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# ACTIVITIES OF CZECHOSLOVAK SCIENTISTS AT THE JOINT ISNTITUTE FOR NUCLEAR RESERACH IN DUBNA, USSR



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# ACTIVITIES OF CZECHOSLOVAK SCIENTISTS AT THE JOINT INSTITUTE FOR NUCLEAR RESEARCH IN DUBNA, USSR

[Following is the translation of an article in Predvoj (Avant Guarde) Vol V, No 7, Bratislava, 16 February 1961]

If one travels by bus from Moscow northbound to the Volga Sea, he spends about three hours passing through typically Russian countryside. Birch and pine forest border the Moscow-Volga Canal. One reaches the colorful little town of Dubna, consisting of two-storied yellow villas with balconies and small gardens. Huge, isolated pines and woods are everywhere within reach. At first glance, one would take it for a small bathing resort and not the seat of the Joint Institute for Nuclear Research, where a group of Czechoslovak scientists, along with scientists of other nations in a 1000 member collective body, is working. At their disposal is the most modern equipment for nuclear research, such as the Synchrophasotron, which produces a bundle of rays of electrons, the energy of which is ten billion electron-volts. The ring-shaped magnet, the outside diameter of which is 60 meters, weighs 36,000 tons. One cycle of acceleration takes 12 seconds. Within this time the particles cover a distance equivalent to that between the earth and the moon.

The main peculiarity of the ring-shaped Phasotron is that a stability of accelerated particles is in both directions (radical as well as vertical) based on a strong focusing achieved by the magnetic field resulting at the circumference. The field is divided so that the current alternates in its direction at the circumference. The purpose of studies performed with this accelerator is to prove the assumption of a large intensity of electrons being piled up during their last circulating period. The scientists are now busy studying the problem of incorporating the accelerator into the synchronized regime.

## Working with Billionths of a Second.

The electronists of the laboratory for high energies, a group of scientific workers from RSFSR, the Ukraine, China and CSSR, is creating the so-called "Millimicrosecond Technique," i.e., a technique of time measurements with only billionths of a second.

The group is trying to find a source for antiprotons, which are free from other particles. M. Vysocansky, a scientist from Czechoslovakia, makes the following statement: "There are very few protons within the bundle of particles darting from the Synchophasotron. Our task consists of purifying the antiprotons by separating them from their particles."

The So-called Clean, Physical Theory.

M. Fischer, another scientist from Czechoslovakia, works in the Laboratory for Theoretical Physics. The head of the laboratory is the academician Bogolubov. The laboratory's scope of work embraces the study of elementary particles and interactions occurring among them. The main task of the laboratory is the mathematical formulation of the general laws governing the reactions which the elementary particles undergo. Under the guidance of Professor Bogolubov, a new theory is being built, called the theory of "Displaced Relations."

Are Nuclei Composite Particles? Do they have Cores?

The Czechoslovak scientist Z. Korbel also studies the structure of nuclei in Dubna. He studies the collisions of protons accelerated in the Synchrophasotron by the use of photoemulsions of nuclei.

Photoemulsions, 400 microohms strong, are used. The emulsions are formed into a block, in which star-like crystals of one, two and more sides are left behind as a result of collisions between nuclei and bundles of protons emanating from the Synchrophasotron. The photographic development is followed by a microscopic determination of the kind of particles forming the beams that compose the crystals. Important questions are: Are the nuclei composite particles? Do they also have some kind of nucleus or core? The scientists of the Institute succeeded in identifying the particles belonging to the star-like crystals. The identification process allows them to determine the electric charge of a particle by the aid of a magnetic pole.

Another Czechoslovak scientist, L. Rob, when shooting off such photoemulsions with nuclei, is concerned with an analogous task, viz., to answer the question, whether an excited state of these particles is possible (a state when the particle has a higher energy than before). From the result of his experiment it was determined that the particles disintegrate spontaneously in two parts.

Talks with Bubble Chamber Investigators.

It is possible to photograph traces of particles formed from bubbles that have originated during the flight of particles through the liquid of a bubble chamber. The disadvantage consists in the fact that a two-dimensional picture results, whereas the bubble chamber, through which the particles pass, have a certain depth. The photographs have to be corrected stereoscopically. Because of the complexities involved, a substantial enlargement of the Calculation Center of the Institute was needed. The electric calculating machine called "Ural" is generally used, but in November the device "Kijev" was introduced, and this year another contribution will take place in the form of the calculating machine called "Moskva."

The bubble chamber method is one of the main methods used with the research of accelerators. The people working with the bubble chamber method are one of the youngest groups among the collective bodies of the Institute and also the group with the largest international representation. Another bubble chamber investigator, as they are generally called, is the

Czechoslovak Zbysek Trka, who investigates nuclei with the aid of pictures from bubble chambers.

Another Czechoslovak scientist at the Institute is Jiri Vrana, whose work is concerned with the origin of heavy particles and who took part in the discovery of a new particle called "Antisigma minus hyperon."

The So-called "Strange particles" identified.

The so-called strange particles have been the object of investigations of the Czechoslovak scientist Prokes since 1957, that is, since the beginning of the building of the bubble chamber. Basically, there is nothing strange about them any more except their name which was kept from the time of their discovery. Physicists then didn't know how to explain some of the properties of these particles and therefore called them strange.

News from Laboratories for Nuclear Research.

In Dubna there is a group of Czechoslovak radiochemists consisting of seven members. Their task is the preparation of heavy transuranium elements by bombardment of heavy uranium nuclei with particles heavier than helium.

The search for chemical separation methods for the resulting products, especially very fast methods, is considered as important as the sphere of the proper physical investigation of elements. Both of the latter processes are equally important, and one cannot exist without the other. Problematics concerning chemical separation and physical investigations is a field of endeavor of a group of scientific workers from various countries whose group leader is Engineer Maly.

In the Laboratory for Neutron Physics, headed by the Nobel laureate Frank, works the docent Muzikar from Czechoslovakia.

Direct Cooperation with Czechoslovakia is Increasing.

Many Czechoslovak scientists who worked in Dubna, such as Ulehla, Tucek, Suk and others, today continue their research in Czechoslovakia and are in direct communication with the Institute in Dubna. Nuclear spectra of elements are measured in Czechoslovakia on samples that have been irradiated in Dubna. Furthermore, the studies of problems based on the method of nuclear emulsions continue to be carried out in Czechoslovakia, as well as the study of the methods of the bubble chamber.

Also, the Czechoslovak scientist Zvolsky wants to continue his work in close collaboration after returning home. His interests lie in studying one of the methods used in analyzing the structure of nuclei by nuclear spectroscopy. The nuclear spectroscopy determines the energy and intensity of a radiation emitted by elements, and from these determinations the conclusion can be drawn concerning total energy forces. Recent investigations indicate that some properties of atomic nuclei bring to mind the properties of molecules possessing an aerial symmetry, and a so-called theory of deformed nuclei develops.

The most modern technical equipment, the possibility of fast scientific information and mutual consultation, good working areas, and a tight collaboration after returning home -- all these are favorable conditions for great successes in the penetration of further mysteries, hidden until the present, within the depths of matter. In all these successes a group of Czechoslovak scientists is taking a part.

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