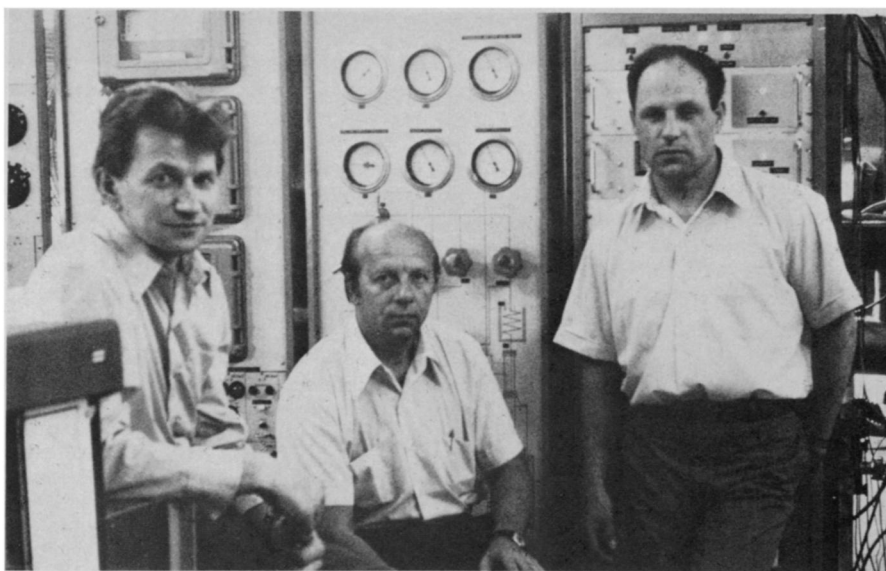


## U.S.-Soviet collaboration at 400 GeV



*Three of the Soviet 7: Yuri Pilipenko, Anatole Kuznetsov, Victor Bartenev.*

Experimental particle physics at the highest energies possible is even more of an international game than particle physics always was. At the ultrahigh energies the available accelerators become very few: In the range of hundreds of billions of electron-volts (hundreds of GeV) there is only one now operating, the 400-GeV National Accelerator Laboratory at Batavia, Ill.

It seems especially appropriate that one of the first experiments at the new NAL accelerator should be an international cooperation, and that it should include physicists from the United States and the Soviet Union. The work involved cooperation of groups from the U.S.S.R. State Committee for the Utilization of Atomic Energy, the NAL, the University of Rochester and Rockefeller University. The Soviet visitors are led by Anatole Kuznetsov.

The experiment included not only people but equipment from both sides of the East-West political frontier. The

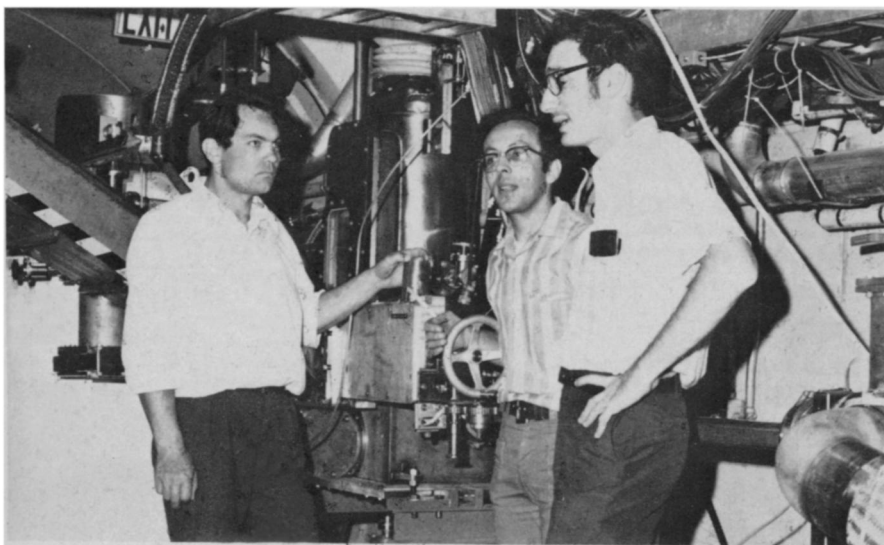
Soviet scientists brought with them a hydrogen-gas jet target that had been perfected at the Joint Institute for Nuclear Research at Dubna in the U.S.S.R. As it was described to the recent meeting of the American Physical Society in New York by Victor Bartenev, the jet sounds rather like the jet of an ordinary gas stove, but it operates at extremely low temperatures and its purpose is to send bursts of hydrogen into the path of the proton beam of the accelerator. This solves a serious difficulty: The experiment has to be done within the ring of the accelerator itself since extracted beams are not yet available. It was thus necessary to provide a target which would interact with some of the protons in the beam and yet not be so thick as to impede the passage of the beam. The gas jet provides such a target. Used with hydrogen gas it gives proton-proton collisions; used with deuterium gas it can provide proton-neutron collisions as well.

