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**ORNL**  
**FOREIGN TRIP REPORT**  
ORNL/FTR-3699

**Date:** August 17, 1990  
**Subject:** Report of Foreign Travel of F. Plasil, Section Head,  
Physics Division  
**To:** Alvin W. Trivelpiece  
**From:** F. Plasil

**PURPOSE**

To attend the 25th International Conference on High-Energy Physics at Singapore.

**SITES VISITED**

8/1-8/90 International Conference, Singapore K. K. Phua

**ABSTRACT**

The traveler attended the 25th International Conference on High-Energy Physics in Singapore, August 1-8, 1990. The conference was dominated by results from the new LEP accelerator at CERN. The precision of the data from LEP is impressive, and all results are consistent with the standard model. No "new physics" has emerged at LEP. The traveler presented a talk on CERN/SPS WA80 results and had several interesting, private discussions on both L\* and WA80 topics.

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## REPORT OF FOREIGN TRAVEL

### I. 25th International Conference on High-Energy Physics Singapore, August 1-8, 1990

This conference was the twenty-fifth in the series known as the "Rochester Conferences," and coincided with the fortieth anniversary of the conference series. The "Rochester Conferences" are held every two years, and they constitute the most important conference series in high-energy physics. This year's conference involved several anniversary commemorative activities, speeches, etc. The conference was attended by about 800 participants, including six Nobel prize winners (Richter, Ting, Gell-Man, Yang, Rubbia, and Salam). In the past, attendance has been as high as 2000. The lower attendance at this year's conference is probably due to the relatively remote location. The physical conference facilities were excellent, and the organization was good.

No new and unexpected physics results emerged. The conference was dominated by CERN/LEP results and by precision measurements in the context of the Standard Model (SM). The first session consisted of four plenary talks on LEP results, one on each of the four detectors. The L3 presentation was made by Sam Ting. Immediately following the four talks, for the next three days the conference format was one of many parallel sessions at which detailed results were presented. One of the parallel sessions dealt with heavy-ion-induced reactions (see below). The final three days of the conference consisted of "rapporteur" plenary talks, which were supposed to take the results presented at the parallel sessions into account. These talks ranged in quality from excellent (F. Dyak on results from  $e^+e^-$  experiments) to average (F. Close on deep-inelastic scattering and W. Willis on heavy-ion physics) to poor (R. Marshak, commemorative lecture of the 25th "Rochester Conference" 40th Anniversary).

Technical details of various presentations will not be given here. The traveler was impressed by the high degree of precision and consistency of the LEP results. Thus, for example, based on about 100K  $Z$  events each, the four experiments have determined the  $Z$  mass (GeV) to be:

$91.186 \pm 0.013$	(ALEPH)
$91.188 \pm 0.013$	(DELPHI)
$91.161 \pm 0.013$	(L3)
$91.177 \pm 0.011$	(OPAL)

for an average of  $91.177 \pm 0.031$  GeV, where the  $\pm 30$  MeV error is due to the LEP energy uncertainty, which may be reduced to  $\sim 5$  MeV in the future. This result, together with determinations of  $G_F$  and the fine structure constant,  $\alpha$ , constitutes the third precisely measured cornerstone of the SM.

Other than a broad support for the SM, the most important specific results are:

1. The determination (from the invisible energy) that the number of families in the minimum SM is 3 ( $N_\nu = 2.89 \pm 0.1$ ).
2. The determination of the Weinberg Angle at the  $Z$  mass:  $\sin^2\theta_W(M_Z^2) = 0.2302 \pm 0.0021$ , which is consistent with every single measurement in the area

of electroweak physics. This result helps significantly to constrain the mass of the top quark,  $m_t$  (see below).

3. Determination from  $n$ -jets ( $n = 2, 3, 4$ ) of the strong coupling constant,  $\alpha_s(m_z^2) = 0.12 \pm 0.012$ .
4. The determination that a low-mass Higgs is excluded ( $0 < m_H < 41.6$  GeV at 95% confidence level).
5. The limit on the mass of the top quark,  $m_t$ , (with the help of other results such as those of CDF, UA2, etc.) of  $m_t = 137 \pm 40$  GeV.
6. There is no hint of any supersymmetry particles, compositeness, or other exotic phenomena (no squarks, sleptons, charginos, neutralinos, etc., at the  $\sim 45$  GeV energy limit and at a 95% confidence level).

