

# KEK News



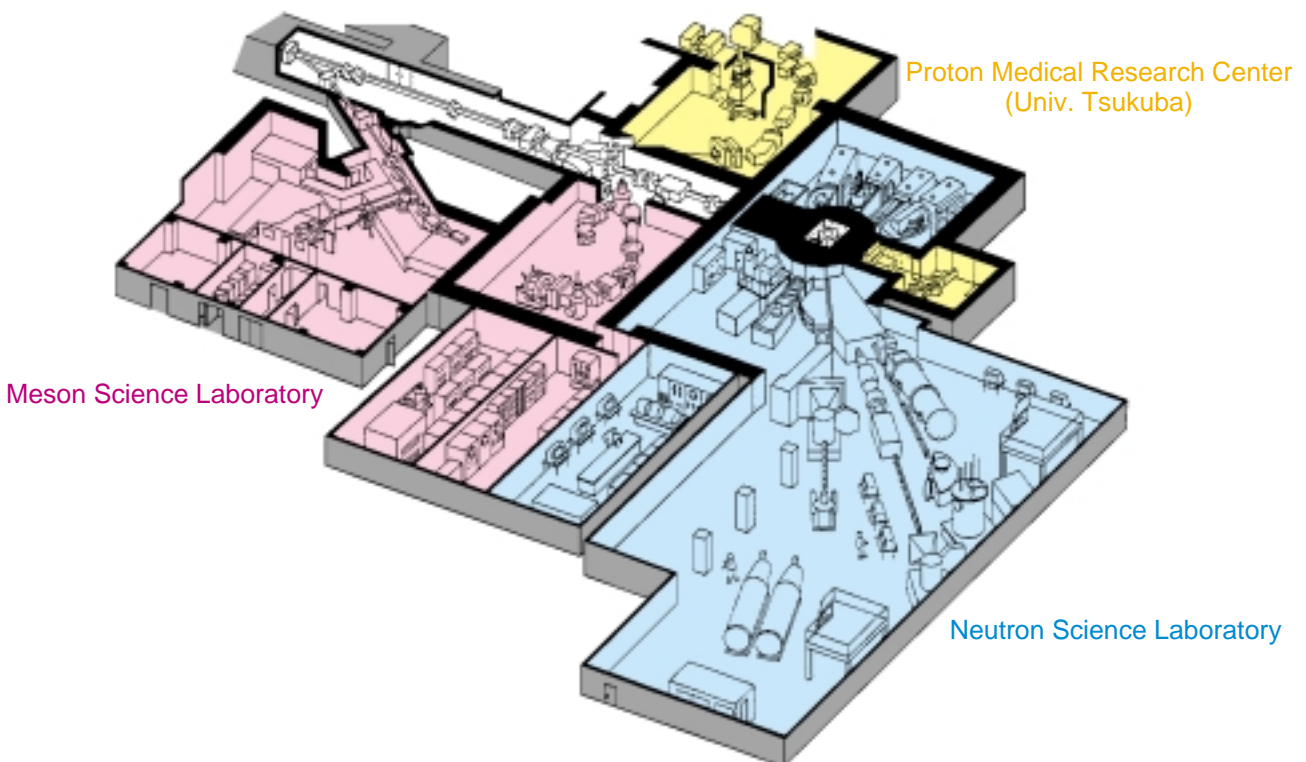
**Special topics  
"Neutron Lab, Meson Lab"**



# Neutron Science Laboratory and Meson Science Laboratory

Neutron Science Laboratory and Meson Science Laboratory were established in 1978 as Booster Synchrotron Utilization Facility in the National Laboratory for High Energy Physics. At the facility, the first pulsed spallation neutron scattering program, the pulsed muon experiments and a proton therapy by Proton Medical Research Center (University of Tsukuba) started in 1980 using a 500 MeV proton synchrotron. Since then, many pioneering scientific researches and technical developments have been made. Now the Neutron and Meson Labs are two of the important facilities of Institute of Materials Structure Science in KEK along with the Photon Factory.

