BROOKHAVEN BULLETIN
Vol. 41 - No. 47 December 4, 1987
BROOKHAVEN NATIONAL LABORATORY

BNL's Search for the Science of Superconductivity

Part III: The Interplay Between Theory and Experiment

The dormant field of superconductivity suddenly awoke at the beginning of this year, with the discovery of new materials that lose their electrical resistance at relatively high transition temperatures. Since then, many of the staff and visitors in Brookhaven's solid state physics community have spent sleepless nights, probing these new materials at the Lab's big machines.

Their dream is to find out why these materials superconduct at temperatures up to 90-100 kelvin. Surprising revelations about the properties of these new superconductors have come through complementary experiments at the High Flux Beam Reactor, National Synchrotron Light Source and Alternating Gradient Synchrotron.

These results have been interpreted in a theory developed at BNL, which describes a novel mechanism for superconductivity at high critical temperatures (T_c). This theory of high T_c superconductivity, in turn, has stimulated further experimentation. The interaction between solid state theorists and experimenters is very evident at Brookhaven, as the third of this four-part series of articles continues to examine, beginning on page 2.

BNL Shares Software With PNL

Some of BNL's newest software is going West — and it's getting a warm welcome from the Department of Energy's (DOE) Pacific Northwest Laboratory (PNL), located in Richland, Washington and operated by Battelle.

IPAP, the Lab's Integrated Inventory Purchasing Accounts Payable system, was designed expressly for BNL users by the Management Information Systems (MIS) Division, with an implementation committee representing Lab organizational units. Together, they worked out the basic requirements of the system. It has been so successful here that DOE has funded a transfer of the software to PNL.

What is IPAP? "It's a way of ordering supplies and equipment by computer," said Robert Bacharach, MIS Manager. "Most labs are still filling out requisitions on paper, which have to go by mail to all the offices involved, risking delays each time. Also, it may take two or three phone calls to determine the status of the order at any given stage. The IPAP system does away with all that by providing purchase information on line."

"So no more paper chasing!" said Michael Guacci, Manager of the Supply and Materiel Division. "This system is just so much more efficient. Now, an early morning order for supplies on site is usually delivered by the afternoon of the same day. It used to take three days. Then, because of system improvements, we have been able to increase our yearly turnover rate from 2.7 to 3.29 by reducing the on-hand stock by $80,000. And we are able to effect delivery of incoming purchases within twenty-four hours of receiving them."

One reason that the system is so useful, Bacharach suggested, is that it was built specifically to fit what system users require. The project was initiated in 1979, when a group of MIS analysts interviewed BNL users, asking them what problems they faced and how they might be overcome. Once the analysts had this information, they developed the system, changing and improving it gradually. "It was an evolutionary, rather than a revolutionary process," said Bacharach, "and it worked."

As the new IPAP system was adopted at BNL, its advantages became so apparent that, in 1985, John King, now Manager of the Contracts and Procurement Division, made a series of presentations to purchasing managers in other national laboratories and at government and contracting agencies. "It's light years ahead of anything else," said King, pointing to the reduced filing, quicker service and built-in checks and controls that make IPAP so practical.

Eventually, BNL hosted eight or nine further demonstrations of IPAP, with one that had particularly successful results. In 1986, DOE reviewed the Contractor Procurement System. During their visit to BNL, DOE staff used IPAP for themselves and thought it could also be useful at other national laboratories.

This was also the opinion of another visitor, from PNL, whose interest in IPAP had been aroused during an earlier presentation. He wondered, "Would it be possible to try the system back home?"

A lengthy review process about the possible transfer took place, involving BNL and representatives from DOE, Battelle and other contractors from the Richland site. Since these contractors may be using the system in the near future, it was important that they approve it — and they did.

After further negotiations, it was decided to transfer the IPAP software to PNL as a test case. PNL had to acquire a Hewlett Packard HP 3000 computer, which they leased, and BNL began installing the software in November.

"It will take a while for the personnel at PNL to become familiar with the system," said Bacharach. "At BNL, the IPAP implementation went slowly at first, especially as administrative use of computers was not so widespread. But soon PNL will experience the savings in work, time and costs that IPAP brings.

"Sharing expensive software systems among the national labs makes sense," continued Bacharach. "In these days of tight budgets, the savings to DOE can be very useful."

— Liz Seubert

Peter Horton

Pictured at one of the meetings held at the Management Information Systems (MIS) Division to arrange the transfer of software for BNL's IPAP system to the Pacific Northwest Laboratory (PNL) were: (seated, from left) PNL's William Collins, General Accounting; Dennis Kehl, Information Systems; Alta Jones, Procurement; and Phyllis Kropf, Accounts Payable; with BNL's Edward Gallagher, MIS Assistant Manager; Robert Bacharach, MIS Manager; and (standing) Nicolas Franco, MIS Systems Development Supervisor.

Coming Up

Vincent Dole, Professor and Senior Physician Emeritus at Rockefeller University, will deliver the next Brookhaven Lecture, the last in a series of four lectures planned this fall to commemorate the Lab's 40th anniversary. He will speak about "Biomedical Research at Brookhaven and Rockefeller Hospital — Our Common Heritage," on Wednesday, December 16, at 4:30 p.m., in Berkner Hall.

BNL Hosts Second Symposium on Genetic and Salt Hypertension

Mort Rosen

Unchecked hypertension is a killer disease. To some extent, this condition of abnormally high blood pressure affects about 20% of the U.S. population.

To share their latest research and information on the role of salt in hypertension, some 80 scientists and doctors gathered at the Second International Symposium on Genetic and Salt Hypertension, held at BNL November 12-13. Basic and clinical aspects of hypertension were discussed, and further studies were planned using Dahl rats.

These rats are two special strains developed originally by the late Lewis K. Dahl, Chief of Staff of BNL's Medical Research Center from 1952 to 1975, whose research showed that high salt intake was more dangerous in a person's early years. In May 1981, the First International Symposium on Salt in Hypertention was held at BNL in Dahl's memory.

The Dahl rats will be used again in the next stage of research at the Medical Department. Junichi Iwai, Head of the Hypertension Group, stated that this research would focus on the role of exercise in salt hypertension, and that a third symposium is planned for the future.

Among those who attended last month's Symposium on Genetic and Salt Hypertension and who are planning the next one were (from left): Junichi Iwai, BNL; Phillippe Meyer, Necker Hospital, France; Lawrence Krakoff, Mt. Sinai Hospital, New York; Louis Tobian, University of Minnesota; Eric Muirhead, University of Tennessee; and Masao Ishii, Yokohama City University, Japan.

BNL's Search for the Science of Superconductivity

Part III: The Interplay Between Theory and Experiment

How two electrons become one Cooper pair in a high temperature superconductor is the one question solid state physicists would most like to answer.

In BCS theory of low temperature superconductivity, phonons interact with electrons, thereby causing electrons to pair. These Cooper pairs all move together, making up a supercurrent flowing without resistance through a superconductor.

In high temperature superconductors as well, electrons are coupled into Cooper pairs. However, as experiments at BNL's High Flux Beam Reactor (HFBR) and National Synchrotron Light Source (NSLS) have indicated, they cannot be paired through interactions primarily with phonons.

Senior Scientist Victor Emery, Physics Department, is one solid state theorist who thinks he has the answer to the electron-pairing question. Emery is chairman of BNL's Interdisciplinary Task Force on High Temperature Superconductors.

Holes in the Theory

In Emery's theory for high temperature superconductivity, there are no lattice-wave phonons, no electron-phonon interactions — and no electrons.

Instead, there are holes, or missing electrons. Though holes are not particles like electrons, they can act like particles in their own right, taking on characteristics such as spin and magnetic moment.

According to Emery, holes interact with spin configurations. Specifically, in the new superconductors, the holes in the electronic shells of the oxygen atoms interact via the copper atoms in between them.

This interaction results in hole-hole pairing, the equivalent of electron-electron Cooper pairing, and in resistance-free supercurrents at high critical temperatures (T_c).

Holes result when atoms do not succeed in filling their outer shells of electrons in forming chemical bonds with other atoms. When atoms chemically combine to form molecules and compounds, they redistribute their electrons among themselves: They give or take electrons, trying to fill their outermost shell of electrons.

For example, in the non-superconducting compound La-Cu-O, which is the parent of the 35-55 kelvin (K) superconductors, each copper atom is missing one electron from one of its outer shells. Therefore, each copper in La-Cu-O has one hole.

