ОБЪЕДИНЕННЫЙ ИНСТИТУТ ЯДЕРНЫХ ИССЛЕДОВАНИЙ

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Материалы 2-й сессии Программно-консультативного комитета по физике конденсированных сред

15—16 ноября 1994 года

Documents of the Programme Advisory Committee for Condensed Matter Physics

2nd meeting, 15—16 1994

Дубна 1994

Материалы

2-й сессии

Программно-консультативного комитета

по физике конденсированных сред

15-16 ноября 1994 года

СПИСОК УЧАСТНИКОВ:

Члены ПКК и приглашенные эксперты

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Гощицкий Б.Н. – ИФМ, Екатеринбург, Россия
Козубек С. – ИБ, Брно, Чехия
Пепи Ж. – ЛЛБ, Сакле, Франция
Румянцев А.Ю. – РНЦ "Курчатовский институт", Москва, Россия
Форсайт Б. – РАЛ, Чилтон, Великобритания (представляет А.Тейлора)
Чер Л. – ИИФТТ, Будапешт, Венгрия
Шрайбер Ю. – ИНК, Саарбрюкен, Дрезден, Германия

Члены *ex officio*, назначенные от ОИЯИ

Аксенов В.Л. – директор ЛНФ
Вылов Ц. – вице-директор ОИЯИ
Иткис М.Г. – заместитель директора ЛЯР
Красавин Е.А. – начальник отдела ЛЯП
Приезжев В.Б. – начальник отдела ЛТФ

Эксперты

Белушкин А.В. – ЛНФ ОИЯИ
Веселаго В.Г. – МФТИ, Москва, Россия
Киселев В.А. – Министерство по атомной энергии, Москва, Россия
Корнеев Д.А. – ЛНФ ОИЯИ
Лаутер Г. – ИЛЛ, Гренобль, Франция
Назаренко В.А. – ПИЯФ, Гатчина, Россия
Окороков А.И. – ПИЯФ, Гатчина, Россия
Мааюф Р. – ЦЯИ, Каир, Египет
Рапеану С. – ИАФ, Бухарест, Румыния
Садыков Р.А. – ИФВД, Москва, Россия
Сердюк И.Н. – ИБ, Пущино, Россия
Соменков В.А. – РНЦ "Курчатовский институт", Москва, Россия
Трунов В.А. – ПИЯФ, Гатчина, Россия
Цыбин А.С. – МИФИ, Москва, Россия
Черноплеков Н.А. – РНЦ "Курчатовский институт", Москва, Россия
Шпрингер Т. – КФА, Юлих, Германия
Щербак А.Ф. – Министерство науки, Москва, Россия

ПРОГРАММА

15 ноября

1. Доклад председателя ПКК об основных направлениях деятельности Комитета и решениях 76 сессии Ученого совета ОИЯИ – Ж. Пепи
2. О программе ОИЯИ по ФКС в 1995 г. и планах на 1996-98 гг. – В.Л. Аксенов
3. О политике пользователей на спектрометрах ИБР-2 – А.В. Белушкин
4. Результаты и перспективы исследования в области взаимодействия пучков тяжелых ионов с конденсированными средами – М.Г. Иткис
5. Перспективы развития радиобиологических исследований в ОИЯИ – Е.А. Красавин
6. Перспективы использования мюонной спектроскопии в физикеконденсированых сред – В.А. Жуков
7. Состояние дел по реализуемым проектам:
   а) РЕФЛЕКС – Д.А. Корнеев
   б) ДН-12 – Б.Н. Савенко
   в) НИДА – Ю.В. Таран
   г) Криогенный замедлитель – А.А. Беляков
8. Дискуссия по докладам
9. Заседание Научного совета Межотраслевой научно-технической программы России "Нейтронные исследования вещества"

16 ноября

10. Информация дирекции ОИЯИ – В.М. Жабицкий
11. Планы по развитию и модернизации реактора ИБР-2 – В.Д. Ананьев
12. Новые проекты
    а) Определение стабильных аберраций в человеческих лимфоцитах, облученных ускоренными тяжелыми ионами – Л. Ризнар
    б) Нейтронография биологических объектов на ИБР-2 – И.Н. Сердюк
    в) Развитие вычислительно-информационного комплекса ЛНФ – В.И. Приходько
    г) Синхротронные радиационные исследования в ЛСВЭ и планы работ на новом источнике синхротронного излучения в РНЦ "Курчатовский институт" – С.И. Тютюнников
    д) Поляризованные нейтроны – Г. Лаутер
15. Обсуждение проектов
16. Принятие решений

Рекомендации

Программно-консультативного комитета по физике конденсированных сред

(2-я сессия, 15-16 ноября 1994 г.)

ОБЩИЕ ЗАМЕЧАНИЯ

1. В соответствии с решением 74 сессии Ученого совета ОИЯИ (июнь 1993 г.) ПКК рекомендует дирекции ОИЯИ обеспечить представление Лабораториям оперативной информации о текущем состоянии бюджета ОИЯИ и его распределении по исследовательским программам (научным направлениям) в рублевой и валютной частях.