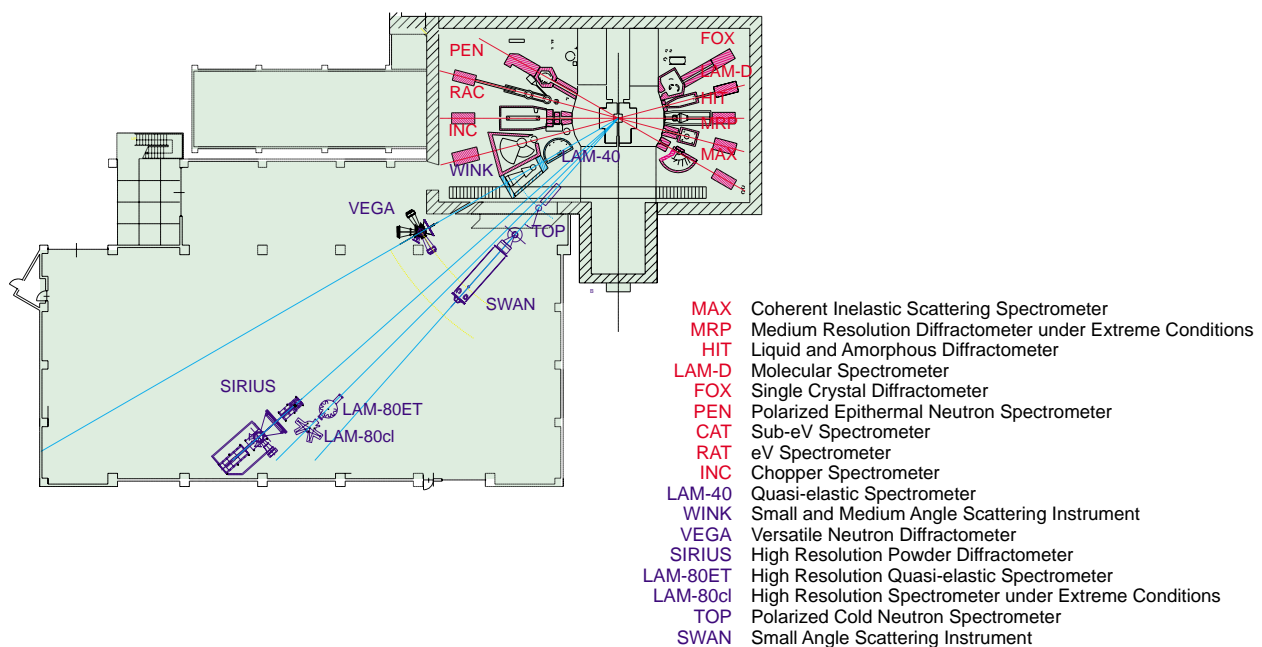
In the near future, neutron and meson facilities will be transformed to be the N-arena and M-arena of Japan Hadron Facility (JHF) Project, respectively. In 1997, University of Tsukuba started construction of a new hospital-based proton synchrotron for cancer therapy in the university campus after the success in KEK. See more detail in following pages.





# Neutron Science Laboratory

Neutron Science Laboratory realized the first practical spallation neutron source (KENS) for neutron scattering researches in the world (1980). High-energy pulsed neutrons are produced by the spallation reaction with the proton beam of 500 MeV and are moderated with water at room temperature and a solid methane at 20 K to become thermal and cold neutrons, respectively. These moderated neutrons are delivered to 17 neutron spectrometers through 11 neutron beam holes in the biological shield.



Several new spectrometers with novel ideas, for example, large-mirror-type spectrometers (LAM-40,-80ET and -D), an eV spectrometer (RAT), a pulsed small-angle-scattering spectrometer (SWAN), powder diffractometers with 2-D PSD-detector-banks (VEGA and SIRIUS) as well as polarized cold and epithermal neutron spectrometers (TOP and PEN) were realized for the first time. These have been used in many scientific fields such as biology, chemistry, condensed matter physics and nuclear physics. The structure study of high-Tc superconductor, 1  $\mu$ eV-resolution spectroscopy of molecular tunneling, the study of parity violation in neutron-nucleus interaction and the direct observation of the Bose condensation in the superfluid He-4 are excellent examples of prominent outputs at KENS.

The fruitful results at KENS have been based on many R&D activities over various range. KENS has developed a solid-methane cold moderator, a high-efficiency target-moderator-reflector assembly for the future high-power neutron source, position-sensitive neutron-detector system, dynamical proton filter, He-3 polarizer, pulsed magnet, ultra-cold neutron and super-thermal technology, etc.

