несценция при сколе - неравновесные гетерогенные хемоэффекты (В.В.Стыров, Ю.И.Тюрин).

В результате исследований, проводимых с 1980 года на кафедре общей физики ТПУ профессорами И.П.Черновым и Ю.И.Тюриным на стыке водородной и радиационной тематик, была впервые понята роль водородной подсистемы в металлах как аккумулирующей среды, способной эффективно запасать энергию различных внешних воздействий, в том числе радиационных. Аккумулирующие свойства водородной подсистемы проявляются в эффектах неравновесной диффузии, проницаемости стенок металлов, неравновесной модификации свойств материалов, эмиссии заряженных частиц в выходе атомарного водорода из твёрдых тел при облучении. Эти свойства твёрдых тел следует учитывать при создании водородных накопителей энергии, решении проблемы первой стенки ядерных и термоядерных реакторов. Работы в данном направлении получили мировое признание.

Physics in TPU

I.P.Chernov

»The city of Tomsk was the sole university city in Siberia – wrote N.N. Simonov, Nobel prize-winner, about the events of Civil War of 1918 – and I had left for Tomsk hoping to set about working again in the field of research. Prof. B.P. Weinberg did really enabled me to work in the research laboratories of Tomsk Institute of Technology...»

The formation of physical science at Tomsk Polytechnic University is connected with the name of Professor Boris Pyetrovich Weinberg. He had been working as the Head of the Physical Department and the Head of Physical Laboratory at Tomsk Institute of Technology for 15 years (1909-1924) remaining the sole Doctor of Sciences in Siberia of that time.

Scientific publications of Prof. Weinberg are of great importance and connected with research conducted in the following areas:

- Physics of Solids (stress-strain properties of metals, dielectrics, amorphates, behavior of solids beyond their elasticity limits, and viscous friction). For the research conducted by Prof. Weinberg in this field he is considered the founder of physics of solids in Siberia.

- Physics of Ice and Glaciers, the control of icing (a fundamental work 'Ice, its Properties, Origin and Disappearance' (1940)).

During his life in Siberia Prof. Weinberg has published about 180 works (the total amount is about 500). His textbook 'A Course on Physics' (1500 pages) had been using by students for thirty years.

In 1923 the first in Siberia Research Institute for Applied Physics was established on the initiative of Prof. Weinberg. He had become its first director. In October 1928 the Institute was reorganized in the Siberian Physicotechnical Institute.

In 1928 a young and well-known physicist Pyotr Savvich Tartakovsky arrived from Leningrad to carry out research in the Siberian Physicotechnical Institute in the field of quantum physics. In order to investigate the internal photoeffect phenomenon in dielectrics discovered by him in 30s, he attracted the team of young physicists among which was Alexander Akimovich Vorobiev. Being a postgraduate A. Vorobiev was engaged in research in alkali-haloid crystals' properties in strong electric fields. Since 1940 A. Vorobiev has started to work at TPU, and soon afterwards become the Head of Department. He intensively developed research at TPU. New Research Institutes were established that time.

In the Research Institute for Nuclear Physics (RINP) the accelerating technology was intensively developing as well as nuclear and elementary-particle physics on its basis. By

means of the synchrotron 'Sirius' the following measurements have been conducted:

- lifetime of 0-meson, measured with a high precision (V. Kryshkin, Y. Yusupov);
- asymmetry of +-meson photo-formation throughout nucleons and nuclei (V. Kuznetzov)
- the cross-section of h-meson-nucleon interaction compared with cross-sections of h-meson photo-formation throughout complex nuclei (G. Dudkin)
- integral cross-sections of partial reactions of --meson photoproduction over nuclei

Within the walls of RINP the theory of hyper nuclei was developed under the leadership of Prof. V.A. Filimonov, which is used in all nuclear centers of the world. Exotic nuclei are being studied at TPU up to the present time about which testify the main theoretical investigations of h-nuclei (Prof. V. Tryasutchev). Professor Pyotr Alexeevich Cherdantzev suggested the unusual fission mechanism, which implies the formation of two centers in a parent nucleus. Scores of years hence his predictions proved correct.

Many of results described above were included in monographs and textbooks on nuclear and particle physics and are the significant landmark in the research of natural science.

