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FOREIGN TRIP REPORT

ORNL/FTR-3399

Date: October 6, 1989

Subject: Report of Foreign Travel of F. E. Obenshain, Research Staff Member, and F. Plasil, Section Head, Physics Division

To: Alvin W. Trivelpiece

From: F. E. Obenshain and F. Plasil

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PURPOSE

To attend and present a talk and a poster at the 1989 International Nuclear Physics Conference in Sao Paulo, Brazil, and to attend and present an invited talk and a poster at the International Workshop on Relativistic Aspects of Nuclear Physics, Rio de Janeiro.

SITES VISITED

August 19–26	Sao Paulo, Brazil	O. Sala, E. W. Hamburger
August 27–31	Rio de Janeiro, Brazil	T. Kodama

ABSTRACT

The travelers attended the 1989 International Nuclear Physics Conference in Sao Paulo, Brazil, and the International Workshop on Relativistic Aspects of Nuclear Physics in Rio de Janeiro. They presented talks and posters covering various aspects of the WA80 experiment at both meetings.

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REPORT OF FOREIGN TRAVEL

International Nuclear Physics Conference
Sao Paulo, August 21–26, 1989

The travelers attended the International Nuclear Physics Conference in Sao Paulo, where F. E. Obenshain presented a contributed talk entitled *"Energy Spectra and Energy Densities Obtained from Sulfur-Induced Reactions at 200 A GeV"* and F. Plasil presented a poster entitled *"Transverse Momentum Distributions of Neutral Pions from $^{16}O + Au$ Collisions at 200 GeV/Nucleon."* The meeting was attended by about 450 persons, with about 35 to 40% of those coming from Latin American countries, largely from Brazil and Argentina. The previous two International Nuclear Physics Conferences were held in Italy and England; the next will be held in Germany. The 1989 meeting is the first large international meeting on nuclear physics to be held in South America. Holding the meeting in Brazil was an appropriate way to mark 40 years of nuclear physics in that country. Most of the institutes were founded just after World War II. Brazil is a developing country, and the level of experimental nuclear physics research is minimal due to the lack of adequate research funds. Most of the research is devoted to low-energy studies and to those areas of physics in which nuclear and solid-state physics overlap. The largest accelerators available are of the electrostatic type. A few of the scientists travel, for example, to CERN and to Fermilab to participate in particle physics experiments; however, most of the scientists in high-energy physics are theorists, and they have strong connections to the U.S.A., Japan, and Europe.

While the conference may have provided a boost to the nuclear physics programs in Latin America, there were many notable absences from the traditional nuclear physics research centers. In many cases institutions were represented only by those invited to speak or to serve as session chairmen, thus leading to a significant reduction in the attendance by those most active in current nuclear physics research. The meetings are held every three years, and as in the past, the invited talks were, for the most part, of a review nature and contained little new material. Furthermore, the nature of the talks and the large size of the meeting did little to stimulate lively discussions. The talks did, however, provide a good overview of work in the various subfields of nuclear physics carried out during the last three years. A few highlights on specific talks are given below.

Sir Dennis Wilkinson provided a stimulating overview of *"Earthbound Nuclear Physics."* He spent a great amount of time reviewing data and demonstrating quark effects in nuclear physics measurements. Unfortunately, the speaker was not aware of the most recent pertinent results.

An excellent review of electron scattering measurements was given by B. Frois from Saclay. He provided recent data from electron scattering on very light systems which clearly show that meson-exchange effects need to be included to account for the measured cross sections. Using only the effect of the few nucleons involved in

these systems does not account for the observations. He concluded that meson field theory works well.

Schiffer reviewed the experimental situation in heavy-ion-induced reactions by discussing selected topics covering the full range of energies from subbarrier fusion to relativistic heavy-ion physics. Considering the broad scope of his topic, he did a good job. Interesting results of the Berlin group on enhanced proton-pair transfer were shown. The enhancement of proton-pair transfer, rather than the long-sought-for enhanced neutron-pair transfer, can be accounted for by the special role of the Coulomb barrier in the proton-transfer case. ORNL work was well represented in this overview talk. WA80 data were shown, as were the giant resonance results of Beene, Bertrand, et al., and the subbarrier fusion work of Stelson et al.

Vinh-Mau from Orsay discussed data on nucleon–nucleon scattering using polarized probes. These data provide a critical testing ground for the various nucleon–nucleon potentials that are on the market. An important point was the fact that none of the N–N potentials correctly predict the triton binding energy.

An excellent review of transactinide research was presented by Armbruster from GSI. Three events of element 109 have now been observed, as compared to only one atom that had been found at the time of the Florence meeting. Considerable time was spent discussing the merits of the use of cold fusion reactions, such as reactions of iron isotopes with lead and bismuth target nuclei. These reactions result in compound systems that have lower excitation energies than compound nuclei formed with lighter projectiles and heavier targets. Elements 106, 107, and higher can only be produced by these cold fusion reactions.