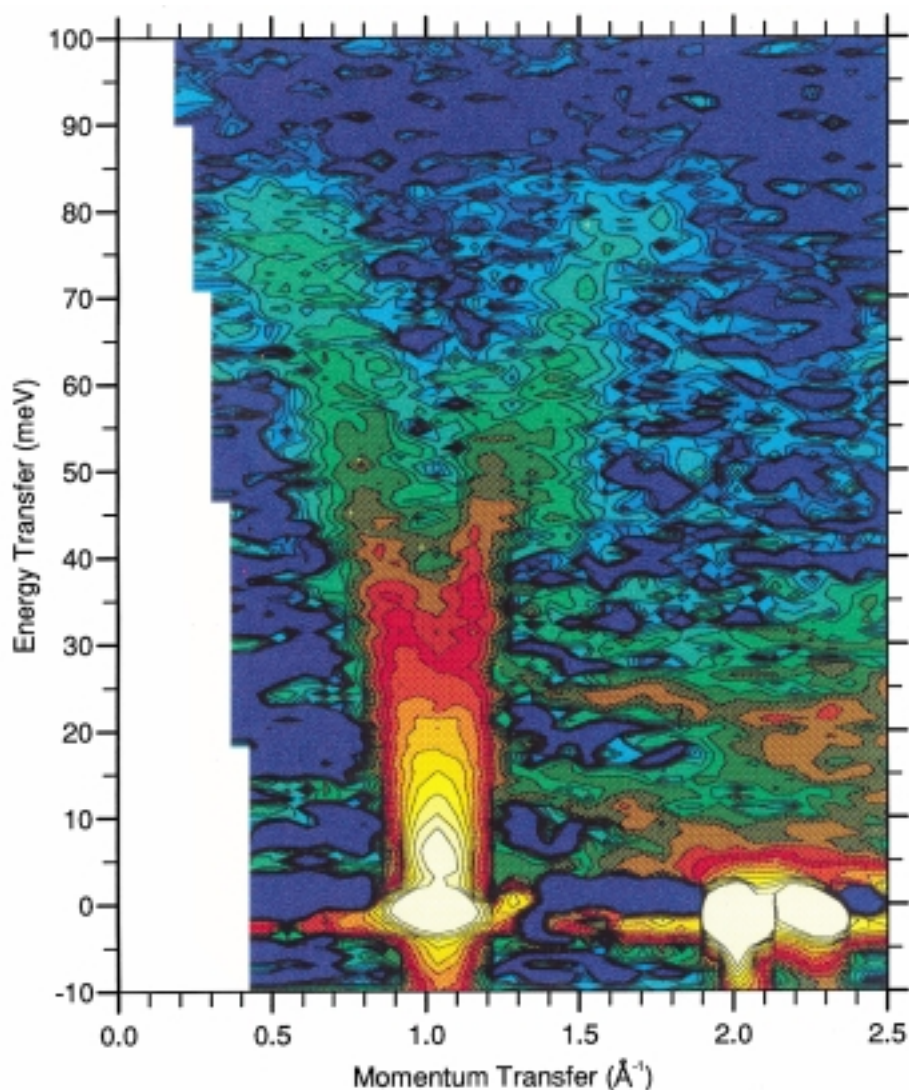
These pioneering works gave great influence in the neutron science, especially to many overseas facilities such as IPNS at Argonne National Laboratory, ISIS at Rutherford Appleton Laboratory and LANSCE at Los Alamos National Laboratory which were constructed after KENS started. Those have also played important roles for the successful construction of a new novel chopper spectrometer MARI and a high performance spectrometer MAPS under the Japan-UK collaboration program.

KENS has been playing an important role as a national center of neutron science in Japan. Scientific proposals of more than 100 a year have been submitted as the Inter-University Research

Program at KENS. About 400 researchers visit KENS for research work with KENS spectrometers and several tens of publications have been made by using KENS experiments every year. Several workshops on research activities with KENS have been held annually.

This facility is widely open to scientists both from inside and outside of Japan.

Recently, Francis FILLAUX, Michael STEINER, Colin CARLILE, Jack CARPENTER, Gordon KEARLEY and others have done experiments at KENS with great success.



Scattering contour map of the magnetic excitations from CsVCl<sub>3</sub>

In recent years, there is a characteristic trend of the oversubscription; the total number of the submitted proposals is steadily increasing while the number of experiments accepted has become saturated. For such increasing demands of neutron scattering researches, the construction of a new intense spallation neutron source is now planned in N-arena of the JHF project.