2. ПКК предлагает дирекции ОИЯИ установить различные принципы представления для новых проектов (новых установок) и для уже существующих научных программ (включая незначительное финансирование).

ОБЩИЕ РЕКОМЕНДАЦИИ

3. ПКК поддерживает рост экспериментальных и теоретических исследований и образовательной деятельности в физике конденсированного состояния, химии, материаловедении, биологии, осуществляемых в ОИЯИ соответствующими объединениями стран-участниц ОИЯИ и ассоциированными членами, и оценивает требуемое финансирование на 1996-1998 годы в размере 21 миллионов долларов США.

4. ПКК рекомендует:

а) отдать в 1995 году наивысший приоритет развитию системы окружения образцов и вычислительной инфраструктуры в Лабораториях ОИЯИ;

б) установить политику пользователей;

в) одобрить техническое задание на производство рабочего образца криогенного замедлителя и обеспечить его финансирование.

5. ПКК подчеркивает также, что после выполнения пунктов 4а-4в, изготовление нового никелиевого подвижного отражателя будет иметь самое большое значение для реактора ИБР-2. ПКК рекомендует дирекции ОИЯИ утвердить проект развития реактора ИБР-2 на период с 1995 по 2005 и обеспечить этой деятельности наивысший приоретет.

СПЕЦИАЛЬНЫЕ РЕКОМЕНДАЦИИ ДЛЯ НЕЙТРОННЫХ ИССЛЕДОВАНИЙ

6. ПКК с удовлетворением отмечает, что рассмотренные ранее новые спектрометры РЕФЛЕКС и НИДА близки к завершению и что проект МИКРОБ на ДН-12 выглядит весьма перспективным. ПКК настоятельно рекомендует усовершенствование установки МИКРОБ (передвинуть чоппер, добавить детекторы).

ПКК рекомендует реализовать также небольшие технические усовершенствования, предложенные на данной сессии для рефлектометра СПН.

7. ПКК рекомендует создание подразделения поддержки биологических экспериментов на ИБР-2, которое должно соответствовать нуждам пользователей. Сектору МУРН НЭОФКС ЛНФ необходимо провести переговоры с Отделом биофизики Лаборатории ядерных проблем о наиболее оптимальной форме такого подразделения. На организацию и текущие расходы этого подразделения следует выделить соответствующую финансовую поддержку.

8. ПКК рекомендует начальнику измерительно-вычислительного комплекса ЛНФ совместно с физиками проработать детальное предложение по усовершенствованию управления спектрометрами, системы сбора и обработки данных.

РЕКОМЕНДАЦИИ В ДРУГИХ ОБЛАСТЯХ

9. ПКК рекомендует реализовать в ОИЯИ проект "Определение стабильных аббераций хромосом в лимфоцитах человека, облученных тяжелыми ионами". В частности, следует обеспечить для этого проекта пучковое время на ускорителе У400-У400М в количестве 150 часов на 3 года.

10. Учитывая взаимодополняемость методов рассеяния нейтронов и синхротронного излучения для физики конденсированных сред, ПКК рекомендует усилить сотрудничество между РНЦ "Курчатовский Институт" и соответствующими группами ОИЯИ.

11. Группе, заинтересованной в исследованиях с помощью мюонов, рекомендуется включиться в общие программы с остальными группами.

РАЗНОЕ

12. ПКК подчеркивает, что все новые проекты и предложения должны готовиться в соответствии с правилами ОИЯИ, включая научное обоснование, этапы выполнения и предполагаемое финансирование.

13. На следующей сессии ПКК планирует:

а) заслушать состояние работ по системам создания условий на образцах с предложениями по их усовершенствованию;

б) заслушать специальное предложение по усовершенствованию спектрометра МУРН: улучшение разрешения, возможность анизотропных измерений, специальное оборудование для окружения образца (гониометр, электромагнит, различные печи и системы охлаждения), развитие программного обеспечения сбора и обработки данных;

в) заслушать предложение об окончательном расположении холодного источника и соответственным возможным перераспределением расположений спектрометров;

г) начать регулярное рассмотрение состояния дел на всех существующих нейтронных спектрометрах;

д) заслушать доклад о реализации политики пользователей (и в дальнейшем рассматривать данный вопрос ежегодно).

14. ПКК утверждает список и сроки конференций по тематике ПКК в 1995 году и просит дирекцию ОИЯИ содействовать их успешному проведению. ПКК подчеркивает особый интерес к предстоящей 7-й Международной школе по нейтронной физике как важного события в сфере образовательской деятельности.

15. ПКК продлевает полномочия д-ра Ж.Пепи на посту председателя ПКК сроком на 1 год.

16. Следующее заседание ПКК состоится в Дубне 10-11 апреля 1995 года.