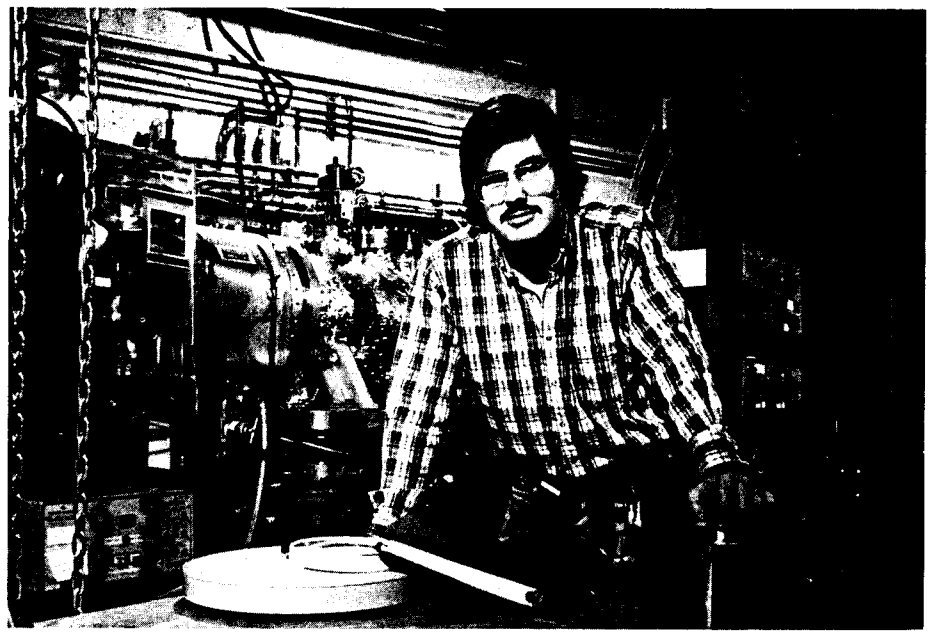
The ability of atoms to bond to other atoms is measured by the number of electrons they can give or take. That number is called valence, and the outer electrons participating in bonding are called valence electrons. A positive valence number means an atom donates electrons, while a negative valence number means an atom accepts electrons.

For example, lanthanum (La) has a valence of +3, which means it gives up three electrons. The alkaline earths barium (Ba) and strontium (Sr) each have valences of only +2, which means they contribute only two electrons each.

Say the parent compound La-Cu-O is doped with either barium or strontium, meaning some alkaline earth is substituted for some of the lanthanum to make one of the 35-55 K superconductors, either La-Ba-Cu-O or La-Sr-Cu-O. As a result of the doping, however, there is one less valence electron to be shared because the alkaline earths give up one less electron than the lanthanum they replace.

If an alkaline earth gives up one less electron, then which atom in La-Ba-Cu-O or La-Sr-Cu-O takes one less electron as a result?

Some researchers thought that each copper, usually having a valence of +2 with one hole in its electronic shell, might become Cu^{+3}, having two holes. This could occur if copper would give up three instead of two electrons.



John Tranquada, at the x-ray ring of the National Synchrotron Light Source.

However, Emery suspected from the beginning that it is oxygen, not copper, that changes its usual valence. According to Emery's theory, some of the oxygen atoms change from O^{-2} having no holes to O^{-1} with one hole.

Superexchange

In materials that become superconducting at high T_c, Emery theorizes that the spins of the oxygen holes strongly interact via the hole spins of the copper atoms between them. This spin interaction is known as superexchange and produces hole-hole pairing.

Like the motion of a planet about its axis, spin is the intrinsic angular momentum of a particle. It exists even if the particle is at rest. An electron, for example, has a characteristic spin. Its spin is related to its magnetic moment, which is a measure of a particle's interaction with a magnetic field.

An electron or a hole can have either one of two spins and, hence, only one of two magnetic moments: either up or down. Two electrons or two holes cannot pair if they have the same spin. For example, if two holes have the same up spin, one of the two holes must exchange its up spin for a down spin before they can pair.

In superexchange, a hole on one atom exchanges its spin by interacting with a hole on a neighboring atom having opposite spin, by going through an intermediate atom residing between the two.

Antiferromagnetism

In the undoped, parent compound La-Cu-O, according to Emery, superexchange takes place among the holes of the copper atoms.

This results in a long-range, three-dimensional ordering of the spins called antiferromagnetism. Antiferromagnetism is the alternating up-down-up-down order of spins in a solid.

Not all solid state physicists expected antiferromagnetism in the family of copper-oxide compounds to which the the new superconductors belong. In fact, some calculations predicted against it.

Doping the parent to produce a 35-55 K superconductor, however, results in holes on oxygen atoms. These holes move from one oxygen to another by hopping across a copper atom sitting between them. As holes move in one direction, in effect, electrons move in the opposite.

In the high T_c superconductors, the conduction electrons of the oxygen, and hence oxygen's holes, are more mobile than those of copper. So, oxygen's holes can more easily hop from oxygen to oxygen, via the intermediate copper atom, and they can exchange hole spins with the copper as they go.

Therefore, a stronger superexchange interaction results among the spins of the mobile oxygen holes than among the spins of the relatively localized holes on the coppers. This interaction of oxygen spins, says Emery, eliminates the three-dimensional, antiferromagnetic order of copper spins in the new superconducting materials.

Instead, holes on the oxygen atoms in the copper-oxygen planes can pair with neighboring oxygen holes having opposite spin, when the temperature drops below T_c. These hole pairs, the hole-hole equivalent of electron-electron Cooper pairs, then make up the supercurrent, which travels without resistance through the superconductor.

Proof of the Theory

Much of the development and proof of Emery's theory has come from experiments done at BNL. The first piece of evidence Emery draws on is a Brookhaven experimental result, one that was a first in the field.

The result is the fact that oxygen, not copper, loses an extra electron, or gains an extra hole. This occurs when the parent compound La-Cu-O is doped with an alkaline earth element, such as barium or strontium, to become one of the 35-55 K superconductors, such as La-Ba-Cu-O or La-Sr-Cu-O.

By taking up one instead of two electrons, some oxygens, therefore, go from having a usual valence of -2 and no holes to having a valence of -1 and one hole.

This was discovered in January at the National Synchrotron Light Source (NSLS) by Assistant Physicist John Tranquada, Physics; Scientist Steve Heald and Physics Associate Arnold Moodenbaugh, both of the Department of Applied Science (DAS).

From x-ray absorption spectroscopy at the x-ray ring of the NSLS, Tranquada, Heald and Moodenbaugh saw in their plots what is called fine structure, which are oscillations resulting from the movement of inner shell electrons into empty holes.

The highly intense, continuous synchrotron radiation spectrum from the NSLS x-ray ring is ideal for making such measurements. Analysis of fine structure provides information about the electrons surrounding or missing from each element in a compound.

Analyzing their plots of fine structure, Tranquada and his collaborators concluded that, as La-Cu-O is doped with strontium or barium, the number of holes on the copper atoms does not change, but holes appear on some oxygen atoms.

In other words, they found that some oxygen, not copper, gains a hole as the insulator La-Cu-O becomes a 35-55 K superconductor, thus establishing the starting point of Emery's theory.

Seeing is Believing

This is not a trick photograph. What you are seeing is a levitating magnet.

It defies gravity not by supernatural power, but as a result of what is called the Meissner effect. The magnet is hovering above a 90-100 kelvin (K) superconductor made by Senior Technical Associate Robert Jones, Materials Science Division, Department of Applied Science.

When a material becomes superconducting, it expels magnetic flux from its interior, and this is called the Meissner effect. So, when a small, permanent magnet is lowered over the surface of a superconducting material, the magnet's lines of force do not penetrate the material. In lowering the magnet towards the superconductor, currents are induced in the material that repel the magnet with enough force to overcome the magnet's weight.

The floating magnet demonstration was first performed in 1945, but by cooling a material down to its low superconducting transition temperature using liquid helium, which becomes liquid at 4.2 K. With the discovery of 90-100 K, high temperature superconductors, the demo can now be carried out in a styrofoam cup in any physics classroom using liquid nitrogen, which liquifies at 77 K.

This demo was put together by Physicist Meyer Garber and Technical Specialist Joseph D'Ambra, of the Research and Development Group of the Magnet Division, Accelerator Development Department.