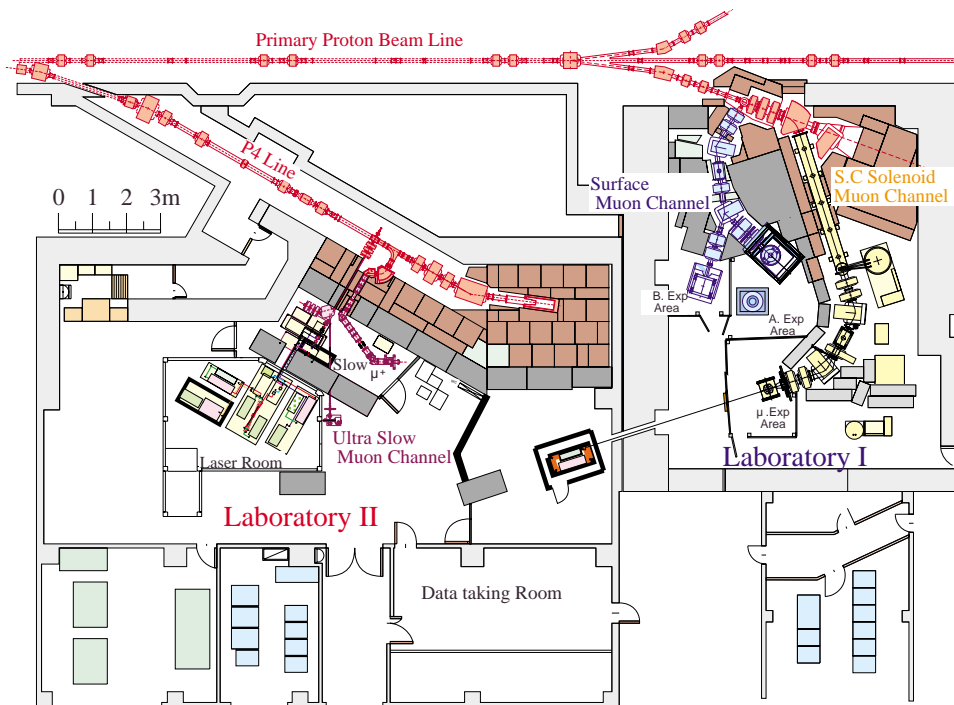
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Neutron Science Laboratory is led by Hironobu IKEDA (photo left) who has been the laboratory director since 1995.

## **Meson Science Laboratory**

The Meson Science Laboratory started in 1980 in KEK site as the first experimental facility of intense pulsed muons in the world using sharply pulsed (50 ns pulse width and 20 Hz repetition) muon beam. Since then, the laboratory was operated as a part of the Faculty of Science, University of Tokyo. In April, 1997, this laboratory joined KEK to form a new organization.

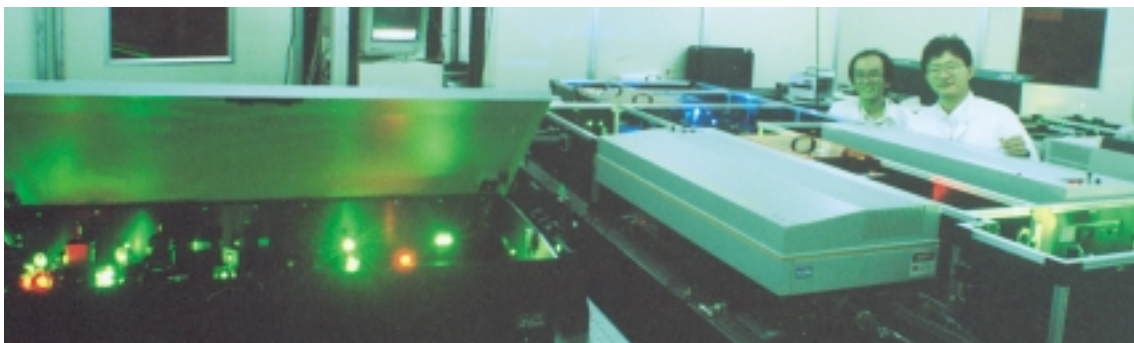
Presently, three types of beam channels are producing pulsed muons for scientific researches ;

- (a) a superconducting muon channel for up to 100 MeV positive and negative muons produced from the decay of pions in flight through a 5 T superconducting solenoid, 6 m long and 12 cm diameter,
- (b) a surface muon channel for 4 MeV positive muons produced from pion decay at the surface of the pion production target of Be, and
- (c) an ultra-slow muon channel for 10 keV positive muon production by utilizing phenomenon discovered and developed in the Meson Science Laboratory, namely, thermal muonium (a neutral hydrogen-like bound state of a positive muon and an electron) extraction into a vacuum from the surface of hot tungsten and laser resonant ionization of the muonium.