The results of the experiment, reported in a series of talks at the APS meeting, are somewhat technical. In general they are further evidence that the effects of proton-proton collisions do not grow without bound as the energy of the collisions increases; rather the various results tend toward static limiting values.

One result, reported by Vladimir Nikitin, has to do with the relations among the cross section (probability) of collision, the energy, and the momentum transferred from one proton to the other. At any given energy, the amount of momentum transferred may vary, and as the momentum transfer goes up, the cross section for collision goes down. The rate at which the cross section declines should get steeper (at least according to one type of theory, the so-called Reggepole theory) as the energy rises. The experiment found that the rate of change of cross section does in fact increase as energy goes up, but at the highest energies it tends toward a static limiting value. One way of visualizing this is that the "size" of the proton increases with energy until it finally reaches a constant limit.

The other result, reported mainly by Leonid Zolin, has to do with the quantum-mechanical scattering amplitude. According to quantum mechanics any particle can be represented as a wave. When such a wave strikes a target part of it is directly scattered like reflected light, part is absorbed by the target like absorbed light. What the experiment finds is that the amplitude of the directly scattered part of the wave tends to disappear, at high energies, indicating that here the proton-proton interaction takes place not by direct scattering but through the intermediary of some absorptive process.

The seven Soviet scientists and their wives have now been living at NAL for



*Photos: NAL*

*Vladimir Nikitin (U.S.S.R.), Ernest Malamud and Bruce Strauss (NAL).*

10 months. Their visit is part of a cultural and scientific exchange under which Americans also visit the Soviet Union. Prior to this experiment a group from the University of California at Los Angeles had done an experiment at Serpukhov, the largest (75 GeV) accelerator in the Soviet Union. Further exchanges are expected in the future. □

## Culture shock and the prisoners of war

At long last the war in Vietnam has produced something that everyone can cheer about. The release of American prisoners of war this week has been greeted with unanimous public approval and interest that far outweighs the sigh-of-relief attitude and skepticism that followed the signing of the Paris peace papers. For good reasons, however, the Pentagon was attempting to keep the emotion and fanfare surrounding the return of the prisoners to a minimum.

Studies describing the unique circumstances of being a POW in the Orient (after World War II, Korea and the *Pueblo* incident) indicate that gradual repatriation is the safest way to prepare returnees for the culture shock that will greet them after years of separation. Those who have been away the longest will have trouble adjusting to the changes in American life style. Some of this week's returnees, for instance, were shocked at the total nudity depicted in a recent issue of *PLAYBOY* smuggled aboard their plane from Hanoi. Others will be faced with family deaths, divorce and wives and children who no longer know them and who will never be able to completely comprehend the ordeal they have gone through.

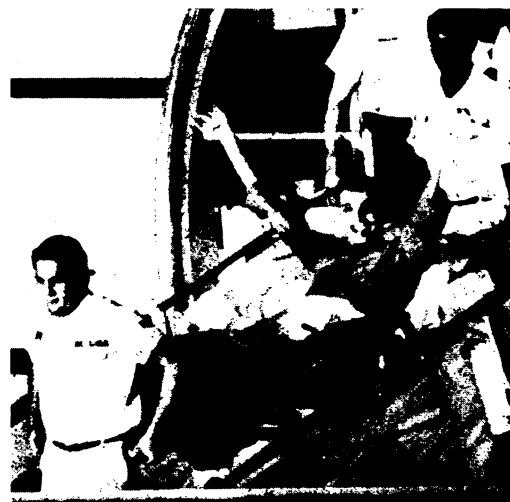
A three-day stay at Clark Air Base in the Philippines with extensive medical examinations and intelligence debriefings (except in two family emergencies) will be followed by further observation and any necessary treatment at military hospitals near the homes of the POW's. They telephoned their families the day of arrival at Clark, but none of the men have to meet their families until they feel they are prepared to do so. This semi-isolation from the outside world should help cushion some of the shock. During these hospital stays, the ex-prisoners will be made aware of changes in their family situations and helped to readjust to normal life. The Air Force has even prepared a slang dictionary (acid, bumper, gay lib, Jesus freak, Ms., zonked) to help bridge possible communications gaps.