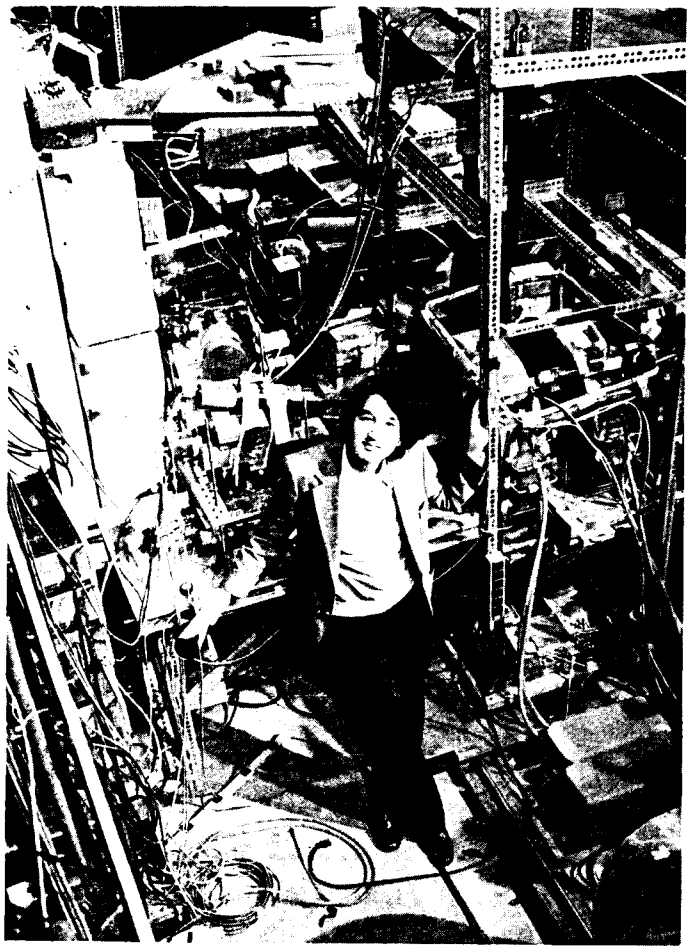
Meissner Effect

Further support for Emery's theory was obtained at the Alternating Gradient Synchrotron (AGS) in February and May by Associate Physicist Yasutomo Uemura, Physics; Arnold Moodenbaugh and Senior Metallurgist Masaki Suengaga, DAS; and their colleagues from the College of William and Mary, and Virginia State University.

The AGS is used by most physicists for high energy physics. However, for Uemura and his colleagues, the muon beam produced by AGS protons is a solid state physics probe.

Superconductors demonstrate other effects besides resistance-free electrical conduction. One of those is called the Meissner effect (see box), named after Walther Meissner who discovered it in 1933.

The Meissner effect is the expulsion of an applied magnetic field from the interior of a material when it is cooled below its T_c and becomes a superconductor.



Yasutomo Uemura, at the Alternating Gradient Synchrotron.

Photos on these two pages by Mort Rosen.

Actually, not all of a magnetic field is expelled: Depending upon the type of superconductor, the magnetic field can penetrate a superconductor's surface where a supercurrent flows. How far beneath the surface the magnetic field can go is called the penetration depth.

Uemura and his co-workers directly measured the penetration depth of both the new 35-55 K and 90-100 K superconductors, using a technique called muon spin relaxation.

They also learned that, as the materials are doped, the number of supercurrent charge carriers increases and the superconducting transition temperatures are roughly proportional to the number of charge carriers. This result is consistent with Emery's idea that the coupling of charges is mediated by a strong interaction like the superexchange interaction.

Antiparallel Construction

The third piece of evidence Emery presents to make his case is another BNL first: It is the discovery and unequivocal establishment of the fact that the spins of the copper atoms in the copper-oxide chains within the insulator La-Cu-O, which is the undoped progenitor of the 35-55 K superconductors, do alternate in an up-down-up-down, antiferromagnetic array.

This antiparallel ordering of the magnetic moments causes no net magnetization of the solid. Hence, an antiferromagnet is not magnetic in the conventional sense, as is a ferromagnet. A ferromagnet, such as an iron-bar magnet, picks up pins and paperclips because its magnetic moments all point in the same direction.

The lineup of opposite copper spins was directly observed in La-Cu-O single crystals by neutron diffraction at the HFBR in May, by Assistant Physicist Torsten Freltoft and Senior Physicist Gen Shirane, Physics; Guest Physicist David Moncton and two other colleagues from Exxon Research and Engineering Company; and three collaborators from AT&T Bell Laboratories.

The HFBR's intense thermal neutrons are ideal for neutron diffraction experiments looking into the magnetic properties of individual atoms in a material. Detailed information on the magnetic configuration of antiferromagnets cannot be obtained by any other method. Through magnetic scattering studies, the size and the direction of the individual atoms's magnetic moments, as well as the lineup of all magnetic moments in a material, can be learned.

As do other types of magnetic materials, antiferromagnets have a characteristic neutron diffraction pattern, called a superlattice reflection. Seeing superlattice reflections, Moncton and his colleagues concluded that La-Cu-O is antiferromagnetic.

However, because they had used unpolarized neutrons, they could not rule out the possibility that the superlattice reflections were not due to another phenomenon, such as a structural phase transition or oxygen vacancy ordering.

To settle the matter for or against antiferromagnetism, Research Collaborator Setsuo Mitsuda and Gen Shirane, Physics; and David Moncton and four others from Exxon Research and Engineering Company carried out a polarized neutron experiment at the HFBR in April, on the parent compound La-Cu-O. In a polarized neutron beam, the majority of neutrons have their spins pointing in one direction.

Mitsuda, Shirane, Moncton and company confirmed that the magnetic moments of the copper atoms in La-Cu-O are lined up in an antiparallel order over a relatively long range, as Emery had predicted.

New & Recent Discovery

Additional confirmation that La-Cu-O is antiferromagnetic came from a muon spin rotation experiment at the AGS in May by Yasutomo Uemura and his colleagues from the College of William and Mary, Virginia State University, and Exxon Research and Engineering Company.

Muon experiments done by others elsewhere revealed the first evidence of magnetic order in oxygen-depleted, non-superconducting Y-Ba-Cu-O. When Y-Ba-Cu-O is in the tetragonal phase, having six oxygen atoms per molecule, the magnetic order is static. To become a superconductor, Y-Ba-Cu-O has to gain one more oxygen atom per molecule, making the transition from the tetragonal to orthorhombic phase. As a superconductor, the magnetic order of Y-Ba-Cu-O is no longer static.

In another Brookhaven first, antiferromagnetism was determined to be the magnetic order in the non-superconducting Y-Ba-Cu-O having six oxygens per molecule.

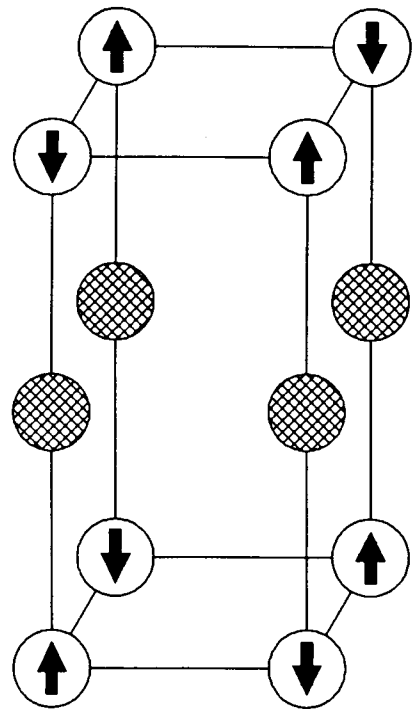
This came as a result of experiments in mid-November at the HFBR, performed by John Tranquada; Physicist David Cox, Physics; Associate Chemist Walter Kunnmann, Chemistry; Visiting Physicist Abdel-Hamid Moudden and Gen Shirane, both of Physics; Masaki Suenaga, DAS; Visiting Research Associate Peter Zolliker, Physics; and five colleagues from Exxon Research and Engineering Company.

This new and recent discovery establishes that antiferromagnetism exists both in the oxygen-deficient precursor of the 90-100 K superconductor Y-Ba-Cu-O, as well as in La-Cu-0, the undoped progenitor of the 35-55 K superconductors.

New Physics

Antiferromagnetism and high temperature superconductivity are most likely related phenonema. As it turns out, the dynamic, two-dimensional order of copper spins in the copper-oxide planes of the new superconductors is totally new physics.

The first to see this new physics in La-Cu-O and La-Sr-Cu-O were Gen Shirane and Research Collaborator Yasuo Endoh, Physics; Guest Senior Scientist Robert Birgeneau and another colleague from the Massachusetts Institute of Technology; and four collaborators from NTT Corporation, Japan. It was discovered in July at the HFBR, through inelastic neutron scattering. They call this new physics quantum spin fluid.



Antiferromagnetic order in a single chemical unit of Y-Ba-Cu-O. The arrows show the spin orientation of the copper atoms having a valence of 2. The cross-hatched circles represent nonmagnetic copper atoms, and the solid lines connect copper atoms having oxygen atoms between them.

What they mean by quantum spin fluid is that the atomic spins of the copper atoms are not frozen solid in an up-down-up-down, antiferromagnetic array. Instead, the ordered spins fluctuate in time, as they would in a liquid or gas. Hence, La-Cu-O is a dynamic, as well as static, antiferromagnet.