Various spectrometers with advanced equipments have been installed including a 10 mK dilution refrigerator and a 4 T longitudinal magnetic field source for condensed matter studies.

Excellent features of pulsed muons have been recognized and used for the realizations of various important discoveries. This influenced muon science facilities such as ISIS at the Rutherford Appleton Laboratory.



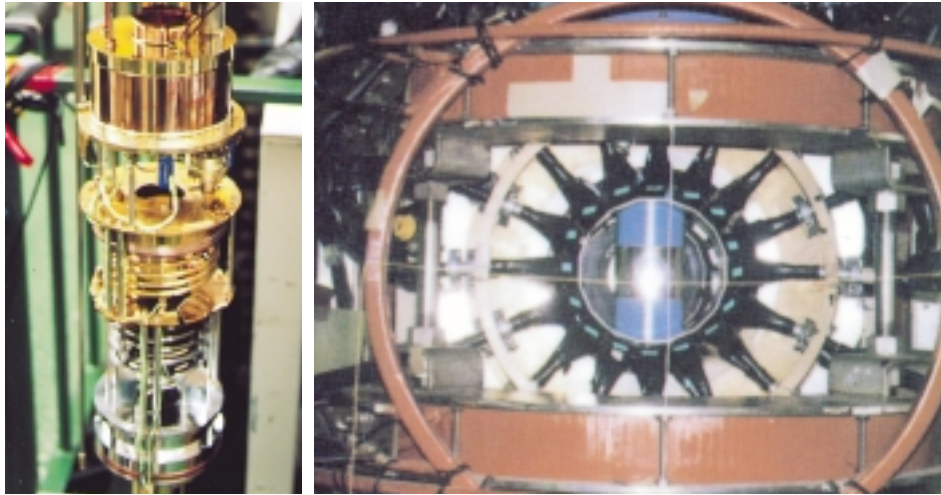
**Lasers for Ultra-Slow Positive Muon Production**

These features can be summarized as follows.

- (a) Muon-decay associated phenomena such as muon spin rotation/relaxation/resonance studies can easily be measured in a long time range up to more than 10 life-times, revealing the microscopic magnetic behavior as well as light particle diffusion phenomena in condensed matter.
- (b) Pulsed extreme experimental conditions can easily be applied in muon experiment realizing muon spin RF resonance as well as laser resonance of the muon states.
- (c) Measurement capability of a muon-associated weak signal against white-noise background (phase-sensitive detection).



Distinguished discoveries include, quantum diffusion of positive muon in copper, magnetism in high temperature superconducting materials, final state spectroscopy of chemical channel reaction of muon/muonium in solid, elementary excitation induced by muons in conducting polymer, muon/muonium centers in illuminated semiconductor, thermal muonium production in vacuum, muonium 1s-2s laser-resonance spectroscopy, muon-to-alpha sticking X-ray in D-T muon catalyzed fusion, etc.



**Very Low Temperature Set-up at Surface Muon Port**

This facility has been widely open to researchers from all over the world and distinguished scientists have enjoyed a long stay to produce remarkable scientific outputs. To name a few, Steven CHU, Allen MILLS Jr., Steven JONES, Donald FLEMING, Jess BREWER, Anthony ARROT and Alexander SCHENCK are the recent visitors.

Due to limited beam-time and weak intensity, it is becoming very hard to fully satisfy the requests of many excellent experimental proposals from all over the world. The realizations of the M-arena of the JHF project is inevitably important.



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The Meson Science laboratory is led by Kanetada NAGAMINE (photo left) who has been the laboratory director since 1997.

## EVENTS

### KEK Open House (September 15th)

KEK held an annual open house on the 15th of September, 1997. Despite of rather heavy rain fall, total 2,500 people visited various facilities. KEK open house started on 1977 and has been inviting outside people to see KEK in action

since then. The open house included special lectures and kid's program of building a radio etc. in addition to tours through various KEK facilities.