Documents
of the Programme Advisory Committee
for Condensed Matter Physics

2nd meeting, 15-16 November 1994

LIST OF PARTICIPANTS:

Members of the PAC and invited experts

Independent members:

Cser L.	- ISSP, Budapest, Hungary
Forsyth B.	- ISIS Facility, RAL, UK (representing A.Taylor)
Goschitsky B.	- IPM, Ekaterinburg, Russia
Kozubek S.	- IB, Brno, Czech Rep.
Pepy G.	- LLB, Saclay, France
Rumyantsev A.	- RSC "Kurchatov Institute", Moscow, Russia
Schreiber J.	- INT, Saarbrücken/Dresden, Germany

Ex officio members appointed from JINR:

Aksenov V.	- Director, FLNP
Itkis M.	- Deputy Director, FLNR
Krasavin E.	- Chief of Department, LNP
Priezzhev V.	- Chief of Departement, BLTP
Vylov Ts.	- Vice-Director, JINR

Experts:

Belushkin A.	- FLNP, JINR
Chernoplekov N.	- RSC "Kurchatov Institute" Moscow, Russia
Kiselev V.	- Ministry of Atomic Energy, Moscow, Russia
Korneev D.	- FLNP, JINR
Lauter H.	- ILL, Grenoble, France
Maayouf R.	- NRC, Cairo, Egypt
Nazarenko V.	- PINP, Gatchina, Russia
Okorokov A.	- PINP, Gatchina, Russia
Rapeanu S.	- IAP, Bucharest, Romania
Sadykov R.	- IHPP, Moscow, Russia
Serdyuk I.	- IP, Puschino, Russia
Shcherbak A.	- Minister of Science, Moscow, Russia
Somenkov V.	- RSC "Kurchatov Institute" Moscow, Russia
Springer T.	- KFA, Jülich, Germany
Trunov V.	- PINP, Gatchina, Russia
Tsybin A.	- MEPI, Moscow, Russia
Veselago V.	- MPTI, Moscow, Russia

PROGRAMME

15 November

1. Report of the PAC Chairman about the guidelines of the PAC activity and the last Scientific Council session — G.Pepy
2. JINR's programme on condensed matter physics for 1995 and plans for 1996-98 — V.Aksenov
3. User policy for the IBR-2 based setups — A.Belushkin
4. Recent results and perspectives of investigations in the field of heavy ions interaction with condensed matter — M.Itkis
5. Development of radiobiological investigations at JINR — E.Krasavin
6. Perspectives for using muon spectroscopy in the field of condensed matter physics — V.Zhukov
7. Status of ongoing projects:
   a) REFLEX — D.Korneev
   b) DN-12 — B.Savenko
   c) NIDA — Yu.Taran
   d) Cryogenic moderator — A.Belyakov
8. Discussion of presented reports
9. Meeting of the Scientific Council of the National Neutron Scattering Programme of Russia

16 November

10. JINR Directorate Report — V. Zhabitsky
11. Plans for the development and upgrading the IBR-2 reactor — V. Ananyev
12. Overview of new proposals:
    a) Detection of steady aberrations in human lymphocytes irradiated by accelerated heavy ions — L. Ryznar
    b) Neutron scattering studies of biological substances at the IBR-2 reactor — I. Serdyuk
    c) Development of the FLNP measurement-and-computation complex — V. Prikhodko
    d) Synchrotron radiation research at LPP and plans for the new SRS at RSC "Kurchatov Institute" — S. Tyutyunnikov
    e) Polarized neutrons — H. Lauter
13. Discussion of proposals
14. General discussion
15. Conclusions and recommendations

RECOMMENDATIONS

of the Programme Advisory Committee for Condensed Matter Physics
(2nd meeting, 15-16 November 1994)

General remarks

1. Following the decision of the 74th session of the JINR Scientific Council (June 1993), the PAC recommends that the JINR Directorate provides the Laboratories with prompt information on the current situation with the Institute's budget and its distribution over research programs (scientific directions) in its rouble and hard-currency parts.

2. The PAC suggests to the JINR Directorate to have different presentation criteria for projects (new installations) and for running scientific programmes (including minor investments).

General recommendations

3. The PAC supports the growth of the experimental and theoretical research and educational activities in condensed matter physics, chemistry, materials, biology performed at JINR by the relevant communities in the member and associate countries (an evaluation of the required amount of money is US$ 21 million for the years 1996-1998).

4. The PAC recommends

a) to give in 1995 highest priority to the sample environment and computational infrastructure of the Laboratories;

b) the establishment of the user policy;

c) to give approval to the technical proposal for the manufacturing of the working sample of the cold moderator and to provide its financing.

5. The PAC also stresses that, once the items 4a and 4c have been established, the fabrication of the new Ni-alloy moveable reflector will be of utmost importance for the IBR-2; and the PAC further recommends that the JINR Directorate approves the project for the upgrading of the IBR-2 reactor for the period from 1995 to 2005 and provides this activity with high priority.

Specific recommendations for the research with neutrons

6. The PAC notes positively that the previously-examined new spectrometers REFLEX and NIDA are nearly completed and that MICROB on DN-12 is very promising. The PAC recommends strongly an improvement of MICROB (move a chopper, add detectors).

It also encourages minor technical improvements proposed at this session for the SPN spectrometer.

