# state & society

## US-Soviet accord will ease joint research

US and Soviet physicists will soon have much greater opportunities for collaboration as a result of the US–Soviet agreement on scientific and technical cooperation signed by President Nixon and Premier Kosygin in Moscow. As seen by the Administration, the pact will increase joint efforts in high-energy physics, controlled fusion, superconductivity, weather modification, magnetohydrodynamics and other areas, and it will increase joint publications. An agreement on space cooperation will result in a joint docking mission scheduled for 1975.

The science and technology accord establishes a US–USSR Joint Commission on Scientific and Technical Cooperation. In the US the agency responsible for the commission's liason with the government is the Office of Science and Technology, and in the USSR it is the State Committee of the USSR Council of Ministers for Science and Technology. The commission itself was planned to be set up during a meeting between Edward David Jr, director of OST, and his then unnamed Soviet counterpart at a meeting in the Soviet Union scheduled for the end of June. Four to eight representatives from government, industry, the universities and private foundations were expected to be chosen as members of the commission.

The commission will meet at least once a year in the USSR and the US alternately, and for meetings on specific topics additional specialists will work with the members. During these meetings decisions will be made about what programs both countries consider appropriate for international cooperation.

Although no programs were established as of this writing, the cooperation envisaged by the US–Soviet agreement is considerably broader than any of the existing scientific exchange programs. All fields of politically nonsensitive basic or applied research can be considered by the commission for cooperative efforts.

The projected programs will take the form of exchanges of scientists and specialists as well as exchanges of scientific and technical information and documentation. Other possibilities include joint development and implementation of programs in basic and applied science; joint research, development and testing and exchange of research results and experience between scientific research institutions and organizations; establishment of joint courses, conferences and symposia; and appropriate government aid in establishing contacts and arrangements between US firms and Soviet state enterprises when a mutual interest develops.

According to a White House spokesman, "This agreement is intended to open up routes of cooperation. We're trying to get the people who are doing the same things in parallel, together, and hoping that we can get some synergism between them."

David suggested that one method of cooperation might be for US and Soviet research teams to divide up the research on a subject or problem and then pool the results. It might also be possible to fund research that would otherwise be too expensive by splitting

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## Greenstein report recommends priorities

The discovery of such phenomena as quasars, pulsars, cosmic blackbody radiation, infrared stars and galaxies and the new theories explaining them have made the past decade particularly exciting for astronomical and astrophysical research. What is needed in order to exploit these findings in the next decade is the subject of *Astronomy and Astrophysics for the 1970's*, the report of the National Academy of Sciences Astronomy Survey Committee chaired by Jesse L. Greenstein of Cal Tech.

The main thrust of the report is to call attention to the fact that astronomy is "one of the most rapidly advancing frontiers of human knowledge," and that because of the high interest in astronomy and the many recent advances in technology with fruitful applications to astronomy, it is important that astronomers and astrophysicists get the funding they need to capitalize on their recent achievements.

The report lists 11 programs, four of which are recommended for immediate funding and are ranked in order of importance; the other seven are unranked.

**Major programs.** The program viewed most important by the committee is the very large radio-telescope array to be used largely for extragalactic radio astronomy. This instrument, for which initial development funds were requested in the FY 1973 National Science Foundation budget, will provide resolution equivalent to an optical photograph. The VLA would consist of an array of 27 antennas spread out over an area approximately 26 miles in diameter near Datil, New Mexico. Total cost will be about $76 million. It is expected to be completed by the 1980's (see PHYSICS TODAY, May 1972, page 17).

As part of this recommendation the committee further suggests that addi-

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tional funding is required at universities for smaller and more flexible radioastronomy programs and instruments.

The second-ranked recommendation is for optical astronomy. In the last few years development of electro-optical devices such as image intensifiers, electronographic cameras, integrating television cameras and digital data handling have offered the possibility of increasing optical telescope efficiency up to 25 times for some purposes. Such an increase would be equivalent to scaling the 200-inch telescope at Cal Tech's Hale Observatories up to 1000-inch at an estimated cost of about $2 billion, while the estimated cost of equipping all nine major American optical telescopes with advanced sensors and appropriate controls is about $15 million.

Furthermore, the committee notes that more large optical telescopes are needed at dark sites to compensate for the lessening effectiveness of many existing telescopes, which are increasingly hampered by the night brightness of expanding urban areas. The report suggests building a 100-inch-class telescope at dark sites. But if larger apertures are ever to be attained a multiple-mirror optical array is suggested. These are expected to cost $5 million and $25 million respectively.

The report ranks third a recommendation for increased support of a moderate-size ground-based infrared telescope in the southern hemisphere, a large (3 to 4 m) infrared telescope in the northern hemisphere "at the best available high-altitude site," high-altitude balloon surveys and design studies for a very large stratospheric telescope. Suggested is an approximate doubling of active groups in the field at a cost of about $2 million per year.

