

PHYSICS

Russians Will Find New Forms of Anti-Matter

► DISCOVERY of new forms of anti-matter is expected when the giant Russian atom-smasher, now the world's largest, goes into full operation, the deputy director of the Joint Institute for Nuclear Studies, which is about 90 miles from Moscow, has predicted.

Prof. Vaclav V. Votruba of Charles University, Prague, Czechoslovakia, forecast the possibilities of producing man-made negative "hyperons" in the powerful machine at the laboratory on the Volga River.

It is expected to give energies of ten billion electron volts (Bev). In contrast, the most powerful machine in the United States, the University of California's bevatron, reaches about six Bev.

Prof. Votruba said he did not know exactly when the Russian machine would be in full operation, but pointed out that it had already successfully operated at 8.3 Bev, the world's record.

Prof. Votruba is one of seven scientists from countries behind the Iron Curtain, other than Russia, who attended the Seventh Annual Conference on High Energy Nuclear Physics.

The appearance of these seven made the non-appearance of seven Russians who had accepted invitations puzzling. A cable from the Soviet Academy of Sciences explained the Russians' absence was due "to technical reasons."

Prof. Votruba said the seven Russians were planning to come to the United States for the Conference as late as April 12. He had no explanation for their sudden change in plans.

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Power Package Reactor Promises Portable Energy**See Front Cover**

► THE ARMY's package power reactor has just begun operation—gone "critical"—at Fort Belvoir, Va. It is first of a new breed of atomic power plants that can be transported by air to remote sites, there to operate reliably for long periods without new fuel.

For the present the pioneer plant, shown on the cover of this week's SCIENCE NEWS LETTER, will generate electricity for use at the Engineer Research and Development Laboratories where it is installed. It will generate approximately 2,000 kilowatts of electricity.

Installed in isolated bases in the Arctic and Antarctic, such plants can also furnish steam for heating as a by-product.

The power package reactor is expected to be as important to land outposts as the famous atomic submarine Nautilus is to the Navy.

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PHYSICISTS CONFERRING—Three nuclear physicists discussing recent research results. From left to right, they are Dr. Geoffrey Chew of the University of California, Dr. Marvin L. Goldberger of Princeton University and Dr. Robert E. Marshak, chairman of the University of Rochester's physics department and of the Conference.

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Basic Length Unit

► A HINT that there is a basic unit of length in the microscopic world of the atom's core reported to the Conference on High Energy Nuclear Physics at the University of Rochester, Rochester, N. Y.

With further experiments to confirm the evidence, scientists would have a tiny, indivisible unit of length, just as they now have the quantum of light, the smallest possible packet of energy.

Dr. Giampietro Puppi of Bologna, one of the 75 foreign scientists who attended the conference, reported recent findings indicating that "the principle of causality" does not apply to the very small region within the atomic core. The principal of causality holds that no effect can be propagated faster than the speed of light.

Scientists explain the findings definitely do not mean that Einstein's theory was mistaken.

What the results do mean is that in the extremely tiny regions of atomic nuclei, the possible quantum of length, events are simultaneous. Within this quantum unit there is no reason to ask how fast events happen. For the large-scale, everyday world, the highest attainable speed is still limited to that of light, 186,000 miles per second.

Dr. Puppi's experiments indicated the "dispersion equations" resulting from the principle of causality do not hold under certain conditions. He found this by hurling pi mesons, the sub-atomic particles that

act as nuclear glue, at protons, the nuclei of common hydrogen, then measuring the results obtained.

Physicists Discuss "TCP"

► TCP was one of the subjects discussed by 300 of the world's leading physicists who attended the Conference.

TCP is not a commercial product but scientific shorthand for a theory concerning how the microscopic world of atomic cores behaves. Because of it, scientists are being forced to reconsider their ideas about the basic symmetry of nature.

The "T" in TCP stands for "time," the "C" for "charge conjugation," and the "P" for "parity."

Until very recently, these properties were believed conserved in all nuclear reactions. Only a few months ago the parity principle had to be discarded on the basis of experimental evidence for "weak" nuclear reactions. Further interpretation of these experiments showed that "charge conjugation" also is not conserved in weak interactions.

Dr. G. Luders of Massachusetts Institute of Technology and Nobel prize-winner Dr. Wolfgang Pauli now propose that even though "C" and "P" do not work alone, they do hold when "TCP" are used together.

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