POW families also received a sort of indoctrination. In a 30-minute film, Navy psychologist William N. Miller

attempts to describe the changes a prisoner must go through if he is to survive confinement. He stresses that POW families must be prepared to accept the returnees' bewilderment, fear and loss of confidence.

Raymond C. Spaulding of the Naval Hospital at San Diego and Charles V. Ford of Harbor General Hospital in Torrance, Calif., have described psychological changes that prisoners undergo (SN: 7/22/72, p. 57). Some crew members of the *USS Pueblo*, for instance, admitted experiencing anxiety, depression, despair, hopelessness and even ideas of suicide. All of these, the researchers say, become part of a repatriation syndrome. In the past this has been an initially bland reaction followed by anger after a return of self confidence. To avoid this, Spaulding and Ford suggest a delayed homecoming that would bridge the gap between prison and home.

These findings have been circulated around the Pentagon and seem to have had some effect on the way the Vietnamese prisoners are being treated. But even with the apparent kid-glove treatment of the prisoners, there have been expressions of concern for their mental health. The American Psychological Association has formally asked what precautions are being taken to ensure that



Wide World Photos

### *The prisoners return: Problems ahead?*

the psychological briefing or treatment be aimed only at the prisoners' rehabilitation and not to manipulate their political opinions.

The APA's Board of Ethical and Social Responsibility, headed by Fred Strassburger, followed up by contacting the Pentagon. A preliminary meeting was set up for this week. The APA is not accusing the Government of mistreating POW's but, says Strassburger, "we want to reassure ourselves that the mental health and rights of the prisoners will be safeguarded." □

## Life's dependence on earth's ultraviolet screen

The argument that began when Harold Johnston of the University of California at Berkeley suggested nitrogen oxides from SST exhaust could catalyze destruction of the atmosphere's ozone layer, exposing earth to dangerous new levels of ultraviolet radiation, received new impetus this week. An ad hoc panel set up by the National Academy of Sciences to investigate possible biological effects of increased ultraviolet radiation issued its report. The study is broader than an earlier NAS evaluation of Johnston's hypothesis (SN: 10/21/72, p. 262).

The new panel concludes, with discreet scientific understatement, that "sufficient knowledge is at hand to warrant utmost concern over the possible detrimental effects on our environment by the operation of large numbers of supersonic aircraft."

Indeed. The panel found that even modest increases in ultraviolet light might diminish the biological productivity of the ocean, damage world agriculture, increase skin cancer in humans and interfere with the sex life of insects. And a decrease of ozone concentration as small as 5 percent would produce a 26 percent increase in the intensity of the most biologically damaging UV radiation. Such an increase, for example, would probably cause a mini-

mum of 8,000 additional cases of skin cancer in the United States, the panel concluded.

The panel reviewed the present state of knowledge of biological effects of UV radiation and recommended several areas for continuing research. They point out that man is one of the few animals to remain in full sunlight, subjecting himself to the damaging effects of UV. These effects vary according to race, with the white race suffering as much as 10 percent incidence of skin cancer. The report recommends establishment of ground-level solar radiation monitoring stations to detect changes in UV levels and performance of studies to determine the effect of such changes on plankton, agricultural crops, animals and people. "The public should be informed," they said, "that even today, excessive exposure to solar radiation should be avoided."

Still unanswered, however, is the question of how many SST's would be necessary before noticeably affecting the ozone layer. As Harold Johnston told *SCIENCE NEWS*, "Full-scale SST development would more or less double nitrogen oxides in the stratosphere, but we still don't know how much that would change the ozone." Several projects are currently seeking an answer to that question. □