7. The PAC recommends that the size of a biological unit should be compatible with the needs of general users, and be linked to the Biophysics Department of the Laboratory of Nuclear Problems. The involved people should have negotiations about the exact form of the unit. Some appropriate financial support should be devoted to the establishment and running cost of this unit.

8. The PAC supports the idea for the FLNP measurement-and-computational complex head to prepare together with the spectrometer scientists a detailed proposal for the upgrading of the spectrometer control, data acquisition and assessment.

Recommendations in other fields

9. The PAC recommends that the project "Detection of stable chromosome aberrations in human lymphocytes irradiated by accelerated heavy ions" be realized at JINR. In particular, the relevant beamtime at the U400-U400M accelerator should be provided in the extent of about 150 h/3 years.

10. Considering the complementarity of neutron scattering and synchrotron radiation methods for condensed matter studies, the PAC encourages close collaboration between the Kurchatov Institute and the JINR teams. A full proposal might be formulated, however the PAC presently sees no funding possibility for it.

11. The team interested in research with muons is encouraged to involve in common programmes with other groups.

Miscellaneous

12. The PAC emphasizes that all projects and proposals must comply with the JINR procedure including the scientific objectives, the phasing and financial considerations.

13. At the next meeting the PAC

a) would like to hear about a sample environment review with enhancement proposals;

b) would like to be informed about a special proposal to improve the spectrometer MURN: better resolution, possible anisotropic measurement, specific sample environment (goniometer, electromagnet, various furnaces and cooling systems), better connection of software and on-line data reduction;

c) will hear about a proposal for the final position of the cold source and associated possible "reshuffling" of spectrometers.

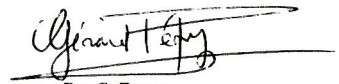
d) will start regular examination of status and activity of all existing neutron spectrometers;

e) will listen to the user policy report (further once a year).

14. The PAC approves the list and schedule of Conferences on the PAC subject matter in 1995 and asks the JINR Directorate to assist in their successful organization. The PAC stresses its special interest to the coming 7th International School on Neutron Physics as a major educational activity.

15. The PAC prolongs the term of duty of Dr.G.Pepy as the PAC Chairman for one year.

16. The next meeting of the PAC will be held in Dubna on 10-11 April 1995.



Dr.G.Pepy

Chairman of the PAC

REPORTS ON STATUS AND DEVELOPMENT OF IBR-2 SPECTROMETERS

HRFD

V.G.Simkin, V.E.Novozhilov, A.I.Ostrovnoj

From October 1993 to December 1994, the following technique work has been performed on the HRFD spectrometer:

1. The comparison of the Li^6 glass as made by the firms GOI (St. Petersburg) and ORTEC has been carried out. This kind of glass is necessary for production of new detectors to be positioned at the scattering angles of 90 and 156. It has been ascertained that the GOI glass quality is not worse than that of the ORTEC glass. Moreover, the GOI glass quality has been found to be better than that of the ORTEC glass with reference to certain parameters while its price is lower by an order of magnitude.

2. After a repair, the disk chopper has been reassembled in the circle corridor and started to operate at the angular velocity of 600 revolutions per minute. This has allowed the background conditions at a sample to be improved.

3. The work on additional collimation of the neutron beam has been performed to decrease the background at the encoder of the Fourier - diffractometer, which has allowed its service life to be extended at least three times.

4. The Li^6 glass detector has been installed and preliminary tested at the scattering angle of 90. This detector allow the range of measured d_{hkl} to be extended, as well as the mechanical stress investigations in the optimum geometry and the high pressure experiments to be carried out.

5. Experiments on investigations of the properties of the methane cryogenic moderator have been performed, which would allow the recommendation on its further development to be proposed.

On the HRFD spectrometer, the work aimed at the extension of its capabilities will be performed in 1994-95.

For the high pressure investigations, a gas compressor will be mounted; the cells for the pressure range 6 to 8 kbar will be designed, manufactured, and mounted in cooperation with Unipress (Poland). Necessary expenditure is $10000

For the high temperature investigations, a vacuum furnace for the temperature range 600 to 900 C will be designed, manufactured, and tested. Necessary expenditure is $3000 - 5000

1. To advance the mechanical deformation investigations and the high pressure experiments, one more Li^6 detector with 20 photomultipliers will be manufactured and positioned on the other side of the neutron beam. This job will be performed within the project NIDA.

2. A work on improvement of the diffractometer parameters will be performed. This includes an adjustment of the rotor and stator system of the Fourier chopper, 156°

Li^6 detector, and the 6′ - collimator, as well as manufacturing and installation of the vacuum chamber for investigated samples.

The following electronic work has been performed on HRFD spectrometer in 1994:

The 8192 time channels PC-type RTOF analyser has been performed and mounted on the HRFD spectrometer. The RTOF analyser are destined to working with the 90 degree Li detector and will be used for NIDA project. This analyser is much more cheaper and have a less size than the old Finland RTOF analyser. Besides, it have comparative technical characteristics.

VME standard installation has been carried out. It consists of the time-code converter, the memory block, The 2 Mbit ROM. It allows to accumulate time-of-flight experimental data with program assigned time channel width and investigate a transitive processions in real time.

