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U.S. & U.S.S.R. Collaboration in High Energy Physics

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High energy physics and international collaboration

High energy physics (HEP) experiments are carried out by university professors and their students at accelerators, large central facilities at government-funded national laboratories. There are a limited number of such HEP facilities in the world, due to their large cost. Fermilab, as an example, cost about one quarter of a billion dollars 20 years ago. An experiment is conducted at the accelerator that best suits that particular experiment, in whichever country that accelerator is located. Some years ago, the directors of the major HEP laboratories issued a statement that the criteria for acceptance of a research proposal are the scientific merit and technical competence of the proposal; note that there is no mention of the country of origin of the experimenters.

The size of research groups varies from one or two people to about 300 scientists, together with engineers and technicians, on a $100 million detector, with the experiment lasting a total of about ten years. A research group is composed of up to 30 university subgroups, each responsible for a piece of the experiment's detector or software. At Fermilab, for example, there are typically about 1,300 physicists and graduate students on our approved experiments at any time, of which some 400 are from institutions outside the U.S. representing about 20 countries. The subgroups get together to carry out an experiment because of a common interest in the physics goals. Results of the experiment are published in the open literature. These factors have historically led to collaboration among physicists from many countries.

History of U.S./U.S.S.R. collaboration in high energy physics

U.S./U.S.S.R. collaboration in high energy physics started in 1966 with the first U.S.S.R. physicist coming to work at a U.S. institution. Individual U.S. physicists visited the U.S.S.R. in the period 1970-74, while the first U.S. group to carry out a collaborative experiment in the U.S.S.R. started its activities there in 1970. In 1972, the first U.S.S.R. group came to the United States. Since that time, cooperation has increased each year and appears to have been unaffected by the state of political relations between the two countries.

Cooperation in high energy physics was discussed in meetings between President Dwight D. Eisenhower and Secretary Nikita Kruschev in 1955 and 1960, and led to a memorandum of understanding in 1960 between the U.S. Atomic Energy Commission and the U.S.S.R. State Committee for the Utilization of Atomic Energy. In 1973, the "Nixon-Brezhnev" agreement on cooperation in peaceful uses of atomic energy was signed. At the third meeting of the committee set up to coordinate that agreement, in 1975, there was established the U.S./U.S.S.R. Joint Coordinating Committee for Research on the Fundamental Properties of Matter (JCC-FPM). The JCC-FPM meets each year, alternately in the U.S. and the U.S.S.R., with about ten delegates from each country. On the U.S. side are representatives from universities and national labs active in high energy physics, with organization and the chairman of the delegation coming from the U.S. Department of Energy.

Representatives at the annual JCC-FPM meetings discuss the collaboration for the forthcoming year and produce a record containing the agreements reached on the numbers and duration of the planned visits for the collaborative research projects. As an example, at the 1990 meeting held at Fermilab, the plans for 1991 contained 1,445 man-weeks of U.S.S.R. physicist time in the U.S. (of which 770 will be at Fermilab), and 532 man-weeks for U.S. physicists in the U.S.S.R. These numbers are a guide to activities between the sending and receiving institutions. Generally, the time spent by U.S.S.R. physicists in the U.S. is significantly higher than that of the time spent by U.S. physicists in the U.S.S.R.; a major reason is that at the present time, the highest energy accelerators and thus the forefront activities of the field, are in the U.S.

U.S./U.S.S.R. collaboration activities at Fermilab

Fermilab has had a tradition of extensive collaboration with U.S.S.R. physicists since its experimental program started in 1972; in fact, the first experiments using the Fermilab accelerator were U.S./U.S.S.R. collaborations. Out of a total of 388 approved experiments at the Laboratory, 28 have had physicists from U.S.S.R. institutions, involving a total of 137 U.S.S.R. physicists; on seven of the experiments, the spokesperson (senior physicist on the experiment) was from the U.S.S.R. At any given time, there have been an average of around ten U.S.S.R. physicists at Fermilab, with the numbers depending on the details of the Laboratory experiment schedule.

The physicists stay at the Laboratory for periods of time ranging from one day to two years; for the longer stays, they are frequently accompanied by their spouses and younger children. Generally, they stay in housing on the Fermilab site or in the nearby communities, identically to other visiting physicists and their families. Since 1972, over 400 U.S.S.R. visitors have been at the Laboratory, some having made several visits. As an illustration of the extent of Fermilab's U.S.S.R. activity, the table on page 27 shows the U.S.S.R. visits to the Laboratory that have been made, or are currently expected, in 1990 alone. The total is over 100. It is instructive to note that U.S.S.R. participation at Fermilab cuts through a wide variety of the Laboratory's HEP activities, from fixed-target and collider physics, through accelerator physics, to theoretical physics and astrophysics.