## II. Heavy Ions

For the first time, reactions with relativistic heavy ions were presented at a "Rochester Conference." This constitutes an important bridge between particle and nuclear physics. A parallel session was organized (and presided over) by S. Nagamiya of Columbia University, and a plenary talk was given by W. Willis of CERN/Columbia University. Unfortunately, the heavy-ion parallel session was scheduled in competition with one of the most important sessions of the conference, dealing with future accelerators, at which Schwitters and Rubbia spoke about the SSC and the LHC, respectively. As though this were not enough competition, C. N. Yang was also presenting a talk at the same time in yet another session. Consequently, the attendance at the heavy-ion session, which fluctuated between 30 and 50, was deemed to be reasonably good.

Unfortunately, most of the talks at the parallel heavy-ion session were not very good. For example, S. Steadman, reporting on BNL work, actually read a prepared text. The longest talk (35 minutes), presented by M. Jacob of CERN, was more suitable for a plenary session than for a technical session. It was high on enthusiasm and low on content. In addition, Jacob made the amazing statement that energy density attained in heavy-ion collisions increases slowly with bombarding energy and much faster with projectile size. (In private discussions following the talk, Jacob admitted, after some argument, that he got it backwards!)

The talk by the traveler on WA80 results did nothing to redeem matters, since it was limited to only eight minutes. The best talk was a 20-minute talk on NA35 strangeness results, presented by H. Bialkowska of Warsaw. The most enjoyable talk was that of B. Sinha of Calcutta, who made up in style and delivery for the sparse scientific content.

The plenary talk of Willis on heavy-ion-induced reactions was well attended, as were all plenary talks. The presentation was well organized, but failed to project the prevailing enthusiasm of the field. The traveler was asked by Willis for six WA80 transparencies for possible inclusion in the plenary "rapporteur" talk. Regrettably, none of the transparencies were used, and WA80 was not mentioned in the talk. The subject matter emphasized dealt with strangeness and with  $J/\psi$  suppression and  $\phi$  enhancement.

### III. Private Discussions

Several discussions were held both on L\* and on WA80 topics.

#### A. Discussion with Sam Ting

Ting, in a more than usually expansive mode, told me that immediately after his appearance in front of the SSC/PAC following the end of the Snowmass meeting, he was called by Roy Schwitters. He was told that the L\* proposal appeared to be technically sound but that marriages will be necessary, since only two general-purpose major detectors will be approved. Schwitters suggested that we (L\*) consider getting together with the TEXAS collaboration since we could benefit from their calorimeter expertise. (Ting said that he does not agree with Schwitters' statement on calorimetry but that he did not take issue with it.) Schwitters also said that EMPACT may be asked to get together with the SDC, since they could help SDC with the muon chambers. However, everybody seemed to be under the impression that EMPACT was not contacted regarding a possible merger. I stated that we should actively solicit a merger with some of the EMPACT institutions, in particular, BNL. Sam agreed that this would be useful. We discussed whom to approach, etc.

During the course of our conversation, Stefanski, head of SSC experimental facilities, was stopped by Ting and involved in the discussion. Ting asked him about the expected content of a 50-page document that the four general-purpose detector proposals need to produce by December 1. (This is the first I have heard of this.) Stefanski was vague, but said that the document has to consider the issue of reducing the scale of the experiment. (Ting had told me that Schwitters said that the requested \$300M was too much and that only \$250M might be available for L\* if approved. Ting plans to initiate a study in which the L\* magnet diameter is reduced from 19 m to 17 m.) Stefanski said that Ting should have gotten a letter requesting the 50-page document and that three specific questions were asked in the letter. Ting said that he did not remember, and asked what the questions were. Stefanski said that he could not remember. The whole conversation had a feeling of unreality about it. What was clear was that only two experiments would be approved, but that three may (or may not) be allowed to go to the proposal stage. A three-way "shoot-out" (presumably SDC, L\*, and EMPACT) can be expected at some point. The traveler hopes that it is sooner rather than later.