The functional scheme of HRFD electronics in VME standard has been carried out. Realisation of this project will be performed in 1995. The installation will be consist of electronics of "point" detectors, electronics of the one-dimensional positive sensitive detector, two channels of low resolution apparatus, four 8192-channels RTOF analysers.

Brief description of the software have been developed for HRFD from October 1993 up to the December 1994.

The software for the data acquisition and control system of HRFD as well as software for analysis and graphic rendering of experimental data were developed. The control program FDC allows user to test, setup parameters and control during experiments of the data acquisition electronics in BITBUS standard and fourier chopper electronics.

FDC performs the experiment as a set of sweeps. Setup operation allows user to change time of sweep, delay, speed of chopper rotation, type of frequency window. Blackman model of frequency window is accepted and it is possible to use different types of the same model of the frequency window in order to compensate the mechanical errors in choppers rotation. Four files in a special format are saved, as a result of measurement in a single sweep. Two files contain the negative and positive components of high resolution spectrum (it is calculates as a result of subtraction of their components), third file contains autocorrelation function and the fourth is graph of chopper rotation speed. Setup operation allows user to cancel the writing on the disk last two files, start measurement at the given time, suspend measurement on the given time between two neighbouring sweeps (this pause may be used for change position of mechanical devices, which is performed by another computer).

NDC program was installed for the system intended for control of the mechanical devices, refrigerator and low resolution spectra acquisition electronics.

This system is built on the basis of PC/386 and electronics in CAMAC standard. Absolute time of the computer clocks is used for the synchronisation both systems.

NDVI routine is used for viewing of low resolution spectra and calculation parameters of marked in interactive mode peaks (position, height and width on the half of height). Program FD is intent to calculate and view of high resolution spectra and it's components. Also FD allows user to mark peaks and calculate it's parameters.

Prototype of data RTOF-correlator on the basis of PC/AT and board with a digital signal processor TMS320C25 was developed for the design data acquisition electronics for another detector in HRFD.

SPECTROMETER OF POLARIZED NEUTRONS SPN-1

A.V.Petrenko

During the current period (from 1.01.93) I carried out following affairs:

Spectrometer work for the experiments was ensured. In this case necessary repair and maintenance works were ensure. Due to the faults of spectrometer itself it was load not more than 1 day when the electromagnet E-2 faults. Now this magnet is under reparation and modernisation, and I hope to obtain ≈ 5 % increasing of Hmax.

I am participating in Russian-Germany project for SPN-1 modernisation. I worked out draughts for mounting at the spectrometer aligning laser, step motors, draughts of the controlled diaphragm for the neutron detector are under preparation. Execution of this affairs will essentially simplify and speed up works for placing and aligning samples in neutron beam, that will dill to the economy of great amount of measuring time.

In the frameworks of this project the cryostat for T=1.5 K÷300 C with superconduction solenoid (Hmax=1 T) and heater for neutron measurements with Tmax=2000 C were manufactured. At present time temperature control system for cryostat, magnetic system for heater and one dimensional position-sensitive neutron detector are under preparation. Execution of cryostat and heater will greatly increase achievable temperature interval, that will make possible on SPN-1 magnetic measurements with different temperatures, that are limited at present time with three intervals: 4.6 K÷20 K, 77 K÷100 K, room temperature. Execution of PSD for reflectometry measurements will give us possibility to measure diffuse scattering simultaneously with measurement of reflected beam and in addition will essentially simplify and speed up samples aligning.

Plans for 1995 :

1. Putting cryostat, heater and PSD into operation. Tie ining of this devices electronics with existence control electronics of SPN-1. Modernisation of spectrometer software.
2. Replacement of spectrometer control drive system.

3. Mounting of the aligning laser and connected with it modernisation of neutron vacuum channel.

This affairs demands not less then 50 % of working time of attached for spectrometer electronics engineer and software engineer and ≈3000 man-hours in FLNP workshop.

The main aim in spectrometer modernisation for 1995÷1998 is the replacement of spectrometers polarizer and analyzer. This replacement has the aim to increase intensity at the sample position and essentially improve the wave dependence of the neutron beam polarization in the range of long (more then 3 A) neutrons wavelengths. This affair needs preliminary methodical investigations that are connected with the choice of polarizer, optimal geometry. This investigations must be done during 1995. It needs 1000 man-hours in design department and 3000 man-hours in workshop of FLNP. Polarizers may have 50.000.000 rub. price.

REFLEX DIFFRACTOMETER - 9 BEAMLINE IBR-2

D.V.Lezhnev

The project is in the stage of completion.

At present, the adjustment in the beam of the main element of the spectrometer - the neutron-optical system is being carried out in cooperation with specialists from PINP RAS.

An electronic module for REFLEX-2 is manufactured. Software development for REFLEX-1 and REFLEX-2 is mainly completed. A stove for samples is ready. A helium cryostat is under test in the REFLEX-1 beam.

Manufacture of parts for the REFLEX-1 and REFLEX-2 has essentially slowed in the FLNP workshops. Financing in rubles for purchase of necessary components for the REFLEX-1, 2 instruments is strongly requested.

