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Round-Table Discussion at the 6th International Workshop "Relativistic nuclear physics – from hundreds MeV to TeV" dedicated to the memory of Academician A.M. Baldin

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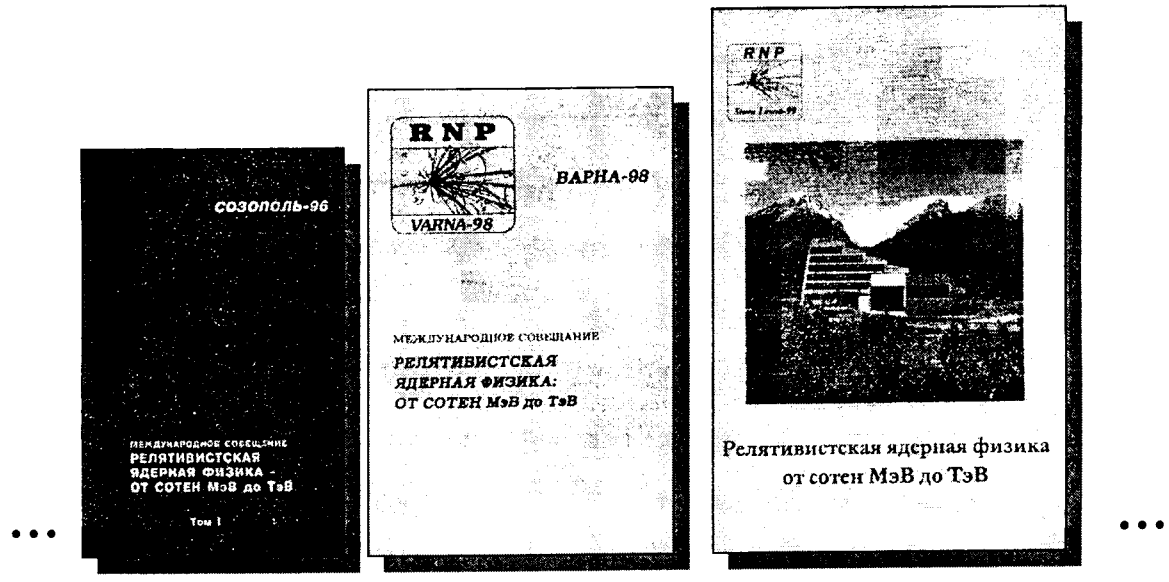
Dear colleagues:

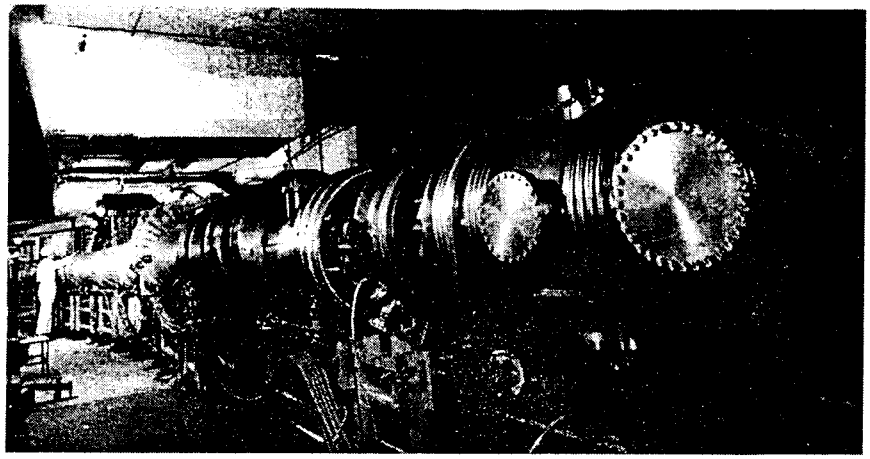
It's my pleasure to open the 'round table' meeting. Let me make some general comments in order to outline the goals of our discussion.