Peter Twin of Liverpool presented an enthusiastic talk on superdeformation, in which he reviewed current experimental results. He showed new results from Daresbury which indicate superdeformation in ^{192}Hg and ^{193}Hg. Other results which he presented have been known previously. He made the point that going to higher spins now depends primarily on the sensitivity of the detectors. This point was used to highlight the need for such devices as GAMMASPHERE and EUROBALL.

Kienle of GSI presented an overview of the status of the SIS-18 facility. The project is nearly completed, and the research program will start in late winter or in early spring of 1990. He pointed out that it is the cooler/storage ring (ESR) that makes the facility unique. The ESR is a 10-Tm ring capable of handling beams of mass 20 to 238, with q/A from 0.5 to 0.39. Kienle mentioned that CERN had successfully operated a superconducting magnet at 9.8 T, which is a new record. He then proceeded to show how a one-third-RHIC-energy accelerator could fit into the SIS tunnel using the new magnets. While GSI does not have any immediate plans to get into the ultrarelativistic heavy-ion research business, the potential next steps in the evolution of the GSI facility are constantly under consideration.

Jerry Nolan (MSU) discussed the status of superconducting cyclotrons. GANIL is beginning to plan a 500-MeV/nucleon superconducting cyclotron, and MSU is working on the conceptual design of a four-sector 400-MeV/nucleon cyclotron and a ten-sector 1-GeV/nucleon cyclotron with K $\sim$ 20,000. Nolan claimed that the

required technology to build such large superconducting cyclotrons is nearly all available.

Numerous interesting hallway discussions were held. These include discussions with B. Sinha of Calcutta, who is in the process of joining WA80 and who might provide a significant quantity of lead glass for the photon detection project. The futures of lead beams at CERN and of the NA35/WA80 merger were discussed with R. Stock of Frankfurt. Stock was not very optimistic regarding the lead-beam project. Discussions with Kienle centered on the location of the next International Nuclear Physics Conference. The likely locations are Frankfurt and Wiesbaden.

Workshop on Relativistic Aspects of Nuclear Physics Rio de Janeiro, August 28–31, 1989

The Workshop on Relativistic Aspects of Nuclear Physics was held at the Centro Brasileiro de Pesquisas Fisicas (CBPF), August 28–31. The opening session was chaired by our host, T. Kodama, and the first speaker was the director of CBPF, J. Leite Lopes, who was one of the founders of the institute some 40 years ago. Professor Lopes spoke at some length about the founding of the institute and the many distinguished scientists who had spent periods of time giving lectures and collaborating on theoretical research. Foremost among these visitors to the institute was Richard Feynman, who traveled there several times during the 1950s. It seems that Professor Lopes was not very happy with some statements in Feynman's book, and his major message was to dispel any thoughts that Professor Feynman was not totally happy with his Brazil experience.

The scientific aspect of the workshop was stimulating, with lively discussions after each talk. The subjects ranged from the search for the quark–gluon plasma in p-p reactions at Fermilab to strangeness production at BNL energies. Two talks covered some of the experimental aspects of the relativisitic heavy-ion studies at CERN. One of the travelers (FP) spoke about our experimental effort WA80, and G. Odyniec spoke about NA35.

The remainder of the program was devoted to theoretical and experimental talks on various aspects of relativistic nuclear physics. One of these talks covered the research in high-energy nuclear physics in Brazil. We learned that there are 11 nuclear physics institutes located in 4 cities in Brazil, namely, in Recife, Rio, Sao Paulo, and Porto Allegre. The research carried out by these institutes is wide ranging and covers the many-body aspects of nuclear physics with constituent nucleons and mesons, as well as the theoretical investigation of the properties of nucleons inside nuclear matter. The quark model and astrophysical applications are also studied. The scientists have good connections with the rest of the nuclear physics community and do not appear to be working in a vacuum. The travelers met many of the Brazilian scientists that were present at the workshop, and interests in collaborative efforts were expressed.

APPENDIX

Itinerary

F. E. Obenshain and F. Plasil

Aug. 17	Travel to Sao Paulo
Aug. 18–20	Vacation and weekend
Aug. 21–26	Nuclear Physics Conference, Sao Paulo
Aug. 27	Travel to Rio de Janeiro
Aug. 28–31	Workshop, Rio de Janeiro
Sept. 1	Centro Brasileiro de Pesquisas Fisicas

F. E. Obenshain

Sept. 2–3	Travel to Oak Ridge

F. Plasil

Sept. 2–8	Weekend travel and vacation
Sept. 9–10	Travel to Oak Ridge

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