In searching for this new physics, Shirane, Endoh, Birgeneau and company essentially took both motion pictures and still photographs of the copper spins of La-Cu-O. They could not see the spins fluctuating in their motion pictures: Because time is average in a motion picture, all they saw were disordered spins.

However, in their still photographs, they could see the instantaneous antiparallel order of the fluctuating spin fluid, by taking them with the equivalent of a very fast shutter speed and a motor drive.

Shirane, Endoh, Birgeneau and their colleagues expected the spins to be correlated antiparallel over a relatively long range before the symmetry was broken. What they did not expect was the short timespan of fluctuation of the spin fluid: a femotosecond, 10^{-15} seconds.

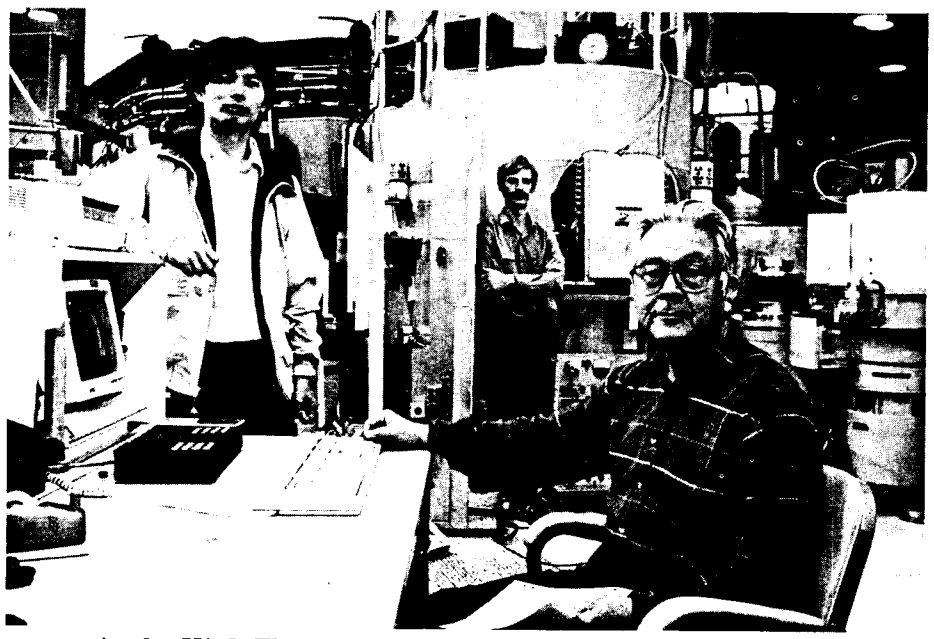
The rapid fluctuation of the spin fluid means that the energy involved is high enough to explain the high transition temperatures of the new superconductors. So the discovery of quantum spin fluid is strong circumstantial evidence for Emery's theory.

Theory Still Stands

"At the very least, I don't think that quantum spin fluid and high T_c superconductivity are coincidental," Emery concludes. "While all the evidence is not in yet and some of the evidence can be used to make the case for other theories, I am optimistic and my theory is still standing."

In the future, the Lab may be challenged to put the new superconductors to good use, for example, in superconducting magnets for accelerators and other applications yet unknown. Because they are brittle ceramics, putting the new materials in useful form will take materials science and engineering expertise, and time — more than was needed for the conventional superconducting alloys.

As the final article in this four-part series will discuss next week, Brookhaven has such scientific and technical expertise, and the experience with conventional superconductors that can be called upon in applying the new materials. — Marsha Belford



At the High Flux Beam Reactor: (from left) Setso Mitsuda, Torsten Freltoft and Gen Shirane.

BNL's Fabulous Forty

What first happened at the Lab in very late June 1971 and has continued to happen at the same time each June ever since?

To add a clue, in 1973, 1978, 1980, 1981 and every year since, it occurred twice — the second time, just before or after the holidays in winter. In fact, it will take place again soon, on Tuesday and Wednesday, December 15 and 16, in the gymnasium.

Need more clues? Try thinking of how many accidents take place around holiday times, and how hospitals prepare to save as many victims as possible by having enough blood for transfusions.

One of the blood donors at the first BNL Blood Drive in 1971 was Thom Albertina, Applied Mathematics Department.

Of course, this now biannual event is the BNL Blood Drive. It was first kicked off in May, 1971, with a Brookhaven Bulletin article that began "Hey, there! You, with the blood in your veins . . ."

Although Lab employees responded to requests for blood in years prior to 1971, they always went off site to donate. But in 1971, the final count reached 925 pints donated at BNL.

This figure represented over 25% of Lab employees in 1971 and was important to hospitals in the area. Not only was extra blood needed urgently around the holidays, but also, new technology was providing the smaller Long Island facilities with new chances of saving patients with heart disease, cancer and leukemia — if blood were available.

The way to make enough blood available then, as now, was to persuade people to overcome the fear of giving blood.

Alf Christoffersen, the first of the BNL Blood Drive Coordinators or Chairpersons, sent a letter to all employees explaining the procedure, and how much good just one pint of blood could do. The Bulletin encouraged a friendly rivalry by publishing the changing percentages of pledged donors in each department as the deadline approached.

Since then, BNL Blood Drive Coordinators, with the help of the many individuals in each department who have acted as Blood Captains, have asked, cajoled and exhorted BNL employees to help save lives by donating blood. Some years produced magnificent results, others were less impressive. Consistently, however, several hundred generous BNL donors have shown up regularly at the gymnasium at their scheduled times to share their good health with others.

Still, no matter how much has been donated, more is urgently needed. Please sign your pledge card as soon as possible. Susan Foster, Blood Drive Chair, Ext. 5126, or your department or division Blood Program Captain, can help you with any concerns you may have. And you can help BNL keep up its long tradition of trying to make sure that there is enough blood in the Long Island bank. — Liz Seubert

1988 Holidays

Holiday	Day and Date Observed	
New Year's Day	Friday	January 1
Floating Holiday (Martin Luther King Jr.'s Birthday)	Monday	January 18
Presidents' Day	Monday	February 15
Memorial Day	Monday	May 30
Independence Day	Monday	July 4
Floating Holiday	Tuesday	July 5
Labor Day	Monday	September 5
Veterans Day	Friday	November 11
Thanksgiving Day	Thursday	November 24
Day after Thanksgiving	Friday	November 25
Christmas Eve	Friday	December 23 (½ day)
Christmas Day	Monday	December 26

Science Shop Opens Today

Mort Rosen

Looking for a gift that will really fascinate the recipient this holiday season? You're likely to find just what you're looking for at the Science Shop at the Exhibit Center. Prices range from 10¢ for a balloon imprinted with the BNL/AUI logo to $22 for the intriguing and attractive Mirage this shopper is admiring. In between, you'll find lightsticks for $1, hand boilers for $2, Bubble Things for $5 and lots, lots more.

The Science Shop is open today and the next two Fridays — December 11 and 18 — from 10 a.m. to 3 p.m. It is located on the west side of Bldg. 701. Please park in the north parking lot. For more information, call Ext. 4049.

In Stormy Weather: Dial 282-INFO

A heavy snow fell overnight. Will the Lab open late?

Lab employees can now get an easy answer to this kind of question, thanks to a new information service. Just **dial 282-INFO** (Ext. 4636) and you'll get one of a number of lines giving 10-second recorded messages on the Lab's current status. If there's no answer, that means there is no special message, and business continues as usual.

The new service, announced by Gerald Kinne, Assistant Director for Reactor, Safety and Security, was implemented by the Applied Mathematics Department's Networking, Engineering and Telecommunications Division.

Local radio stations will continue to give information on Lab closings as in the past.

Information Desk: SUNY at Stony Brook

Representatives from the State University of New York at Stony Brook will be in Berkner Hall on Thursday, December 10, from 11:30 a.m. until 2 p.m., at an information desk outside the cafeteria. Information about Stony Brook's new evening engineering program will be available, and employees' questions about any of Stony Brook's educational programs will be welcomed.

NYC Train Trips

The schedule for December 1987 is as follows:

Saturday, December 12
Wednesday, December 16

The fare is $6.50 per round-trip ticket. Children under five ride free. Reserve a ticket by sending a check or money order, payable to BNL or Cash, through the U.S. mail to BNL, P.O. Box 322, Upton, NY 11973. Do not send cash. Your check or money order must be received by the Friday preceding the trip. Put your telephone number and the date of the trip on the back of the check. Your reservation is made when your check is received. For a confirmation of your reservation, send a stamped, self-addressed envelope along with your check.

Departure: Patchogue LIRR station: Wednesday, 7:55 a.m.; Saturday, 8:41 a.m. Be at the station 15 minutes before departure.

See Supplement for BERA News and Classified Advertisements.

