

# 1. SCIENTIFIC RESEARCH

This chapter deals with reviews and original communications on the results of scientific research carried out in 1992-93 at FLNP in the three principal fields of research foreseen in the FLNP scientific program: the physics of condensed matter, neutron nuclear physics, and applied research.

## 1.1. EXPERIMENTAL EQUIPMENT

The base installations of the Laboratory used for implementing this research were the IBR-2 fast pulsed reactor and the IBR-30 pulsed booster. The experimental equipment for studies in the physics of condensed matter is located at the IBR-2 reactor (Table 1), and for studies in neutron nuclear physics, mainly at the IBR-30 booster (Table 2).

Table 1

Neutron spectrometers at the IBR-2 pulsed reactor

Spectrometer	Object of investigation	Collaboration
<i>I. Neutron diffraction</i>		
1. Time-of-flight diffractometer, DN-2	Crystal structure, phase transitions, transition processes	Russia, France, Germany, et.al.
2. High resolution Fourier diffractometer, HRFD	Precise structure analysis	Russia, Finland, GB, Germany
3. Time-of-flight diffractometer, DN-12	Crystal structure at high pressure (to 200 Kbar)	Russia, Germany, Hungary, Uzbek Repub.
4. Texture diffractometer, HRNS	Textures of industrial products and rocks	Russia, Germany
5. Diffractometer with a pulsed magnetic field, SNIM	Magnetic structure in a magnetic field of up to 15 T	Russia, Bulgaria, Czech
6. Diffractometer of ideal crystals, DIFRAN	Dynamic diffraction of neutrons	Russia, Latvia
<i>II. Small-angle neutron scattering</i>		
7. MURN spectrometer	Subatomic structure of matter: glasses, solutions, polymers	Russia, France, GB, Germany, Hungary, Ukraine
<i>III. Inelastic scattering of neutrons</i>		
8. Direct geometry spectrometer, DIN	Hydrogen in metals, liquid helium	Russia
9. Inverted geometry spectrometer, KDSOG	Crystal fields, phonon spectra	Russia, Poland
10 High resolution spectrometer, NERA-PR	Molecular spectroscopy	Russia, GB, Poland
<i>IV. Neutron optics</i>		
11. Spectrometer of polarized neutrons, SPN-1	Magnetic inhomogeneities, domains	Russia, France, Germany, Poland
12. Neutron reflectometer, REFLEX	Surface phenomena, internal fields	Russia, Germany, Hungary, Poland

Table 2

## Neutron spectrometers at the IBR-30 booster

No Beam	Spectrometer	Object of investigation	Collaboration
1	PARCS	<i>Rare reactions (neutron, charged particles) on stable and radioactive nuclei in the resonance energy range</i>	Russia: PINP; USA
1A	CASCADE	<i>Two quanta decay of compound states</i>	Latvia
3	DRENIS	<i>Sub-barrier fission</i>	Bulgaria
4	POLYANA	<i>Polarized neutron and nuclei</i>	USA
5	DELRENE	<i><math>\gamma</math> - spectra of fission fragments, fission of aligned nuclei</i>	Russia: PEI; Slovakia
7	UGRA	<i>Neutron elastic scattering angular distributions</i>	Germany
7	ROMASHKA	<i><math>\gamma</math> - multiplicity in capture and fission</i>	Russia: RNC KI; Bulgaria

The reported investigations were partly carried out at external neutron sources. For example, the entire program of research with ultracold neutrons is implemented at the reactors of the St.Petersburg Institute of Nuclear Physics (Gatchina) and All-Russian Research Institute of Experimental Physics (Arzamas). On the other hand, the interest of external users in the neutron sources of the Laboratory is rising. During the past two years the number of users has, in particular, increased in the field of the condensed matter physics, which can be seen from Table 3.

Table 3

**Experiments on the IBR-2 spectrometers**  
November 1992 - June 1993

Spectrometer	Number of experiments (samples)	Users			Comments
		FLNP	Others	Total	
1	2	3	4	5	6
<b><u>Diffraction:</u></b>					
DN-2	14(20)	10	12	22	<i>Structure and real-time Structure</i>
HRFD	4(6)	4	6	10	
DN-12	2(2)	1	3	4	<i>High pressure</i>
HRNS	3(72)	2	8	10	<i>Texture analysis</i>
DIFRAN	1(1)	3	4	7	<i>Dynamic diffraction</i>
SNIM	2(1)	2	3	5	<i>Pulsed magnetic field</i>
<b><u>SANS:</u></b>					
MURN	17(280)	7	13	20	<i>Small angle scattering</i>
<b><u>INS:</u></b>					
DIN-2	5	2	12	14	<i>Direct geometry</i>
KDSOG	14(23)	5	7	12	<i>Inverted geometry</i>
NERA	10(38)	5	6	11	<i>Quasi elastic scattering</i>
<b><u>Neutron Optics:</u></b>					
SPN-2	13(9)	8	3	11	<i>Depolarization and reflectometry</i>
<b>Total</b>	<b>85(&gt;450)</b>	<b>49</b>	<b>77</b>	<b>126</b>	