### Ceremony to celebrate the launching of the new KEK (September 16th)

On the 16th of September 1997, KEK celebrated the launching of the new organization. Total 290 people from various universities, institutes, embassies and industries from all over Japan attended the ceremony. From overseas to attend the ceremony were Paul R. WILLIAMS (CCLRC, UK), Goldon

WALKER (RAL, UK), Shouxian FANG (Chinese Academy of Science), Virulh SAYAKANIT (Chulalongkorn U., Thai), Won NUMKUNG and Lee KWANG-SOO (Pohang Accelerator Lab., Korea), James ALEXANDER (Cornell U., USA) , Wolf GUENTER (DESY, Germany) and Satoshi OZAKI (BNL, USA). Following the address of



the KEK Director-General, Hirotaka SUGAWARA, Nobutaka MACHIMURA (Minister of Education, Science, Sports and Culture), Keiichi KODAIRA (Director, National Astronomical Observatory), Shigehiko HASUMI (President, University of Tokyo), Masaru HASHIMOTO (Governor, Ibaraki Prefecture) and Paul WILLIAMS gave congratulatory address.

The ceremony was followed by a banquet at Tsukuba Dai-ichi Hotel. The banquet started with “Kagami-wari” ceremony, a Japanese-style ceremony of opening a “sake” barrel together. Many people who worked at KEK some time or another in the past 25 years came back for this occasion from all over Japan as well. They had an additional get together following the banquet.



The “KAGAMIWARI” event initiated the party

### KEK-CERN Steering Committee meeting (October 8th)

The 3rd KEK-CERN Steering Committee Meeting for the collaborative work of the LHC accelerator construction was held at KEK on October 8th, 1997. Yoshitaka KIMURA was

nominated as the chairperson of the meeting. The progress of the insertion quadrupole magnet R&D in 1997 and the plan in 1998 were discussed and fixed in the meeting.

## TARA project reached new phase (October 14th)

Collaborations between laboratories, universities and industries is getting more encouragement by the government so that scientific research results can be efficiently brought into industrial applications. One of such project called TARA (Tsukuba Advanced Research Alliance) officially started in 1995 and was led by Noriyoshi SAKABE who built a general purpose experimental facility for analyzing macromolecular structure at KEK Photon Factory. The project members consists of 145 people from 8 research laboratories, 17 universities and 14 industrial companies. Since the starting of the facility, 37 papers were published. After the recent completion of an office building next to the Photon Factory, they had a tour through the facility and a celebration on the 14th of October.



TARA facility at KEK Photon Factory

## KEK Special Lectures (October 24th)

On the 24th of October, public lectures and a panel discussion were given in Tokyo. Following the lectures by Makoto KOBAYASHI and Tadashi MATSUSHITA, a panel discussion chaired by Toshimitsu YAMAZAKI was presented. Haruo KURODA, Fumitaka SATO, Hiroataka SUGAWARA, Hiroyuki TORII and Kazuhiko NISHIJIMA were the panelists on the subject of “Frontiers of Science using High Energy Accelerators.”



## KEK Art Festival (November 4th ~ 9th)



The second week of November was the annual KEK Art Festival week. Oil paintings, photographs and hand crafts done by KEK members and visitors were exhibited. A music concert was also held on the 4th of November. A performance of a Chinese mandolin “Pi-Pa” charmed many audiences.

## Workshop to start a scientific collaboration between KEK and India (December 11th ~ 12th)

On December 11-12, 1997, Hirotaka SUGAWARA, Shoji NAGAMIYA, Fumihiko TAKASAKI, Susumu IKEDA, Akito KAKIZAKI, Yoshishige YAMAZAKI and Mizuho KOIDE of KEK visited Bhabha Atomic Research Center (BARC) in India to discuss a possible mutual collaboration in the area of science that use particle accelerators. Prominent Scientists of India, such as Rajagopala CHIDAMBARAM (AEC Chairman), Anil KAKODKAR (BARC Director), Shyam KAPOOR (BARC Physics Division Director), gathered together to participate in the meeting. Two full days were spent for presentations on the KEK activities and on the Indian activities as well as

discussions of mechanisms on how to create a fruitful collaboration.

They also had tours through facilities at both BARC and Tata Institute.

The KEK delegation then visited the Atomic Energy Commission of India for discussions of a possible mutual collaboration. In particular, an enthusiastic proposal was presented from Indian side in the fields of hadron physics, B-physics, neutron physics, sciences using synchrotron radiation, accelerator technologies and theoretical physics. Both sides agreed to start an immediate collaboration in a few “selected” areas of research rather than to start in all areas at once.