Holiday Party

The Cooking Exchange and the Hospitality Committee will host a holiday party on Thursday, December 17, from 5 to 7:30 p.m. in the Recreation Building in the on-site apartment area.

Hospitality Committee and Cooking Exchange members and their families, as well as on-site residents and guests, are invited. A donation of $2 per adult is requested. We also are asking each couple or family to bring either an appetizer, some finger food or a main dish for approximately 15 people. Desserts and beverages will be provided.

There will be small gifts for the children. Please telephone Milica Stevanovic, Ext. 3009, or Sharon Hall, Ext. 3032, by Friday, December 11, if you are coming to the party with children and would like your children to receive gifts.

We would like you to join us for this holiday get-together. Please come and bring the children. Free babysitting will be provided.

Christmas Tree Safety

In many homes during this holiday season, the main decoration will be a Christmas tree, either natural or artificial. These simple precautions can help ensure that your beautiful tree will also be safe:

Natural Trees

- Use only a fresh-cut tree.
- Place the base of the tree in water and check the container regularly.
- Position the tree away from heat sources, such as radiators, which cause more rapid drying, and keep it away from open flames, such as from candles or fireplaces.
- Locate the tree as far from stairways as possible, leaving halls and exits unrestricted.
- Use only Underwriter's Laboratories (UL) or Factory Mutual (FM) lights, and inspect all lights for frayed wires, broken sockets or other electrical defects.
- Keep other electrical devices, such as toys, trains or spark-generating equipments, from under or near the tree.
- Do not leave lighted tree unattended; disconnect lights every night.
- Use only noncombustible decorations. Carefully weigh claims concerning the fire resistivity of sprays and some "angel hair" type decorations, some of which may easily ignite.
- Don't rely on using commercial or homemade sprays to make trees and evergreens fire retardant. Even if a solution is an effective fire retardant, it could prove ineffective if the entire tree is not covered.
- Keep the tree indoors only about two weeks.

Artificial Trees

- Make sure that they are noncombustible, including the branches, trunk and trunk wrapping, and that they display the UL or FM label.
- Do not use electric lights on metal trees; illuminate only by spot or reflective lights.
- Miniature lights may be used with some artificial trees; however, follow tree manufacturer's instructions precisely. Lights should have the UL or FM label.

BROOKHAVEN BULLETIN

Published weekly
for the employees of
BROOKHAVEN NATIONAL LABORATORY

ANITA COHEN, Editor
MARSHA BELFORD, Senior Reporter
LIZ SEUBERT, Reporter

35 BROOKHAVEN AVE., UPTON, N.Y. 11973
Telephone (516)282-2345

Mort Rosen

Sovon Som with one of his paintings.

Show and Lecture By Calcutta Artist

Sovon Som is an Indian artist, who paints mainly in watercolor on silk. His imaginative paintings, which glow with color, will be the focus of an exhibition next week, presented by the BERA Art Committee. The show will open with a reception in Berkner Hall, Room B, from 5 to 7 p.m. on Monday, December 7. It will continue on Tuesday and Wednesday, December 8 and 9, from 11:30 a.m. to 1:30 p.m.

Som, who is Dean of Visual Arts at Rabindra Bharati University, Calcutta, India, is visiting his sister, Prantika Som, Medical Department. The paintings Som will exhibit are not captioned as he prefers that no verbal symbols cloud their visual impact.

Besides exhibiting his own work, Som will present an illustrated talk on "Kalighat Painting: The Urban Folk Art," in Berkner Hall Auditorium, Wednesday, December 9, 12:15 to 1:00 p.m. Kalighat painting developed in the nineteenth century in India when a group of folk artists settled on the outskirts of Calcutta and documented their impressions of the social and cultural development of the time. Their bold style departed significantly from traditional Indian art, and is believed to have influenced such western artists as Picasso and Matisse.

Peter Horton

Golf Champs

In posing for this picture, Alan Raphael (left) and Mark Culp may have been watching the birdie in the camera. However, the birdie that interests them more is a golfer's "birdie," a golf hole played with one stroke fewer than par for that particular hole. This year, Raphael and Culp sank several birdies and became BERA Golf Association team league champions when they defeated Bill Sampson and Lou Snead in the finals.

Raphael and Culp were also the regular season, Group 4 team champions. The other regular season team champions were Jesse Becker and Bob Gibbs in Group 1, Bob Meier and Dan Mullaly in Group 2 and Glaister Fraser and Howard Vetter in Group 3.

Chang Park won the individual league championship by defeating Joe Klemish in the finals. At the close of the 1987 BERA Golf Association season, regular season individual champions were: Group 1, John Usher; Group 2, Mike Losquadro; Group 3, Joe Carbonaro; Group 4, See Meng Wong.

Bowling

Red/Green League

High games were bowled by E. Sperry IV 279/656 scratch, W. Kristiansen 222/600 scratch, H. Marshall 218/605 scratch, M. Guacci 210, L. Jacobson 210, R. Mulderig 203, A. Warkentien 201.

White League

Betty Jellett rolled a 221/188, Sandy Asselta 203, Jeannette Thiede 192, Pat Manzella 185, Joe Ferrante 211, Ted Erickson 208, Ken Asselta 202.

Volleyball

Standings as of November 30

League I	
Upfagrabs	18-3
Xrayted	13-8
Dinkers	13-8
Cannonballs	9-12
Phoubars	7-14
Bumpers	3-18
League II	
Set-Ups	15-3
Nuts & Bolts	13-5
Fossils	10-8
Chunga's Revenge	10-8
Slammers	9-9
Photons	4-14
Upton Ups	2-16
League III	
Printouts	10-2
Renegades	9-3
Screwballs	8-4
Sourcerers	7-5
Misfits	6-6
Spikes	5-7
Airheads	3-9
Good Times	0-12
Open League	
Phoenix	10-2
Dakota	8-1
Serendipity	8-4
Not Too Bad	6-6
Duituits	2-7
Leftovers	1-8
Rowdy Radicals	1-8

All film badges will be changed tomorrow. Please place your badge in its assigned rack space before leaving work today.

BROOKHAVEN BULLETIN

Published weekly
by the Public Affairs Office
for the employees of
BROOKHAVEN NATIONAL LABORATORY

ANITA COHEN, Editor
MARSHA BELFORD, Assistant Editor
LIZ SEUBERT, Reporter

35 Brookhaven Ave., Upton, N.Y. 11973
(516)282-2345

Arrivals & Departures

Arrivals

Xiuhua Cui ..... Accel. Dev.
Joseph B. Gadbois ..... Plant Eng.
Gregory E. Hall ..... Chemistry
David A. Harder ..... Nuc. Energy
Asao Kusumegi ..... Instrum.
Henryk A. Mach ..... Physics
Thomas M. Nolan ..... Accel. Dev.
Philip J. Pietraski ..... NSLS
Donna L. Rubino ..... Fiscal
Karen E. Sampson ..... Con. & Proc.

Departures

This list includes all employees who have terminated from the Laboratory, including retirees:

William E. O'Grady ..... App. Science
James P. Pleickhardt ..... Plant Eng.
Gary G. Rooks ..... Sfgrds. & Sec.

Cooking Exchange

Since Hanukkah, Christmas and New Year's will soon be here, the next Cooking Exchange demonstration will feature special recipes to celebrate the holiday season. The meeting will be held on Wednesday, December 9, from 12:30 to 2:30 p.m. After the recipes are demonstrated, those attending will be able to sample the different prepared foods. All Brookhaven employees and family members are invited. There will be a charge of $2 per person to cover the cost of recipe ingredients. Babysitting will be provided for 50¢ per child.

Equipment Demos

Philips Information Systems, Inc., will demonstrate their new PC/WP product called "The Office Partner II - Transfer Utility," on Tuesday, December 8, from 10 a.m. to 3 p.m., in Berkner Hall. Philips Representatives will be on hand to answer any questions, and all current Philips users are invited to attend.