X-ray sources in our galaxy and others "pose a serious challenge to our understanding of high-energy astrophysics," according to the committee. As its fourth-recommended program it suggests support for four High Energy Astronomical Observatories, large spacecraft in earth orbit equipped to observe x-ray sources. Two HEAO's were requested in NASA's FY 1973 budget. These are survey craft with large collecting areas and are intended to seek out and accurately position new x-ray sources and measure their spectral characteristics. They will also carry gamma- and cosmic-ray instruments.

The survey committee recommends funding for the remaining two HEAO's, which are included in NASA planning. These would be pointable and would contain focusing x-ray optics permitting short time-scale fluctuations in intensity to be detected and then possibly correlated with optical and radio fluctuations. The estimated cost of the four HEAO flights is $380 million.

**Other programs.** The remaining seven projects are unranked relative to each other but they are all considered essential to a well balanced program of astronomical research.

- ▶ The construction of a very large millimeter-wavelength antenna. This would be used for detection of molecules in space and the study of the high-frequency end of the radio spectrum. The cost is estimated at $10 million.
- ▶ A doubling of support within three years for astrophysical observations from aircraft, balloons and rockets to $12 or $13 million per year.
- ▶ A continuation of the more sophisticated Orbiting Solar Observatories through OSO-L, M, and N at a cost of $90 million with $10 million for ground-based work.
- ▶ An increase in support for theoretical investigations including expansion of computing capabilities by a total of $3 million per year.
- ▶ An expanded program of optical space astronomy with particular attention to the ultraviolet region of the spectrum, directed toward eventual launch of a large space telescope in the 1980's.
- ▶ A large (about 100 m) steerable radio telescope designed to operate efficiently at wavelengths of 1 cm and longer at a cost of about $35 million.
- ▶ Construction of several modern astrometric instruments at various locations at an estimated cost of $6.4 million.

To provide support for these programs, the committee recommends that funding for basic astronomical research increase at the rate of 5½% per year in constant dollars from the current $270 million per year to an average $335 million per year over the next decade. According to the committee, "without such growth it will be virtually impossible to carry out the program of exploration on whose threshold astronomy now stands."

**Funding.** Funding of less than these 11 programs would "seriously impede our efforts to capitalize on the recent past," the committee asserts. Of the four ranked programs, Greenstein says "I think the first four of the ranked programs will be implemented. Failure to do so is not just a question of not responding to the opinion of the astronomy community. It's a question of simply stopping certain large areas of astronomy at their threshold of success." However, if funding prohibits the initiation of large capital programs, the committee urges implementation of its lower-cost programs of highest priority, such as detector development and implementation for optical astronomy and increased support for university radio astronomy, infrared astronomy, and aircraft, rocket and balloon astronomy.

Should funding be increased beyond current expectations, the committee proposes a number of additional programs. The most important of these is construction and launch of a large space telescope, "possibly with manned resupply and maintenance." NASA has recently announced that it will proceed with detailed planning of such an instrument to be launched and serviced by the space shuttle in the 1980's.

During the time the astronomy survey was developed, a similar study was made for physics. Some recommendations for astrophysics were included in the report of the NAS Physics Survey Committee (PHYSICS TODAY, July, page 23) chaired by D. Allan Bromley. Both committees shared a panel on astrophysics and relativity. The physics survey committee identified two of the astronomy committee's top four programs as "high-leverage situations"—situations in which small changes in funding can sometimes be reflected in disproportionately large changes in scientific productivity. In both these cases, the VLA and the use of HEAO's, the physics survey committee notes that it concurs with the conclusions of the astronomy survey committee that these are important to astronomy, astrophysics and physics. —SMH

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up the job, although neither country would supply funds for work in the other country.

David anticipates a lessening of the difficulty that some Soviet scientists have had in getting permission to travel outside of the USSR. Since the commission will have access to the highest levels of government, both in the Soviet Union and in the US, there is the possibility of freer interchange of information and people, he said.

Several areas of physics were pointed out as being especially suitable for cooperative work, among them high-ener-

gy physics. Expansion was suggested along the lines of a recent exchange of high-energy physicists, when a US group worked at Serpukhov in 1970–71 and a Soviet group is working at NAL this year.

The Soviets are apparently as interested as the US in the search for new energy sources, and a number of the research topics earmarked for possible joint efforts are in energy research. Controlled fusion is one area in which there is already significant Soviet–American cooperation, and it is definitely under consideration. David said he hoped that more cooperation would shorten the time it will take to demonstrate the feasibility of a controlled-fusion device. Other areas of physics in which both countries have an interest and that were mentioned as suitable for joint research efforts include magnetohydrodynamics, breeder reactors, solar energy and weather modification.