Plan for 1995:

1. Test operation of REFLEX-2 in January and REFLEX-1 in February.
2. Physical parameter measurements of the REFLEX-1, 2 spectrometers in March-April.
3. The REFLEX complex is to be commissioned in May.

Prospects for 1996-1998:

1. An increase in the luminosity by about a factor of 4 by means of a new thermal moderator with a flat face and slit recess, i.e., by creating a so-called neutron gun.
2. Equipping of REFLEX with an analyzer of the reflected beam polarization.
3. Creation of a superconducting solenoid-based magnetic system.

YuMO SPECTROMETER

A.I.Kuklin

The spectrometer is located on beam-line 4 of the reactor IBR-2. At last year the following important actions, which changed parameters of instrument were made:

1. Experiments with cold moderator were performed. These experiments show that intensity with cold moderator is 20-30 time more than water moderator within 3-14 Angstrom range wavelength.
2. First experiments with polyethylene scatter for foregoing variation of standard, which give absolute calibration of sample cross-section, were performed.

Now we have vanadium foils in front of the scattering detectors. The vanadium, along with advantage, have insufficient cross section for some samples. The polyethylene is standard for this purpose.

1. Installation of device of mechanical movement of collimator and sample table was continued. If we have problems with automatically control of position of sample and collimator, we should use mechanical device for adjustment.
2. Work for creation of thermostatic complex was begun. Now we have the thermostat, which operates only from +10 to +80#C. New device gives us the temperature range from -70 to +130#C.
3. First experiments for ability of application high pressure chamber was started. It was found, that thise chamber may be used for broad sort of samples.
4. Technical requirement for :
   - thermobox,
   - device for movement of thermostat and stabilization of position,
   - device for movement and variation standards, were prepared.
5. Line-connection with chopper and experimental room in experimental hall of reactor was fulfiled and long time experiments for estimation of difference of phase was performed. It was found, that phase of chopper is stable and changes phase no more the width of channel.

In nearest future I would like:

1. To create the thermostatic complex with computerized control of temperature, namely:
   - creation of thermobox, (design should be prepared up to the end of 1994),
   - creation of device for thermostat, (design should be prepared up to the end 1994),
   - purchase by interface for thermostat,
   - preparation of program for computeresed control of thermostat,
   - preparation of thermocontrol in thermobox and electronic block for computer line.

   (All complex should be ready the end of 1995.)
2. To create the devices for internal standards, including:
   - preparation of design,
   - creation of electronic block for control,

- preparation of program for control these devices.

3. Install the mechanical devices for change position sample table and collimator in two dimensional direction.

4. To create the electronic block for connection line signal from chopper (if phase change more than require) and computer and preparation program for these purpose.

5. To prepare these complex for checking of high voltage system.

For installation of all we need in additional financial support, and support of oure factory&design department, and also of electronics department.

By electronic departments next impotant work was performeed:

"Text"-program:

1. Preparation of spectrometer equipment-module "Master" and module "Slave".

2. Software for experimental data and on-line sorting of matrics 256 kB, using transputer T80 and PC. (This is first installation in LNP and second in JINR).

This work enable to us to receive needed speed in line-conection for system "TEXT". This is impossible to realise previously technic.

Next step including development of existing system for "TEXT" and possibilites new modules.

SNIM-2

G.A.Varenik, V.V.Nietz

The SNIM-2 consists of the NS-3 neutron spectrometer and the IMU-2 pulsed magnetic facility and is located at the 6b beam of IBR-2. It is designed for the condensed matter investigations by elastic and inelastic neutron scattering using a pulsed magnetic field. Until recently, NS-3 had been used at IBR-2 only as a neutron diffractometer but now the experiments on the inelastic neutron scattering from the single crystals with a pulsed field are being prepared.

In 1993 and early 1994, the diffraction investigations had been continued. These investigations dealt with two problems: a) kinetics of the induced spin-flop transition in antiferromagnets with the one-axis anisotropy, b) antiferromagnetic ordering induced by the external field in the rare-earth orthoferrites.

The work on improvement of the spectrometer performances has been continued. The results achieved in this activity can be appraised from the following performance data:

1. The temporal resolution in the transitional processes measurements by the neutron diffraction is about 4 mks.

2. The minimal relative width of the hysteresis loop is about 0.5% as reliably registered in a phase transition investigation in the pulsed magnetic field.

3. The width of the voltage distribution at the IMU-2 capacitor bank, i.e. the repetition rate of the amplitude values of the pulsed magnetic field, is within the limits of 0.4%.

To expand the spectrometer potentialities, the work has been continued on the creation of the generator of the rectangular magnetic field pulses. However, because of the serious shortage of money and personnel, this work was only restricted to the assembly of the equipment manufactured earlier for the first section of the generator. Besides, calculations have been performed of several types of the pulsed magnets for further physical investigations with greater volume of samples and better homogeneity of the magnetic field distribution.

The following measures are scheduled for the next year:

1. Preparation and performance of the experiments on methodology for refinement of the spectrometer parameters in the inelastic neutron scattering investigations using the pulsed magnetic field.