•

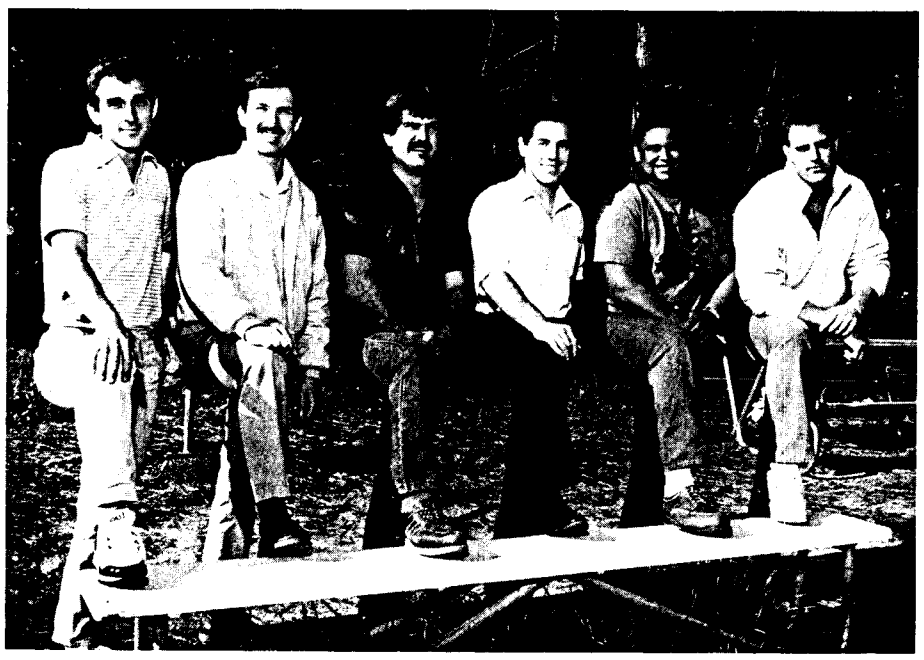
Keithley Instruments will present their test and measurement instrumentation on Thursday, December 10, from 10:30 a.m. to 3:30 p.m., in Berkner Hall. The demonstration will include electrometers, multimeters, frequency counters, scanners, switching systems, and personal computer data acquisition and control systems.

Basketball League

The BNL Basketball League is now organizing for the 1988 season. Teams play a twelve-game schedule beginning January 7. All games will be played on Thursday nights. A $20 participation fee is required.

We are expanding the league this season with the hope of increasing participation, so all are welcome. Please sign up at the gym entrance. If you have any questions, please call Jim Desmond, Ext. 4837.

Football Champs



Peter Horton

With a 26-game winning streak lined up behind them, the Delayed Reactions celebrate their fifth consecutive year as BERA Touch Football League champions. Ready to go for next season are: (from left) Ed Meier, Gerry Shepherd, Wayne Rambo, Mike Anerella, Mitch Williams and Pete Ratzke. Not pictured: Rich Domenech, Leroy James and Gordon Smith.

Choral Group: Concert Rehearsals

The BNL Choral Group will present a Christmas Concert in the cafeteria during lunchtime on Thursday, December 17. A schedule of rehearsals has been set, but because of scheduling conflicts at Berkner Hall, one will be held at the Brookhaven Center, North Room, as follows:

December 4 — Berkner Hall
December 8 — Brookhaven Center
December 10 — Berkner Hall
December 15 — Berkner Hall

Each rehearsal is expected to last less than half an hour. Please arrive at noon sharp. All parts are needed, especially tenors and basses. Please join us. For more information, call John Weeks, Ext. 2617, or Janet Sillas, Ext. 2345.

Holiday Hams

Let the Cafeteria prepare your holiday ham. At $2.15 per pound, plus tax, these smoked, bone-in hams average 17-18 pounds each. The hams are fully cooked and ready to eat. To reserve your holiday ham for Christmas, call the Cafeteria at Ext. 3541.

Cafeteria Menu

Week of December 7

Monday, December 7

Chicken noodle soup	(cup)	.75
	(bowl)	.95
Sweet & sour pork over rice		2.95
Baked ziti w/meat sauce & garlic toast		2.85
Stuffed tomato cold plate (lite-weight)		2.25
Hot deli: Baked ham	(bread)	2.65
	(roll)	2.75
	(hero)	2.85

Tuesday, December 8

Cream of tomato soup	(cup)	.75
	(bowl)	.95
Savory baked chicken w/1 veg.		2.95
Beef stew w/ buttermilk biscuit		2.85
Chef's salad cold plate		2.25
Hot deli: Corned beef	(bread)	2.65
	(roll)	2.75
	(hero)	2.85

Wednesday, December 9

French onion soup	(cup)	.75
	(bowl)	.95
Virginian pork chop w/1 veg.		2.95
Super sausage pizza	(slice)	1.15
Pasta primavera w/1 veg.		2.85
Hot deli: Roast breast of turkey	(bread)	2.65
	(roll)	2.75
	(hero)	2.85

Thursday, December 10

Minestrone	(cup)	.75
	(bowl)	.95
Baked meat loaf w/vegetable gravy & 1 veg.		2.95
Fillet of fish Parisienne w/1 veg.		2.85
Fettuccine carbonara w/1 veg.		2.85
Hot deli: Chicken breast on a roll		2.85

Friday, December 11

New England clam chowder	(cup)	.75
	(bowl)	.95
Veal steak Italian-style w/1 veg.		2.95
Fried fisherman's platter		3.35
Hot deli: Pastrami	(bread)	2.65
	(roll)	2.75
	(hero)	2.85

Classified Advertisements

Placement Notices

The Laboratory's placement policy is to select the best-qualified candidate for an available position, with consideration given to candidates in the following order of priority: (1) present employees within the department and/or appropriate bargaining unit, with preference to those within the immediate work group; (2) present employees within the Laboratory as a whole; and (3) outside applicants. In keeping with the Affirmative Action plan, selection decisions are made without regard to age, race, color, religion, national origin, sex, handicap or veteran status.

Each week, the Personnel Office lists new personnel placement requisitions. The purpose of these listings is, first, to provide open placement information on all non-scientific staff positions; second, to give employees an opportunity to request consideration for themselves through Personnel; and, finally, for general recruiting purposes. Because of the priority preference policy stated above, each listing does not necessarily represent an opportunity for all candidates. As a guide to readers, the listings are grouped according to the anticipated area of recruitment.

Except when operational needs require otherwise, positions will remain open for one week following publication date.

For further information regarding a placement listing, contact the Employment Manager, Ext. 2882.

LABORATORY RECRUITMENT - Opportunities for Laboratory employees only.

2738. SECRETARIAL POSITION - Requires AAS or equivalent, excellent secretarial and communication skills. A thorough knowledge of BNL practices and policies desired. Will provide secretarial support to the Office of the Associate Director for Administration. Experience with calculator use for basic mathematics is required. Responsibilities include the preparation of reports and correspondence on MICOM word processor, travel and meeting arrangements, mail distribution, maintenance of files, etc. Director's Office.

2739 OFFICE SERVICES POSITION - Requires excellent clerical and communication skills and a broad knowledge of laboratory operations, policies and practices. Familiarity with technical terminology or previous experience in a technical work environment desired. Duties include report preparation and maintenance of files and records. In addition, will be trained to assist Building Safety Coordinator in building inspections. Physics Department.

2740 LABORER POSITIONS - Plant Engineering Division.

OPEN RECRUITMENT - Opportunities for Laboratory employees and outside applicants.

2741 P&GA SPECIALIST - Familiarity with scientific notation for preparation of technical documents containing mathematical equations essential. Previous experience on Texet Electronic Publishing System desired. Knowledge of typesetting and good English skills helpful. Photography and Graphic Arts Division. (Reposting of Job #2677).

Motor Vehicles & Supplies

84 CHEVY PICKUP - 305 V8, a/t, trailer pkg., a/c, cap. $6,300; 86 Camaro Sport Coupe, V6, 26k mi., tilt, $8,200. Bob, Ext. 4672/4904 or 929-4753.

76 CHRYSLER - runs well, $500. George or Ed, 981-5964.

80 VW RABBIT - very good cond., $500. Ext. 2423 or 669-9234.

85 PLYMOUTH HORIZON - low mil., damaged right front, best offer. Jim, 732-6871 after 6 p.m.

79 BUICK LeSABRE - 350 V8, a/c, 4 dr., p/s, p/b, p/l, am/fm, 4 new tires, good cond., $1,600. Ext. 3137 or 3115 after 6 p.m.

79 THUNDERBIRD - black, full power, am/fm, a/t, p/s, p/b, excel. cond. Jerry, Ext. 7427 or 475-5591 eves.

79 VW RABBIT - needs work, new tires, $200. 728-2104 eves.

81 DATSUN 280 2X - blue/silver, needs body work, 80k mi., runs very well, $3,600. 368-0083.

76 NOVA - new parts & tires, runs, needs tranny, body good, 6 cyl., $300. Ext. 2816 or 878-0480.

80 OLDS CUTLASS - diesel, 76k mi., excel. cond., $1,650. Peter, Ext. 4004 or 286-0934 eves.

86 SUZUKI SCOOTER FA50 - excel. cond., $300. 821-0250.

83 CHEVY CELEBRITY - a/t, p/s, a/c, 6 cyl., 75k mi., good cond. Tom, 472-4228

BMW PARTS - 1600/2002, used. 751-7963 eves.

