FOREWORD

The present report on FLNP activity covers a two-year period from 1992 to 1993. (Earlier, the 1992 annual report was released in Russian). This was a time of radical economic and political changes in JINR member states which posed a series of difficult problems for Institute and Laboratory authorities connected with supporting and developing the research program. The main achievement of this difficult period is that the efficiency and stability of the Laboratory staff was preserved and we succeeded in solving large-scale scientific and technical problems within the framework of the FLNP programme.

With the aid of neutron scattering new results have been achieved into investigations in the physics of condensed matter. Using the method of inelastic cold neutron scattering the complex structure of the elementary excitation spectrum in superfluid helium was revealed. In bismuth HTSC compounds studied by neutron diffraction, the existance of an additional superstructure in the crystalline lattice was proven. By measuring the depolarization of a polarized neutron flux in superconducting YBaCuO ceramics the manifestation of the depinning line was observed in the magnetic field distribution of the sample. With the aid of reflectrometry using polarized neutrons, an investigation was carried out with latent film structures of Co/Cu/Co in which a very weak antiferromagnetic coupling between magnetic and non-magnetic layers was observed.

The experimental facilities for studies in the physics of condensed matter have been considerably developed and perfected. In 1992 for the first time at a pulsed neutron source, a Fourier diffractometer was put into operation. The achieved resolution and luminosity put this new HRFD diffractometer in the ranks of the best spectrometers in the world. The group of diffractometers at the IBR-2 reactor was also enhanced with a new specialized DN-12 setup designed for investigations under very high pressures. The first stage of up-dating the MURN small-angle diffractometer has been completed, bringing it up to the level of the best set-up of this type, located at ILL (Grenoble). The realization of the second stage (commissioning of a new position-sensitive detector, in particular) will make it possible to obtain record parameters at the MURN spectrometer with the installed cold moderator.

In another main field of research foreseen in the FLNP scientific programme - neutron nuclear physics - a number of experiments with a unique monoisotopic ^{113}Cd sample should be noted. Earlier a series of p-wave neutron resonances was observed by FLNP physicists. Their spins were determined in a joint Dubna-Geel experiment. At the LANSCE pulsed neutron source a joint group of scientists from Dubna and Los Alamos measured p-odd effects in these resonances. An analysis of all data has not confirmed the sign coherence of p-effects observed earlier for thorium and uranium nuclei. The technique developed at FLNP to investigate the cascade γ-decay of a compound nucleus caused by thermal neutron capture, was applied to the measurement of cascade γ-radiation for the ^{170}Yb radioactive isotope produced after the β-decay of ^{170}Lu. The known scheme of levels has been considerably corrected and supplemented, thus revealing the existence of good prospects for combining this technique with traditional methods of nuclear spectroscopy. New measurements of the fission cross-section for the ^{237}Np isotope were performed, which eliminated discrepancies between the reported data.

Among the methodical developments, implementation of which is now under way, two major projects, UGRA and ISPIN, take a noticeable place. The first project aims at determining the neutron electric polarizability by a precision measurement of the angular distributions of scattered neutrons of intermediate energies. The purpose of the second project is to create a set-up for measuring the neutron lifetime using ultracold neutron gas from the BIGR pulsed reactor at Arzamas.

Among the applied studies, we can note the completion of the development and the first broad application of the method of biomonitoring atmospheric deposition with the aid of neutron activation analysis of moss and pine needles, the successful testing of methods of dynamic radiography, and neutron doping of silicon at the IBR-2 reactor.

The stable operation of the FLNP base installations, the pulsed IBR-2 reactor and the IBR-30 + LUE-40 pulsed booster, has contributed to the fulfilment of the FLNP research program. The IBR-2 reactor is still the most intense neutron source in the world. In 1994 it will be 10 years since it was put into service. In connection with the partial burn-up of fuel in 1993, the first renewal of the active core was carried out, and permitting the reactor to run for 6 more years, in the previous working mode. The physical start-up of a cold moderator based on solid methane has become a great achievement of 1992. An enhancement of the cold neutron flux by approximately a factor of 5 was obtained as compared with the regular water moderator. The program to prepare the moderator for regular operation at the reactor was completed in 1993.

In the near future another base installation, the IBR-30, will be replaced by a new high resolution pulsed neutron source. In March 1993 the Plenipotentiary Committee of JINR member-states arrived at the decision to construct a specialized source of resonance neutrons (IREN). The rate the project development has been carried out in collaboration with the Institute of Nuclear Physics of the Siberian Branch of the RAS (Novosibirsk) and some other Russian research institutes, allows us to hope that the installation will be put into service at the planned time - in 1996.

The data acquisition and processing complex of FLNP has received a large development effort. The computing complex distributed according to territories is based on seven SUN Work Stations and VAX Microcomputers which have been substituted for the central FLNP processor, with the PDP-11/70 computer forming its basis for many years. This work has been implemented within the framework of the CAS project - Computer-Aided Systems - for the IBR-2 spectrometers. In 1993 the project was carried to completion. Practically all neutron spectrometers at the base installations of the Laboratory are equipped with the new generation PC/AT computers. At the present time the laboratory computer network unites more than 100 personal computers and the computers of the physical installations.

The scientific achievements of FLNP were commended with JINR awards. In 1992 first prize in the scientific and technical research section was given to the series of investigations on "Small-angle neutron scattering as a method to investigate the submolecular structure of matter". The "P-odd correlation investigation in reactions with light nuclei following the capture of thermal polarized neutrons with the emission of charged particles" research was awarded the encouraging prize. In 1993 first prize in the scientific and technical applied studies section was granted to the work "Textural analysis by the method of neutron diffraction and problems of geophysics".

An extensive program of collaboration with foreign scientific centers within the agreements and minutes adopted by JINR, or directly by the Laboratory, undoubtedly contributed to obtaining high scientific results. Contacts with German research institutes within the framework of the JINR-BMFT agreement and with Hungarian institutes were especially diverse.

During the period covered by the report the structure of the Laboratory underwent some changes. The Department of Electronics and Computing Techniques was dissolved and a number of sectors and research groups were organized within the scientific Department of the Physics of Condensed Matter headed by A.M.Balagurov. The low temperature sector became part of the Institute of Technical Physics Problems of the Russian Ministry of Atomic Energy.

The number of employees has been reduced from 580 people for 1.01.92 to 492 people by the beginning of 1994.

The creation of a large group of neutron spectrometers at the FLNP base installations and, a broad level of cooperation with other institutes gave rise to the creation of a new user policy. Committees of users for every research direction have been established comprizing the most well-qualified members of the Laboratory Staff.

The budget financing of FLNP during these years was only enough to maintain normal functioning of the personnel and infrastructure of the Laboratory. The resources for supporting and developing scientific research to a considerable extent were provided by external investments granted by the Russian program of high-temperature superconductivity, the Russian fund for fundamental research and other programs.

In 1992 the Laboratory of Neutron Physics suffered a heavy loss. On the 1st of August Yu.M.Ostanevich (born 25.07.1936) died. He was a Doctor of physics and mathematics head of the scientific Department of Physics of Condensed Matter. Yu.M.Ostanevich was a recognized leader in the team of experimenters working in the field of fundamental and applied physics of condensed matter. He was a prominent scientist and a well-known specialist in the world community of neutron physicists for investigations in the field of solid matter with the aid of small-angle neutron scattering. The name of Yu.M.Ostanevich will undoubtedly remain in the history of the Frank Laboratory of Neutron Physics of JINR.

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