2. Performance of the first physical experiments on the registration of the soliton excitations at the magnetic phase transitions induced by the magnetic field with using of the inelastic scattering.

3. Bringing the installation of the rectangular pulse generator to the phase necessary for the adjustment work.

4. Elaboration and installation of the helium cryostat with cooling of the sample by the helium vapor for achievement of the temperature of 5 K in the work with the pulsed field.

DN-12 DIFFRACTOMETR

S.L.Platonov, V.E.Novozhilov

A model version of the neutron diffractometer for investigations of materials under high pressure has been mounted at Channel 12 of the IBR-2 reactor. The technique-testing measurements have been carried out. The time-of-flight resolution (~1.5%), neutron flux at the sample (~10^6 neutrons/cm/s), and the effect-to-background ratio have been determined. The effect-to-background ratio on the order of 100 has been obtained for the standard Al_2O_3 sample, which corresponds to a typical value for the best diffractometers at stationary reactors. The first physics experiments have been performed. New information has been obtained on the phase transitions in hemetite Fe_2O_3 (under a pressure of up to 4.7 GPa) and the behavior of unit cell parameters and interatomic distances in Hg-1212 ($HgBa_2CaCu_2O_{6.3}$) under a pressure of up to 3.6 GPa. Also, the vibration spectrum and structure change investigations have been performed for NH_4Cl under a pressure of 4 GPa.

Further improvement of the facility parameters is connected with an increase in luminosity and the effect-to-background ratio. These parameters are proposed to be improved by optimal disposition of the thermal neutron beam chopper, use of the

curved mirror neutron guide with a super-mirror covering instead of the vacuumized straight guide, and a new detector system consisting of 128 neutron counters instead of the 16 used now.

The engineering specifications are to be completed in 1994. The following is planned for 1995: to receive from Hungary the mirror neutron guide sections, to orders the nonstandard equipment, as well as to start the assembly of the mirror neutron guide, chopper, detector system, and biological shielding.

Planned for 1996-98:

- to complete the assembly of the facility;
- to perform the experiments on methodology;
- to arrange the work bay for the high pressure cell assembly and the pressure measurement of the cells;
- to fit out the facility with the physics equipment (cryostats, furnaces);
- to start performance of physics experiments on a regular basis.

For the present equipment, the attainable pressure is 10 - 15 GPa.

After completion of the facility improvement program, the attainable pressure will be 40 GPa.

DN-2 DIFFRACTOMETER

A.I.Beskrovnyj, V.E.Novozhilov

The diffractometer is equipped by two accumulating channels for experimental spectra. One of them is used for accumulating the spectra from PSD (Position Sensitive Detector). The operating program permits to scan the reciprocal space of the crystal in experiments with single crystals. The orientation of a crystal is carried out by computer operated thriple-axices goniometer GKS-100 with the use of a file, prepared previously. Due to this, the possibility has appeared to make the exposition for different orientations of polycrystal sample in automatical regime and, comparing the diffraction patterns, to determine the presence of the texture in sample.

The second channel is used for the accumulation of the diffraction patterns in the real time experiments. SNM-counters are placed on different distances and angles of scattering (1-170 deg.). Eight spectra are accumulated simultaneously. Memory size is 256 K. Using information from several detectors, it is possible to study diffraction spectra in the interval of d-spacing from 0.8 E to 60 E and inhomogeneities from 10 E to 3000 E in a small angle scattering.

The possibility of temperature changing is realised with the use of computer operated low temperature helium refrigerator.

It is planned to use two- co-ordinates position sensitive detector DIPS instead of PSD- detector on the delay lines and a triple- circled computer operated goniometer. This equipment of DN-2 permits to realise the possibility of completely automatic measurements of diffraction patterns of single crystals and to study a great

volume of a reciprocal space of a crystal at the same time. For realisation of this stage it is necessary to have the data acquisition system in VME- standard, to design and construct two channels time digital convertor, to make the operating program of triple- circled goniometer, to buy a few electronic blocs in CAMAC standard. The price of equipment is 7100 Krub. in the context of the price list of JINR central workshop of 1994 year.

THE KDSOG-M INVERTED GEOMETRY SPECTROMETER

I.Natkaniec, S.I.Bragin

During the reported period, the electric step motors have been installed at the spectrometer for automatic control of the analyzer crystals and detectors. Suitable electronic equipment and the software for the control of adjustment of the analyzer crystals and detectors have been developed and installed. The "Pravets" controlling computer has been replaced by Robotron-386. Two diffraction detectors have been added. The high voltage dividers for the individual adjustment of the detector sections have been made and installed. Manufactured and installed were the units of : stoppage of measurements at the absence of monitor count, chopper desynchronization, and the absence of the reactor starts; the shaft cryostat temperature control.