## International Party (December 16th)



Over 10% of researchers working in KEK is from outside of Japan. International Affairs Division and International Collaboration Office were created recently to make KEK a more easy-to-work place for researchers from outside of Japan.

They hosted the first “International Party” on December 16th. Over 70 people came to the party and had a good time together.



# ANNOUNCEMENT

## First Asian Particle Accelerator Conference in March 1998

The first Asian Particle Accelerator Conference (APAC98) will be held at KEK from March 23 - 27, 1998, under the auspices of the Asian Committee for Future Accelerator (ACFA). Accelerator-based science in Asia has made a remarkable progress in the last two decades and the trend will certainly continue into the next century. ACFA was established in 1996 to promote accelerator-based science together in

the Asian region. APAC conference will be held biennially and the APAC98 is the first one. About 300 scientists will be participating from Asian countries as well as from other countries of the world.

For information, see

<http://www-proc.kek.jp/apac98.html>

or contact apac98 conference office at

E-mail: [apac98@kekvox.kek.jp](mailto:apac98@kekvox.kek.jp).

## International Workshop on JHF Science (JHF98)

The International Workshop on JHF Science (JHF98) will be held on March 4-7, 1998 at KEK. The planning of Japan Hadron Facility (JHF) is actively in progress. The JHF is a high-intensity accelerator complex with a 50-GeV proton synchrotron, a 3-GeV booster synchrotron and an injector linac. With these accelerators, a wide variety of new science programs ranging from nuclear/particle physics to material/life sciences will be conducted. Main goals of the workshop are to sharpen the scientific focus on individual scientific program at the JHF and to

design realistic experimental projects at the JHF. The workshop will have plenary sessions by distinguished key-note speakers and parallel sessions for individual research subject. The organizing committee welcomes participation of any individuals who are interested in the science at JHF. Information can be obtained at the Web site of

" [http://www-jhf.kek.jp/JHF\\_WWW/JHF98.html](http://www-jhf.kek.jp/JHF_WWW/JHF98.html) ".

The e-mail address of the workshop secretariat is " [jhfp98@jhfp1.kek.jp](mailto:jhf98@jhfp1.kek.jp) ".

## ICHEP2000 in Osaka

ICHEP2000, the 30th International Conference on High Energy Physics in the year 2000, will be held in Osaka, Japan. It was decided at the meeting of IUPAP-Commission C11 on the Particles and Fields held on July 30th in Hamburg during LEP 97, and subsequently endorsed by the board of trustees of IUPAP. The host institute is Osaka University. The conference will be sponsored by JPS (The Physical Society of

Japan) and KEK. Sponsorship of JSC (Science Council of Japan) is also requested. Date is tentatively fixed as from July 27th to August 2nd, 2000.

For inquiries, contact Yori NAGASHIMA of Osaka University ([naga@hep.sci.osaka-u.ac.jp](mailto:naga@hep.sci.osaka-u.ac.jp)).

## PEOPLE

### Reiki KIJIMA is the new head of KEK administration

Former director of administration, Michiaki TAKAISHI was replaced by Reiki KIJIMA as of October 16th. (Takaishi is now the Deputy Director General of Nagano Olympic Winter Games Organizing Committee.) Reiki KIJIMA was a director of Administration at Nagaoka University of Technology

before he took present position. He is a connoisseur of Japanese " sake " and enjoy walking around on foot.



### Shigeki SUWA ; 1920-1997



Shigeki SUWA , the first Director General of the National Lab. for High Energy Physics (former KEK) died on the 16th of December, 1997. Dr. Suwa started his research in 1950 at the University of

Tokyo. He then engaged in a construction of a variable energy cyclotron at the newly founded Institute for Nuclear Study (INS). In 1963, he started to work for the polarized target experiments at Argonne National Lab.

Urged by Japanese physics community, he returned to INS in 1966 and devoted himself to construct a new big facility for high energy physics studies. His diligent and persevering efforts resulted in establishing KEK in 1971 with a plan of a 12 GeV proton-synchrotron for its major facility. He served as the first

Director General of KEK and worked for bringing up Japanese High Energy Physics activities to a world level. After his retirement in 1980, he became the director of a newly created Particle Radiation Medical Research Center for cancer therapy and diagnostics (till 1984).

In later years, he engaged in education at the Science University of Tokyo until 1991 while serving as a special adviser to KEK Director General since 1984. With his achievements in construction of a variable energy cyclotron, he and his colleagues received

the Fujiwara prize.

