology Division (ITD) on July 25 is for you.

This Sunday, ITD will open its doors to Lab tourists, to display its threedimensional visualization technology (pictured above) — and more.

More includes a glimpse of the world's tenth-fastest supercomputer, which was built for the RIKEN BNL Research Center at the Lab, housed in ITD and dedicated to calculations of the physics of BNL's Relativistic Heavy Ion Collider.

Since no tour will be complete without a trip into cyberspace, Lab tourists will also have 14 Web-browsing terminals available to them for their Internet use.

Besides the ITD facility tour, Summer Sunday visitors may take a guided bus trip around the site and participate in the Whiz Bang Science show. Fun for children of all ages, this show is a lively interactive demonstration of basic scientific principles which will be presented at 10:30 a.m., noon, 1:30 p.m., and 3:30 p.m.

The history of the site during its pre-BNL days as Camp Upton, a U.S. Army camp during World War I and II, will be on display at the Camp Upton Historical Collection. Housed in a Camp Upton chapel, this museum contains items donated by veterans who had passed through the camp, and artifacts of the Army found on site.

Organized by BNL's Museum Programs on Sundays through August 29th, Summer Sunday tours are open to all and are offered from 10 a.m. to 5 p.m., but all must arrive before 3 p.m.

job descriptions based on documentation and audits. Human Resources Division.

DD8767. CONTRACTS SPECIALIST POSITION - Requires a bachelor's degree in business or equivalent experience; experience with high-technology procurements is desirable. Must be well-versed in all aspects of procurement and have the ability to draft RFPs, contract modifications, and special provisions. Also requires experience performing analyses of cost and man-hour estimates and a knowledge of Federal Acquisition Regulations. Division of Contracts & Procurement.

scattering. Current topics of research in the group include: high-temperature superconductivity, correlated-electron phenomena, and low-dimensional magnetism. Requires a Ph.D. in physics, with experience with modern design and operation of triple-axis neutron spectrometers highly desirable. Under the direction of J. Tranquada, Physics Department.

MK7640. ENGINEERING POSITION - (term appointment, reposting) Requires a bachelor's degree in engineering, with mechanical, basic electrical and vacuum experience desirable. Will be responsible for establishing the new Pulse Laser Deposition Facility working directly with scientific staff. Will design and construct support structures for the equipment, interface the vacuum and laser portions of the system, build a gas manifold, and oversee the necessary interlocks and safety aspects involved in the process. Physics Department.

MK8777. COMPENSATION ANALYST - Requires a bachelor's degree in business administration or related field several years' experience as a compensation professional, including experience with database manipulation, input/analysis of survey data and writing iob descriptions. Additional skills include excellent analytical, mathematical and communication skills, demonstrated ability to work as a team member, and PC skills, including Microsoft Office, Excel, Access, Word, and knowledge of HRIS. American Compensation Association certification preferred. Responsibilities include compensation data compilation and analysis, creating/managing compensation related HRIS and database reports, communicating compensation information to all levels of Lab personnel, conducting market pricing studies and salary surveys, and writing