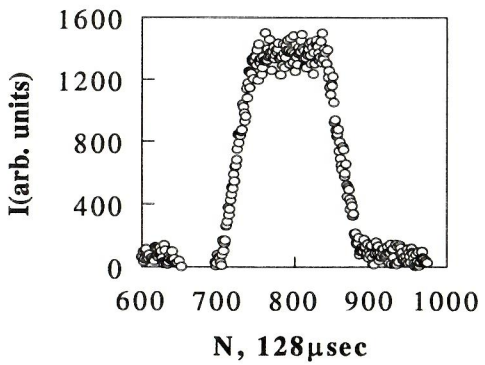


Fig. 1. Transmission of the chopper at the f=10Hz

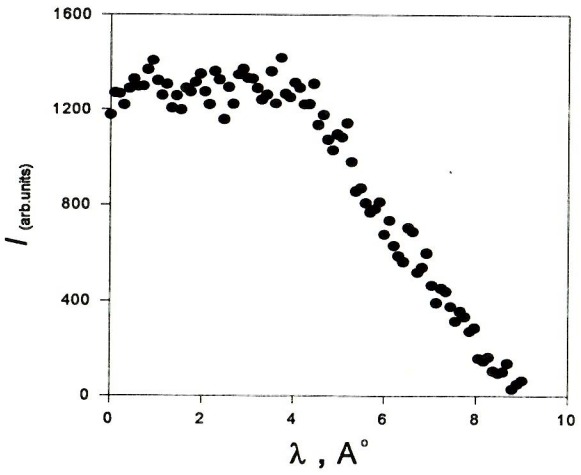


Fig.2. Transmission of the chopper at f=10Hz and ϕ=1.02ms

In the circle corridor of the IBR-2 reactor (in 5 m from the core), a one-disk chopper for suppressing the delayed neutron background and satellite peaks has been manufactured and mounted. At the chopper revolution frequency f=10Hz, the width of the temporal window of transmission at the half-height is 18.5 ms and its leading edge is 5.3 ms (Fig. 1).

These parameters allowed the background conditions to be significantly improved for the inelastic scattering spectra. In fact, the transferred energy range where the delayed neutron background is low has been widened from ~ 40 meV to ~75 meV, which allows the inelastic scattering experiments to be carried out in this transferred energy region on the samples with a low scattering cross-section (of the order of several tens of millibarns). The use of a one-disk chopper allows also the satellite peaks to be removed, which largely extends the region of the diffraction spectrum's measurement toward greater λ.

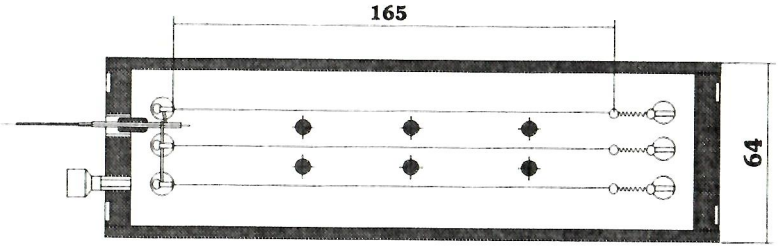
In 1994-95, we intend to start the Leybold closed-loop cycle refrigerator for experiments in the temperature range 10 to 300 K.

The test investigations of the capabilities of the inelastic neutron scattering in the inverted geometry are planned to be carried out with polarized neutrons.

INVERTED GEOMETRY MULTI-CRYSTAL SPECTROMETER NERA-PR

A.Yu.Muzychka, I.L.Sashin

During the reported period, a technical work at NERA-PR has been mainly aimed at the realization of new factors of the experiment conditions. On the basis of the GCA gas compressor made in Poland, the high-pressure helium system has been mounted and started. This system will allow investigations to be performed under the pressure of up to 400 MPa. To improve the experiment conditions and extend the technique scope, a LEYBOLD cryogenerator which allows investigations to be performed in the temperature range 10 to 300 K has been purchased. A special cryostat for work with the cryogenerator has been designed and manufactured. To perform the quasi-elastic neutron scattering (QNS) experiments, the spectrometer has been equipped with the zinc single crystals and helium detectors at eight scattering angles. For accumulation of the spectrometric information four independent analyzers including 16 detectors each were created.



A schematic view of the SNM-75 counter. The filling is 5 10^5 Pa (4 10^5 Pa He3+Ar).

In 1994 - 95, modernization of the detector system is scheduled to take place. The spectrometer complex is planned to be performed in the VME stsandard. A contract has been entered into with the Tellus company for delivery in 1995 of 50 new SNM-75 helium counters of rectangular cross-section. One SNM-75 counter will be installed instead of a bank of five SNM-17 counters, which will provide more reliable work of the detector system as well as facilitate the use and increase the efficiency of the spectrometer. The contract value of 40 million roubles will be paid at the expense of the specialized fund from the fees of the Republic of Poland.

Further equipment of the spectrometer with the single crystals and counters will be carried out for the QNS experiments with the resolution of approximately 30-50 μeV. The QNS analyzer quantity will be brought up to 16 as specified by the design. A contract has been entered into with the UNIPRESS company for development of the new high-pressure gas chambers for pressure of up to 1000 MPa. The tuning-up and commissioning of these chambers is scheduled to take place in 1995. It will extend the pressure range at the NERA-PR facility.

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