According to Vladimir Kirillin, the Chairman of the USSR Committee for Science and Technology, there are some plans for new publications. He said, "Since we shall undertake joint research, joint work, joint efforts, there will definitely be joint publications also."

There are no plans at present to appropriate new funds for these programs; the intent is rather to give researchers who are already funded the opportunity to work more closely with their scientific counterparts in the Soviet Union than they can at present.

The space agreement, which was signed at the same time in Moscow, provides for a joint rendezvous and docking mission planned for 1975 using modified Apollo- and Soyuz-type spacecraft. This will necessitate an expenditure of about $250 million that will have to be authorized by Congress and about $100 million in existing hardware. No information was released on the cost of the project to the Soviets. There is no word as to whether any scientific experiments will be performed on the mission. —SMH

## Health Sciences program gets $5m shot in the arm

The Harvard–Massachusetts Institute of Technology Program in Health Sciences and Technology has received its first major research support, a $5 000 000 five-year grant, from the National Heart and Lung Institute for a multidisciplinary program of research on biomedical materials. Directed by Robert W. Mann, Germeshausen Professor at MIT, the program includes 15 separate projects and involves the collaboration of 33 investigators from Harvard and MIT. The projects evolved from a series of seminars held over the past two years under the auspices of a joint Harvard–MIT program for engineers, physicists, medical researchers and clinicians from the two universities and from university-related hospitals in the Boston area.

The research, ranging from basic research to the application of research findings to actual health services, is divided into four major categories. In the first category, which involves the study of synthetic materials that can remain in contact with flowing blood without altering the blood composition and without causing coagulation, participants include Edward W. Merrill, David F. Waugh and William F. Bernhard of MIT, Edwin W. Salzman of Harvard and Beth Israel Hospital and Edgar Haber of Harvard and Massachusetts General Hospital. Large molecules, natural and artificial membranes and the dynamics of cells are being studied in the second phase of the program. Researchers in this field are S. Roy Caplan of the Harvard Medical School, Alvin Essig of Harvard and Tufts Medical School, M. Howard Lee, H. Eugene Stanley, Ernest Cravalho, Padmakar Lele and Ionnis V. Yannas from MIT, H. Frederick Bowman from Northeastern University, Charles E. Huggins of Massachusetts General Hospital and John F. Burke from the Shriners Burns Institute.

Research projects organized around how chemical substances are transported in the blood and shuttled between red blood cells and blood-vessel walls form the third category of research. Involved in this phase are Ascher H. Shapiro and Borivoje Mikic of MIT and Philip A. Drinker of Harvard Medical School and Peter Bent Brigham Hospital. In the fourth category, concerned with new instrumentation and new techniques for the study of biological materials, participants include George B. Benedek, Robert E. Ogilvie, Arthur R. Van Hippel and John G. King from MIT and Marijka Holtrop of the Children's Hospital Medical Center.

# in brief

*American Science Manpower, 1970,* the final report of the 1970 National Register of Scientific and Technical Personnel, has been released by the National Science Foundation. This report, which is the eighth and last in the biennial series that began in 1954, is available from the US Government Printing Office, Washington, D. C. 20402 for $2.50 per copy. The National Register has been discontinued in its present form, but alternative methods for gathering statistical information on science and engineering manpower are now being developed.

*National Patterns of the R&D Resources, 1953–72—Funds and Manpower in the United States (NSF 72-300)* is available from the US Government Printing Office, Washington, D. C. 20402 for $0.50.

Copies of the National Science Foundation's report on *Graduate Student Support and Manpower Resources in Graduate Science Education, Fall 1970* (NSF 71-27) is available from the Superintendent of Documents, Washington, D. C. 20402 for $1.25 per copy.

Funds are available for ten young physicists to attend the meeting on particle accelerators in radiation therapy of the American Association of Physicists in Medicine, October 2–4 at Los Alamos. Contact C. A. Kelsey, Department of Radiology, University of Wisconsin Medical School, Madison, Wisc. 53706

A 40-inch reflector telescope at the University of Virginia's Fan Mountain Station of Leander McCormick Observatory was recently dedicated. The telescope will be used for long-focus astrometry.

*Science Resources Studies Highlights* —"Functions Other Than Defense and Space Showing Rising Share in Federal R&D Expenditures" is available from the Distribution Section, National Science Foundation, Washington, D. C. 20550.

## Fulbright scholarship alumni: Where are you?

In connection with the 25th anniversary of the Fulbright academic exchange program, the Board of Foreign Scholarships, the presidentially appointed body supervising the Fulbright scholarship program, is attempting to compile a full list of Fulbright alumni now active in the major academic disciplines in the US as well as an authoritative statement on what the program has contributed to the American academic community.

The Board is therefore requesting that all alumni contact them as soon as possible with the following information: name, current address, current position and year and country of grant. The Board would also appreciate any brief comments from the alumnus on what