Our international workshops "Relativistic Nuclear Physics - from Hundreds of MeV to TeV" have become traditional and have been held since 1995. This one is dedicated to the memory of Academician Alexander Baldin - a founder of the new scientific direction - Relativistic Nuclear Physics.



Experiments in this field are directly related to the principal problems of strong interaction physics – the quantum chromodynamics (QCD) at large distances and the quark confinement. Most problems of relativistic nuclear physics are concentrated on a search for regularities in the behavior of relativistic multiparticle systems. The study of these regularities is of great importance also for astrophysics and cosmology, as well as for development of electronuclear energy facilities and solving problems of transmutation of radioactive wastes from electric power stations.

This workshop has a particular importance due to completion (in the year 2000) of the system of beam slow extraction from the Nuclotron at JINR and its conversion into a users' machine, as well as the active polarization studies at the Jefferson laboratory (USA), preparation of new projects for LHC (CERN) and especially commissioning (in 2001) of the RHIC collider at BNL.



The Beam Extraction System at the Nuclotron

Let me emphasize that the main goal of our 'round table' is to discuss "Nuclotron white book" topics. It means to consider the most interesting problems to be included in the programme of Nuclotron machine.

The physics programme at the accelerator complex of the JINR Laboratory of High Energies is aimed to study the fundamental problems of modern nuclear physics, which are beyond the frame of the perturbative QCD. The main topics of this programme:

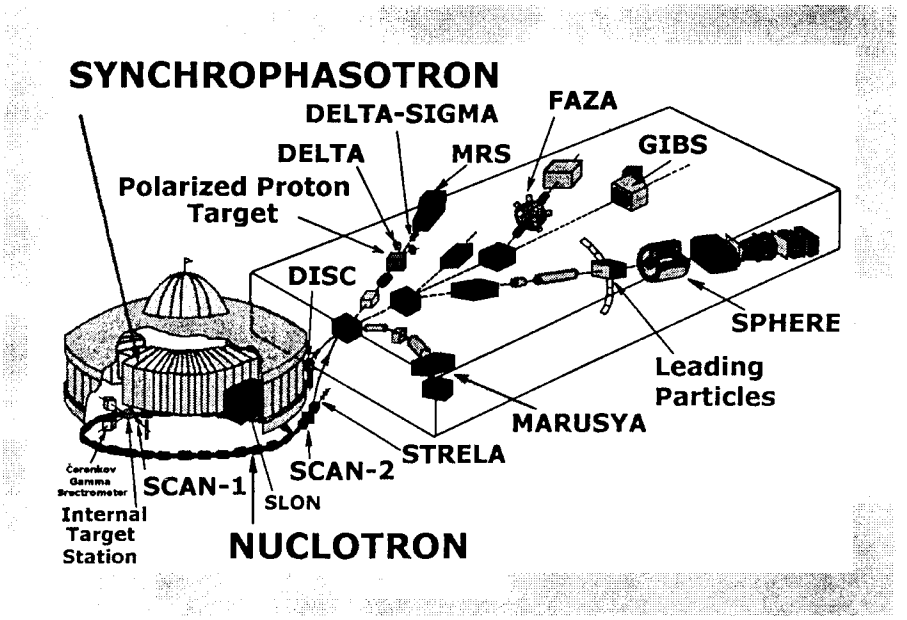
- study of the nature of spin
- colour and confinement phenomena under specific nuclear medium conditions
- investigations of relativistic nuclei interactions to study the quark-gluon degrees of freedom in nuclei
- a search for asymptotic regularities in the behavior of nuclear matter at high energies
- research into the spin structure of light nuclei

Let me briefly remind you about some new results obtained at the LHE accelerator complex.

New results obtained at the Dubna Synchrophasotron in the field of spin physics using the set-ups SPHERE and DELTA-SIGMA as well as very important data on the study of nuclear multifragmentaion obtained at the installation FAZA should be noted.

The main goal of the SPHERE project is to study the deuteron spin structure at short internucleon distances using hadronic probes and spin effects in hadron scattering in a few GeV region. These investigations will be continued at the Nuclotron after obtaining the polarized beam with enough intensity.