In addition, his long and outstanding contributions in developing high energy accelerator technologies and particle physics activities earned him a “ Medal with

Purple-Ribbon ” from the Japanese government in 1982. He also became a recipient of the honorable medal, “ The Order of Sacred Treasure, Gold and Silver Star ”, in 1991. We miss him very much. We

had a gathering to pay a tribute to the memory of late Dr. Suwa on the 27th of January, 1998. Over 200 people attended.

## Hajime ISHIMARU ; 1940-1997



Hajime ISHIMARU, an internationally known scientist/engineer on vacuum technology for accelerators and a professor in the Accelerator Laboratory at KEK, died of stroke on the 6th of October, 1997. He was 57 years old. We all miss him very much.

He had a Ph.D. in physics as well as in engineering. Started to work on accelerator in 1972 when KEK was just starting, he built a beam transport line between a 750 keV pre-injector and a 20 MeV linac for the 12 GeV proton synchrotron.

He recognized a problem of residual radioactivity from stainless steel vacuum chamber. His pursuit resulted the all-aluminum-alloy vacuum system for TRISTAN, which was an  $e^-e^+$  collider with the world-highest energy of the time (60 GeV) (1980-1986). His great success in TRISTAN won the

admiration of vacuum specialists from all over the world and his contribution to the ultra-high vacuum technology is recognized to be a great step forward. Ishimaru was a truly innovative person. Among many of his achievements, development of an insulated BNC-type coaxial feed-through for cryogenic vacuum with good high frequency performance extending to a GHz region is well known. In addition to his devotion to education for the next generation, he contributed to many accelerator programs such as SRRC project in Taiwan, which brought him the highest honor of Taiwan in this field. He was awarded “ The Order of the Sacred Treasure, Gold Rays with Neck Ribbon ” from the Japanese government.



## Message from the Director General



Last year, we started a new organization aiming for the research activities in the 21st century with a big hope in our mind. In high energy physics field, facilities for our B-Factory and the Long Baseline Neutrino Experiments will be ready this year, which should be part of the frontiers of physics in the 21st century that we can be proud of.

In the mean time, we have some problems unsolved during the last year. We tried hard to get the large hadron project (JHF) approved for materials structure science field and for nuclear physics field but was not officially approved last year because the Government started the reform of the Japanese financial systems. We are eager to get the JHF project going and the JHF is one of the reasons we did the reorganization for so that we have to try hard for it.

Under any circumstances, modifying the project or giving up the project is not an acceptable answer. We should present our belief as scientists to the Japanese citizen what should be done to get the science of the 21st century going. Budget matter is government's decision and not ours. In this sense, it is the year to fight back. Restructuring of the government will proceed during this year as well. We should not think of our survival or pursue our own interests. We should have the right idea on what should be the right thing for this country for the science of the 21st century and for the science related fields such as energy policy and so forth. We should speak up. It is our responsibility.

Hope this year will be a good one for all of us.

January 12, 1998

Director General Hirotaka SUGAWARA

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### KEK home page addresses ;

KEK welcome :<http://www.kek.jp/>

KEK Director General: <http://director.kek.jp/>

KEK job openings :<http://www.kek.jp/personnel.html>

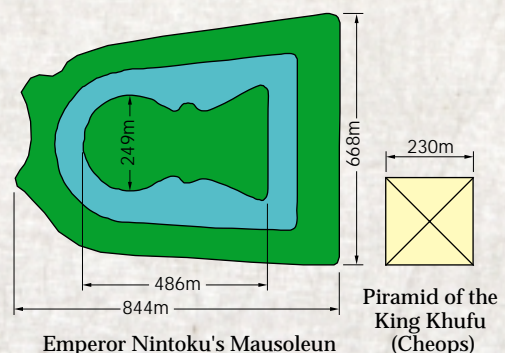
### Picture on back cover (Dai-sen Kofun)

The picture on back cover is not an accelerator facility in Japan. It is a tomb (mausoleum) of an Emperor (said to be of the Emperor Nintoku) in the mid-5th century.

Although its height is not impressive (35 m), its base size (844m × 668m) is far larger than the largest pyramid of Egypt. (King Khufu's (Cheops) : 230m × 230m, 147m high)

This mausoleum is near Osaka where ICHEP2000 will be held. (20 minutes from the symposium site)

(picture : courtesy of Sakai City Museum)







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