Experiences, benefits, prospects

What has the U.S.S.R. gained by this collaboration? A major gain has been the opportunity for U.S.S.R. physicists to carry out physics research at the highest energy accelerators in the world. These are currently are in the United States. The scientists gain some view of U.S. technology, although that can be obtained at other major laboratories in Western Europe and Japan. They also see U.S. management techniques, style of working and reduced bureaucracy compared to conditions in their own country.

What has the U.S. gained by this collaboration? Many excellent U.S.S.R. physicists have worked on experiments here, helping to further the field and interacting with our own physicists. The U.S. has had the use of new and novel equipment invented in the U.S.S.R.; two examples are a hydrogen gas jet target, which was the central component of the first Fermilab physics experiments; and a lithium gas lens essential for antiproton production for the Fermilab Collider.

The U.S.S.R. physicists bring with them state-of-the-art equipment built in their laboratories, which would otherwise have to be purchased with U.S. funds. In 1984, for example, there was over $5 million worth of such equipment at Fermilab; in 1991, the amount is expected to be greater. Obviously, we gain some view of the state of U.S.S.R. technology.

Mutual benefits and prospects are many, and are to be found primarily (but certainly not exclusively) on the human level, which can only be helpful to relations between the two countries. Contacts made in joint efforts often lead to close friendships. U.S. scientists become better informed on life and attitudes in the U.S.S.R.; likewise, U.S.S.R. scientists (and their families) experience U.S. life firsthand, and return to presumable tell their colleagues.

Obviously, there are small problems in activities of this nature, but they are not severe enough to have significant impact. The exchanges tend to be a little more formal than necessary, which probably stems from the needs of the U.S.S.R. bureaucracy. Also, most U.S. physicists find travel and living in the U.S.S.R. more difficult than they are used to in the U.S. or Western Europe. In spite of the negatives, over the years, the collaboration has been growing, and all indication are that it will continue to grow; the consensus is that it is very beneficial to both sides.

Members of the U.S./U.S.S.R. Joint Coordinating Committee for Research on the Fundamental Properties of Matter at the 13th meeting held at Fermilab, October 25-26, 1990 are: (front row, l. to r.) P.V. Bogdanov (U.S.S.R., Ministry of Atomic Power and Industry); A. N. Skrinsky (U.S.S.R., Director of Institute of Nuclear Physics, Novosibirsk); A. A. Vassiliev (U.S.S.R., Head of Nuclear Physics and Controlled Fusion, Ministry of Atomic Power and Industry, Co-chair of JCC-FPM); W. N. Hess (Director of Office of High Energy and Nuclear Physics, DOE, Co-chair of JCC-FPM); J. Peoples (Director of Fermi National Accelerator Laboratory); N. Samios (Director of Brookhaven National Laboratory); (back row, l. to r.) A. V. Pavlov (U.S.S.R., Ministry of Atomic Power and Industry); V. A. Nazarenko (U.S.S.R., Deputy Director of Leningrad Nuclear Physics Institute); V. Matveev (U.S.S.R., Director of Institute for Nuclear Research, U.S.S.R. Academy of Sciences); A. Ts. Amatuni (U.S.S.R. Director of Yerevan Physics Institute); I. V. Chuvilo (U.S.S.R., Director of Institute of Theoretical and Experimental Physics); V. A. Yarba (U.S.S.R., Deputy Director of Institute of High Energy Physics); R. Rubinstein (Fermi National Accelerator Laboratory); T. Toohig (Superconducting Super Collider Laboratory); P. K. Williams (DOE); K. Strauch (Harvard University); D. Lowenstein (Brookhaven National Laboratory); D. Leith (Stanford Linear Accelerator Laboratory) and H. Grunder (Director of Continuous Electron Beam Accelerator Facility). Not pictured are: D. K. Stevens (Director of the Office of Basic Energy Sciences, DOE); E. Knapp (Director of LAMPF, Los Alamos National Laboratory) and J. R. O'Fallon (Director of the Division of High Energy Physics, DOE).

U.S.S.R. Visitors to Fermilab in 1990

Visitors	Institution	Collective Length of Stay (Wks)
E704		
12	IHEP	241
1	JINR	1
DØ		
25	IHEP	233
1	Moscow State University	1
E672		
14	IHEP	126
1	Moscow State University	26
E761		
1	ITEP	8
10	LNPI	277
Accelerator		
7	IHEP	34
Theory/Astrophysics		
1	LNPI	4
1	ITP Kiev	7
1	ERPI	9
1	Lebedev	3 days
2	JINR	2
1	ITP Moscow	1 day
1	INR	3 days
Miscellaneous		
16	Min. At. Pwr. & Ind.	2 wks, 2 days
12	LNPI	3
2	IHEP	5
3	JINR	3
1	ITEP	1
1	Efremov Inst.	1 day
1	Kurchatov	1 day