80 BUICK REGAL LTD - a/c, full power, am/fm cass., 58k mi., needs paint, good cond., $2,600. 212-353-1535.

86 TOYOTA MR2 - a/t, fully loaded, 25k highway mi., excel. cond., best offer over $12,000. Donna Ree, 473-6294.

WHEEL RIMS - 13", $5. Susan, Ext. 4267.

DODGE VAN WINDOWS - $10; 1958 Ford generator, $10. Frank Rumph, 588-3565.

ROOF RACK - Yakima, 48" mount, rain gutters, $25. Ext. 3864.

71 VW SUPER BEETLE - 4 speed, red w/black int., runs very well, many extras parts, snow tires w/rims. Ray, Ext. 3536 or 289-7615.

77 PONTIAC VENTURA - 4 dr., a/t, good cond., new exhaust system, $400. Ext. 3426.

86 SUBARU DL WAGON - 18k mi., excel. cond., extras, $7,500. 288-3104 eves.

77 TOYOTA CORONA - sedan, deluxe edition, body good, runs well, $950. 363-7286 before 9 p.m. & wknds.

79 HONDA CIVIC - 85k mi., some new parts, good tires, runs well, $700. Pete, Ext. 4100.

80 MAZDA PICKUP - cap, sunroof, see at Lab, $800. Rich, Ext. 3464.

81 PONTIAC T-1000 - a/t, a/c, p/s, p/b, excel. body, needs battery, starter solenoid, $650. Ext. 3848 or 281-6498.

75 TOYOTA CELICA GT - 5 speed, a/c, 105k mi., runs well, dependable, new exhaust, $500. Tom, Ext. 5010.

78 CHEVY MONZA - 3 speed, hatchback, am/fm, $400. 874-3796.

74 FORD LTD - 2 dr., p/s, a/c, am/fm, new tires, exhaust, excel. body, best offer. 924-4749.

84 MONTE CARLO CL - deluxe int., p/s, p/b, p/w, a/c, am/fm stereo cass., 35k mi., $6,600. 924-8260 eves.

68 NOVA - rust, but no dents, runs well, good tires, $250. 929-3209.

82 CAMARO BERLINETTA - T-tops, p/s, p/b, p/w, a/c, am/fm stereo cass., 38k mi., $5,700. 924-8260 eves.

76 JEEP CHEROKEE - 4wd, 2 new tires. 744-8790 after 6 p.m.

84 SUBARU GL - a/c, am/fm cass., excel., $3,500. Ext. 4120 or 588-8492.

78 DATSUN B210 - orig. owner, 39k mi., a/t, a/c, new brakes, excel. cond. $2,000. Ext. 4333 or 929-6984.

80 PLYMOUTH HORIZON - 4 dr., 107k mi., good engine, recent clutch, body dents, $600. 286-0047.

76 SAAB 99GL - runs, good for parts, $450. Bill, Ext. 7229.

TOYOTA 20R ENGINE - exhaust, manifold, hardly used, $50. Mike, Ext. 4100.

67 MONTEREY - many new parts, interior mint, body good, runs well, $400. 281-6986 after 5:30 p.m.

75 CAMARO - 6 cyl., wire wheels, raised lettered tires, radio, louvre, $1,500. Ext. 2529 or 588-7989 eves.

Boats & Marine Supplies

20' O'DAY SAILBOAT - 1974, 3 sails, furler/reefer, VHF, 7½ Merc, compl. mooring, new trailer, extras, $5,500. Gene, 265-4376.

14" FIBERGLASS SAILBOAT - AMF Zuma, 18' alum. mast, $870. Ext. 7636 or 744-8790.

21' BAYLINER - 1986, sleeps 5, I/O, canvas, radios, winterized, extras, excel. cond., $17,000. 878-0480 eves.

12' SEAGULL - sturdy, dry, glass, 2 jibs, motor mount, needs work, $500 neg. 744-6059.

OUTBOARD MOTOR - Sears Gamefisher, 7.5 h.p., $250. Marty, Ext. 3843.

Miscellaneous

MICROSOFT BASIC INTERPRETER - for Apple MacIntosh Version 1.01, new, $50. Susan, Ext. 4267.

POOL TABLE - 4x8, excel. cond., w/accessories, $60. Bob, 584-7350.

HAMMOND SPINET ORGAN - double keyboard, foot pedals, good cond., $300. 475-7891.

TICKETS - 2, Carnegie Hall, Montreal Symphony Orchestra, Jan. 23, 1988, 8 p.m., orchestra seats, $22.50/each. Mike, Ext. 4061.

RADIO CONTROL VAN - "Lunch Box", w/battery & remote control, $145. Ext. 7636.

STEREO RECEIVER TURNTABLE - loud speakers, $250 for all, will sell separately. Susanna, Ext. 3959.

FIREWOOD - seasoned oak, delivered, $130/full cord. 732-2849.

BUILDING MATERIALS - make offer, you haul; basketball backboard & hoop; 2 overhead garage doors; Colonial shutters, more. Fred, 261-5735.

HUMIDIFIER - Edison, wood grain console, 4 gallon, $40; kitchen set, table w/leaf, 4 chairs, $50. Tony, 698-9274.

WOMAN'S BIKE - Lotus 10-speed, like new, orig. $375, sell for $150; 5' convertible couch, light brown, like new, orig. $275, sell for $75. 654-5485.

WOOD/COAL STOVE - w/pipe, $250; playpen, $20; battery operated swing, $15; walker, $10; carriage, $10, all for $50. Patti, 399-6373.

DEC PRO 350 COMPUTER - w/extra memory, hard disk, CP/M card, printer, software. Ext. 5130 or 874-3652.

SKIDOO TNT SNOW MOBILE - two seater, good cond., $575. Ray, 289-0883.

UNICEF XMAS CARDS - & gifts. 744-8386.

BABY CARRIAGE - Prego (Italian), very good cond., asking $60. Torsten, Ext. 3817 or 878-1210.

KITTENS - 2, affectionate, female, Sealpoint, 3 months old, w/shots, $100/each. 588-2916.

DINETTE SET - glass top, chrome trim, brown velour seats, $75. 331-9887.

COPY MACHINE - Cannon PC-2D, like new, $425. Tim, Ext. 3436 or 727-7741.

MAKITA DRILL - ⅜", variable speed, reversing, used for one weekend, excel. cond., $50. Rick, Ext. 3932/3051.

SANYO COMPACT REFRIGERATOR - 2, excel. cond., $50/each. Ext. 3894 or 744-9812.

MAPLE DRESSER - $65. Ext. 2543.

IBM CGA CARD - asking $60; Gemini 10X Printer, for parts, $35. Ext. 2521 or 924-2134 eves.

YOGURT/ICE CREAM MACHINE - Electro Freeze, 2 flavor, pressurized system, 1 year old, like new. 924-6019 before 11 a.m.

RECLINER/LIFT CHAIR - motorized, upholstered, excel. cond., $250. Ron, Ext. 3887 or 286-0353.

PICNIC TABLE - 60" round, 4 curved chairs, $125; Wolmet chair, $20. 928-5230 or 744-2203 after 6 p.m.

POINSETTIAS - red, several sizes, florist quality, delivery in Dec., low prices. 727-6818 after 3:15 p.m.

GE COOKTOP - 4 burners, works well, $30. Sandy, Ext. 3369 or 286-1022.

SOFA BED - good cond., best offer. 751-7963.

BEDROOM SETS - 1 Colonial, 1 Contemporary, both double w/hdbrd., $150/each, $250 for both. 471-2370, 1 p.m. - 9 p.m.

SEARS UPRIGHT VACUUM - 5.2 amps, 2 speed, $25; 16" girl's Huffy bike, pink, $40; boy's Ross BMX, new, orig. $220, sell for $75. 924-5419.

COAL - pea size, $110 for 1 ton+. Ext. 7686 or 878-0897.

SEWING MACHINE - electric, works, $25; Majolica pitcher, 80 years old, $20. 475-1826 after 6 p.m.

GAS HOTPLATE - 6 burner, $10; Thomas full size minstrel organ, make offer. Frank Rumph, 588-3565.

RCA COLOR TV - remote control, very good cond., asking $150. Bernard, Ext. 4391/2694 or 345-3579.

SCOTTS SPREADER - $10. Gene, 265-4376.

GIRL'S ICE SKATES - size 7, $5; desk, 24"x54", $20; Olympia typewriter, $15; bookcase, $8. Pete, Ext. 4326.

KIRBY VACUUM CLEANER - $50; woman's winter coat, never worn, size 6-8 small, $35; piano bench, $75. Ext. 3699.

TORO MOWER - self-propelled, needs work, $30; Sears leaf mulcher, electric, $30. Victor, Ext. 2395.

XMAS TREES - live, 15, come & tag, $5/each; air compressor, 30 gallon tank, $30; 22" pot belly stove, cast-iron, old, good, $40. 878-6637.