Works on the theory of channeling crystals and radiation of relativistic electrons have been started at TPU in the early 70's under the leadership of Prof. A. Vorobiev. The team of physicists who have begun those investigations, was headed by Professor Sergey Alexandrovich Vorobiev, and soon the team organized laboratory 13 at RINP now headed by Y. Pivovarov, D.Sc. In 1979 the effect of channeling electrons in crystals on the inner beam of the synchrotron was experimentally found out. In 1985 the group of our scientists (S. Vorobiev, B. Kalinin, S. Pak, A. Potylitzin) discovered a new type of monochromatic radiation in crystals — parametric X-rays. Within following years the physicists of Tomsk Polytechnic University have conducted a cycle of investigations of parametric X-rays responses. The experimental findings obtained were supported by many tests conducted on accelerators of the USA, Japan, Canada, Germany, Ukraine, and Armenia. Subsequent years have seen remarkable discoveries in this field: the increase of monochromatism and intensity of transitional radiation owing to periodical foil 'piles' used as a target and the discovery of diffraction radiation of non-relativistic electrons. All those findings gained international recognition of the scientific community: four international symposia 'Radiation of relativistic electrons in periodical structures' were held in RINP, proceedings of which were published in special numbers of the journal 'Nuclear Instruments and Methods in Physics Research'.

Since 1959 the research at RINP has been carried out by means of cyclotron to investigate the mechanism of interaction between deuterium ions and helium isotopes and nuclei. As a result of that research more data have been obtained on elastic deuterons' scattering throughout nuclei, and the nature of anomalies of H4 back scattering was discovered on light nuclei.

The research findings were published in monographs on nuclear physics. On the basis of basic research a set of nuclear-physical methods has been developed which allowed getting principally new information about properties of solids. These methods helped to discover a new effect of 'Recreation of the structure of defect crystals by means of ionizing radiation (the effect of small doses)' (I. Chernov, A. Mamontov). The principally new is the fact that the weak influence of ionizing radiation causes fundamental changes in crystals, brings a crystal into equilibrium state and improves its physical properties.

Since 1970 research was intensively carried out in the field of undulator radiation with the help of a special iron-free unulator. The findings obtained in spectral angular radiation responses were used further in the developing service undulators by many of foreign accelerators (M. Nikitin).

The following basic research has been carried out by means of high-current electron and ion accelerators:

- developed physical basics of the electron energy-SHF oscillations energy conversion (academician G. Mesyatz, correspondent member A. Didenko)

- invented and investigated new devices: relativistic magnetron and 'virkator'

- powerful ion beams generated from explosive-emission plasma (G. Remnev, Y. Usov)

- effects produced by blast waves, crater formation, modification of microstructure and properties of different materials (G. Remnev, A. Ryabchikov)

- physics of atom transfer within the condensed phase under the influence of powerful ion beams

Problems of particles' passing through a substance during a long period of time are still being topical. It is conditioned by that almost all information about the properties and structure of atoms, nuclei, and elementary particles is obtained from investigations of the interaction between particles and the substance. Such important problems as physics of cosmic beams, physics of nuclear reactors, radiation physics and chemistry, radiation engineering and technology, nuclear physics, radiation control, radiation medicine, flaw detection, atmosphere optics come to solving tasks of atom transfer. Monte-Carlo method, the most effective method of solving problems of atom transfer has become the object of independent investigations. All these problems are the components of research which is developing at the Faculty of Applied Physics and Engineering of TPU (A. Kolchuzhkin).

A number of important results were obtained in investigating transformation effects in electron-photon fluxes close by the atmosphere-Earth surface or multilayer absorbers used for the research of cosmic beams. The consequent theory of such transformation effects has been formulated on the basis of especially modified perturbation theory. Theoretical findings were supported by the experiments carried out by our scientists on the accelerator 'Sirius' at RINP.

While working at the Department of General Physics Professor Vladimir Alexeevich Sokolov has conducted research into the interaction between non-equilibrium gaseous media and the surface of solids. As a result a non-heat radiation of solids in flames or phenomenon of candoluminescence was discovered. The scientific school created by Prof. Sokolov in the realm of chemical physics of surfaces has been recognized all over the world, especially since the 1980s when the role of the surface of solids has become more important in microelectronics, chemical lasers, non-equilibrium isotope separation, degradation of protective films, space-crafts, and so on. Results of investigations are abstracted in Prof. Sokolov's monographs 'Lumminescence and absorption' (1969) and 'Radicalorecombinating luminescence of semiconductors' (1976). Later the followers of Prof. Sokolov had discovered and studied new effects of the interaction between free atoms and the surface of solids, i.e. the generation of electron-hole couples, emission of charged particles, and luminescence or non-equilibrium heterogeneous chemoeffects (V. Styrov, Y. Turin).

Since 1980 Professors I. Chernov and Y. Turin (Department of General Physics) have conducted experiments on the hydrogen subsystem in metals as a vehicle which effectively accumulates energy of diverse external effects, including radiation. Accumulating features of the hydrogen subsystem are displayed in effects of non-equilibrium diffusion, modification of material properties, emission of charged particles in the output of atomic hydrogen from solids under the irradiation process. These properties of solids must be taken into account in creating hydrogen accumulators, settling problems of the first wall of nuclear and thermonuclear reactors. This scientific trend gained the international recognition.