Of great interest are the results of investigations obtained on a Nuclotron internal beam of light nuclei at the set-up SCAN-1 and those obtained by the group of the collaboration MARUSYA. The program of research at the Nuclotron using the available set-ups STRELA, GIBS, SMS, MARUSYA, DELTA and SPHERE in the framework of such new projects as SCAN-2, LNS, NIS and PP-SINGLET offers good scope for further work.



The LHE Accelerator Complex

The Nuclotron programme is tightly connected with the research programmes at CERN, BNL and other research centres.

JINR has large and successful experience of participation in the experiments with relativistic nuclei at CERN (NA45, NA49 and WA98 experiments) and in the preparation of new projects (ALICE and CMS) for the LHC.

Participation in the STAR and PHENIX experiments using RHIC at BNL also allows one to obtain data over a new interesting range of energies.

There are unique conditions at the JINR LHE for research with polarized beams of deuterons and neutrons of today's highest energies. However, this research should be carried out at the Nuclotron as the characteristics of polarized beams can be improved at the Nuclotron significantly.

Thus, obtaining an extracted beam of polarized deuterons of enough intensity is the most important problem in developing the Nuclotron from the viewpoint of spin physics. This can be realized due to multiturn injection of negative deuterium ions.

One of the most important tasks for JINR at present is technical improvement of the Nuclotron and establishment of a users' center for research in the field of Relativistic Nuclear Physics (RNP) and for applied physics using relativistic ions over an energy range of several GeV per nucleon.

I'd like to note that the Nuclotron machine makes JINR a leading center in the field of Relativistic Nuclear Physics and QCD. In the world there are no similar facilities, which can provide experiments to study the transition region from nucleon degrees of freedom in nuclei to quark-gluon ones.

QCD, which treats hadrons as complex objects consisting of fundamental constituents – quarks and hadrons, must in principle describe both asymptotic states and corresponding phase transitions (e.g., transition from proton-neutron to quark-gluon phase of the nucleus). From the experimental point of view, the quark-gluon structure function of hadrons and nuclei is one of the fundamental objects studied by QCD. However, the application of QCD to nucleus-nucleus interactions, in particular in the region where both quark-gluon and nucleon degrees of freedom are important, meets with difficulties, and the nature of confinement and

respectively the transition from usual (nucleon) nuclear matter to colour quark-gluon plasma is not quite clear.

The proposals to produce secondary beams of exotic proton-rich and neutron-rich nuclei are of interest. These investigations will shed light upon the origin of elements in the Universe and allow one to understand the structure of exotic nuclei. The Nuclotron opens up new possibilities for research of hypernuclei. In particular, the lifetime of hypernuclei can be measured with an accuracy of 3-5 ps. This will improve significantly the results of the previous experiments.

The discussions at the workshop are useful to JINR and other scientific centers. As a result, some collaborations are being created. They have wider scope than individual groups. So, for example, a polarized proton target was passed to JINR from France, as a result of which the unique conditions were created to investigate nucleon interactions with different spin orientation together with a polarized neutron beam. The polarimeter from Saclay is used at LHE for calibration measurements necessary for the group from the Jefferson laboratory. The physicists from RIKEN are ready to supply with a ^{3}He-polarized target for our joint experiment at the Nuclotron.

Taking into account the positive experience of the international workshops "Relativistic nuclear physics – from hundreds MeV to TeV", I would like to recommend to hold similar workshops regularly in the JINR member-states and in some other countries with the aim of a wider involvement of physics groups in the research programme at the Nuclotron.

Conclusion

In conclusion, I would like to express my hope that this round-table discussion and the whole Workshop will results in new important ideas and suggestions to the existing programme in Relativistic Nuclear Physics. There are of course many interesting tasks and problems to be solved and it's important for us to find out their role and place in the overall panorama of High Energy Physics. I also think that this type of workshops should be rather regular.

Thank you.