KAWASAKI ATV - 3-wheeler, 110cc, 5 hours, almost new, best offer; player piano, best offer. Ext. 4100 or 653-8966.

SKI POLES - Scott Fluorescent, 46", $15; Hoover rug shampooer/floor polisher, brand-new, $50; range hood, 30", white, still in box, $30. Ext. 4727.

BABY ITEMS - & Fisher Price tricycle. 744-9677.

COPIER - $15. Ext. 4192.

CONVERTIBLE COUCH - good cond., beige, all foam, light-weight, opens to 80" bed, orig. $800, asking $350. 473-8387.

WATERBED - king, four poster, complete, $90; shed, 8'x10', w/base, $70; seasoned oak, $75/cord. Ext. 5611 or 281-2002.

POOL TABLE - 4'x8', w/ping pong table top & accessories, $150. Bob, Ext. 2542 or 878-0375 after 6 p.m.

COUCH/LOVESEAT - velvet, w/wood trim, $100; table, $20; coffee table, $35; wooden étagère. $10. 689-7259 after 6 p.m.

STEREO RACK SYSTEM - cabinet w/glass door, brand-new, $20; TV stand, VCR shelf, tape cabinet, 1 mo. old, orig. $75, asking $40. Jim, Ext. 4758.

SKI BOOTS - Kastinger SL-master, man's size 9½, used 1 season, $30. Gary, Ext. 4095 or 758-5592 eves.

WALNUT FRAMES - $15; night table, $55; brass lamp, $75; wicker bird cage, new, $20; antique hall mirror, $95. 928-5220 or 744-2203 after 6 p.m.

HI-RISER - w/2 bolsters & 3-piece cover set, $100. 281-6026.

COLONIAL DINING ROOM SET - hutch, 6 chairs, neg. 758-4684 eves.

PING PONG TABLE - w/net & paddles, $25; lawn mower, 4 cycle, $20; Scott spreader, $10; Cyclone spreader, $10. Gene, 265-4376.

LENOX CHINA - 2-5 piece settings, "Olympia" Platinum banding, new, $90/for both. 286-3679.

WHEATSTONE BRIDGE - 40 milliohms to 6.4 megohms, brand-new, made in Germany, make offer. Dick, Ext. 3273.

SKI BOOTS - Kastinger, woman's size 8½, good cond., $35; man's leather jacket, size 40, good cond., $35. Walt, Ext. 4798.

UPRIGHT PIANO - make offer. Ext. 2876.

SKI BOOTS - boy's size 6, Fuji, used once, 3-pin type, $15. 286-3679.

IBM PC - 20MB HO, 2-360KB FO, 8087, 2.25M BRAM, monitor, monographics card, software, extras, asking $1,800. Ext. 2521 or 924-2134 eves.

SKI RACK - 6-pair, external mount, rain gutters, locks, $50. Ext. 3864.

Free

BOILER/OIL BURNER CONTROLS - pre-energy crisis vintage, remove from basement. Bill, Ext. 7229.

RABBITS - 2, large New Zealand & hutch. Culwick, Ext. 4930.

AQUARIUM ACCESSORIES - pumps, filters, hoods, books, etc. Alan, Ext. 2928 or 821-1389.

CLEAN FILL - you pick up. Augie, Ext. 3884 or 821-0379.

KITTENS - clean, litter trained, very playful. 924-5192.

Car Pools

BELLMORE/WANTAGH/SEAFORD/MASSAPEQUA - 2 drivers to join 2 man pool. Victor, Ext. 2395.

HAMPTON BAYS - to join or start car pool. Ext. 3123.

Real Estate

Real Estate advertised for sale or rent is available without regard for the race, color, creed, sex or national origin of the applicant.

For Sale

HILTON HEAD, SC - 3 bdrm. condo, sleeps 8, 2 baths, washer/dryer, wet bar, 6 tennis courts, 3 pools, whirlpool, golf, ocean view, asking $89,000, will rent. 929-8912.

MILLER PLACE - North of 25A, 3 bdrm. custom ranch, entertainment area, l/r, family rm., custom f/p, 24' x 26', 2-car garage, finished basement, and much more. Ext. 3353 or 473-5786.

SELDEN - 3 bdrm. L-shaped ranch, eik, den, formal d/r, new heating system, a/c, fenced, pool, garage, much more, $139,000. 698-0057.

MOUNT POCONO, PA - timeshare, balance of 8 years. Bob, Ext. 5317 or 472-0251.

MT. SINAI - North of 25A, 3-4 bdrms., 27' family rm. w/fireplace, eik, formal dining rm., 2 full baths, garage, covered patio, prof. landscaped, in-ground sprinklers, fenced, 2 a/c units. Ext. 2494.

ROCKLEDGE, FL - 2 bdrms., 2 baths, kitchen, den, living rm., combination porch, 2 car garage, good location, 75x115 lot, $64,500. 305-631-2840.

For Rent

HILTON HEAD, SC - 2 bdrm. condo, sleeps 6, beach, pool, tennis, golf, winter rates, $300/wk. 585-9149.

BELLPORT VILLAGE - 2/3 bdrm. furn. house, avail. Jan.-Dec. '88, non-smoker, single/couple, no pets. 286-8060 after 5 p.m. & wknds.

MASTIC - share house, l/r, d/r, eik, den, laundry room, yard, 10 mins to Lab, 5 mins to beach, clean, well-kept, secured, $395/mo. + ⅓ util. Ext. 5110 or 399-3087.

BROOKHAVEN HAMLET - share house w/2 other professionals, 4 bdrms., 2 baths, ¾ wooded acre, $350/mo. incl. all. Randy Furlong, Ext. 3835 or 286-4028.

CATSKILLS - 3 bdrm. chalet, sleeping loft, fully furn., great for skiing, near Hunter & Windham Mts., avail. day, week or wknds. Kay, Ext. 4501 or Bea, Ext. 3642.

MILLER PLACE - 2 brms., fireplace, furnished, washer/dryer, quiet, walk to beach & store, $975/mo. 473-3349.

EAST PATCHOGUE - 2 bdrm. house, l/r, d/r, den, kitchen, bath, f/p, garage, 1 acre, $800. Andy, Ext. 2907 or 289-1755.

HAMPTON BAYS - 2 bdrm. house, winter rental till May 20, 1988, $440/mo. + util. 728-2104 eves.

ROCKY POINT - large studio apt., clean, walk to beach, avail. immediately, $400/mo. incl. util & cable. 744-2045.

CENTER MORICHES - 2 bdrm. waterfront apt., eik, living rm., priv. ent., dock space avail., cable, a/c, $675/mo. incl. all. 878-8177 after 6 p.m.

Wanted

TENNIS BALLS - used, for my dogs. Victor, Ext. 2395.

HOUSE TO RENT - single family, must accept pets. Ext. 7237.

BASEBALL CARDS - 1986 Mets, will buy or trade. Ray, Ext. 2238 or 348-7719.

On-Site Services

FRIENDLY BROOKHAVEN GULF SERVICE - weekly special: 6 cyl. tune-up & oil, lube & filter, $54.95, free heating system check. Ext. 4034.

Services

Services are listed as a courtesy to BNL employees. They are neither screened nor recommended by the ***Bulletin****.*

RUG SHAMPOOING - very reasonable, Lab discount. 924-6019, leave message.

JEWELRY REPAIR - gold & silver, rings, chains, etc. Dan, Ext. 2319.

CALLIGRAPHY - for all occasions, envelopes, invitations, place cards, etc. Andrea, 821-0260.

BRICKWORK - patios, walks, swimming pools, Belgian block, landscape ties, 20 yrs. experience, Lab discount. Tony, 698-9274.

GENERAL CONTRACTOR - home improve., dormers, extensions, siding, shells, kitchen & bath alt., design service, licensed & insured. 475-6981.

BABYSITTER - avail. during the week, 10 years experience. Annie, 345-3579 or Bernard, Ext. 2694.

FRENCH LESSONS - during the week. Annie, 345-3579 or Bernard, Ext. 2694.

CHILD CARE - my home, Farmingville, county certified. 732-9324 after 6 p.m.

CARPET SHAMPOOING - low rates. 924-0756 after 5 p.m.

WORD PROCESSING - typing, reasonable rates. Ext. 4207 or 653-9514 eves/wknds.

CARS PAINTED - small cars, reasonable. 395-1078 or 281-7568 after 6 p.m.

HOUSE CLEANING - good, reliable, reasonable rates. 589-9258.

MAGIC SHOWS - book early for your child's birthday, Xmas or any special event, Lab discount, brochure avail. 395-3963 after 6 p.m.

SCULPTURED NAILS - beautiful nails for the holidays, $30/set, $15/refills. Patti, 399-6373.

XMAS CARDS - family photo, order now. Ripp Bowman, Ext. 4672.