#### B. Discussion with Sandy Donnachie

Dr. Donnachie is the head of the SPS Committee, which approves heavy-ion runs at CERN. Donnachie is a very fair-minded, open person; and since WA80 has had considerable problems with the SPSC, the traveler decided to discuss with him his views of future WA80 follow-on proposals (WA80+). A proposal for 1991 is currently being considered by the SPSC.

Donnachie said that the lead-beam project is now an official project of CERN, since it was endorsed by CERN Council. He also said that sulfur beam may again

be available in 1992. Donnachie said that the committee still has considerable difficulty with the WA80+ proposals regarding photon measurements. He said (as we know) that, while the proposal for 1991 should be a free-standing proposal, much of its justification is based on issues related to the lead-beam project. This creates an awkward situation. He also said that Gutbrod's style (overconfident, overenthusiastic, and sometimes cocky) does not always help the WA80 cause. On the positive side, he said that the rapid implementation of the large-geometry (U.S.S.R.) lead-glass array was very impressive and that he likes the concept of measuring something else (HBT) simultaneously with the photons.

At the conclusion of our discussion, Donnachie indicated that WA80+ would very probably get some time in 1991 and/or 1992. However, he was rather pessimistic about the lead-beam era. He said that proposals may be due next April but that, unless we come up with some new, attractive ideas and broaden our scope, we will probably not get the go-ahead. He said that competition for beam lines and other resources will be very intense and that it is even possible that the West SPS Area may be decommissioned.

#### *C. Conversation with Frank Close*

Frank Close quizzed me on what progress (if any) was being made in building up a high-energy physics group at ORNL. He was disappointed to learn that we still had not secured continuing funding from DOE. He said that he needs to make a decision whether or not to return to Tennessee by the end of calendar 1990 (as he promised Bill Bugg). DOE support of high-energy physics at ORNL/UT is an important factor in helping him make a decision. We also discussed current support with Director's Exploratory Funds and the status of our joint ORNL/UT hiring efforts. Close said that he plans to visit ORNL in late October and hopes to talk to Dr. Trivelpiece to urge him to accelerate ORNL's efforts to secure permanent funding. Close also asked about progress regarding the new Joint Institute with an expanded scope. Again, unfortunately, I was not able to report any action or progress. Our one area of high activity, ORNL/UT L\* involvement, did not interest Frank as much as the other topics.

#### *D. Conversation with Bill Willis*

Willis asked me about details of ORNL's SSC involvement. He feels that none of the experiments proposed are designed to handle the ultimate SSC luminosity. His own R&D project (with BNL) addresses this issue. He will make a decision at some point as to which collaboration he will join (presumably contingent on the acceptance of his R&D results). He said that Columbia intends to be a major player in both SSC and RHIC arenas. He will be in charge of the SSC effort. (It struck me that Columbia's strategy is not that different from ours.)

#### *E. Conversation with the Two Igors of Dubna*

Discussions were held with Igor Savin and Igor Golutvin of Dubna. They are in charge of L\* silicon calorimeter R&D and production in the U.S.S.R. They need

U.S. help to carry out this task. In early July at Snowmass, it had been agreed among Bill Bugg, Yuri Galaktionov, Igor Savin, and the traveler that a silicon procurement R&D proposal to the SSC would be generated on behalf of L\* at a meeting at CERN, August 22-24, 1990. Unfortunately, neither Dubna staff members nor Sam Ting pursued the matter to the point of securing the required invitations and arranging for payment of expenses. Thus, as of August 8, 1990, no arrangements had been made for the Soviets to travel to CERN. Consequently, it was the opinion of the two Igors that the August meeting at CERN has to be cancelled. On the other hand, a meeting that had been discussed earlier, which is to take place in Oak Ridge in January 1991, is still possible. The traveler agreed to issue official letters of invitation on his return to Oak Ridge. Members of Soviet industry that may contribute to the large-scale production of silicon calorimeter detectors are expected to attend this meeting.

## APPENDIX

### Itinerary

7/21-22	Travel from Oak Ridge to Bangkok, Thailand
7/23-31	Personal period
8/1-8	High-Energy Physics Conference, Singapore
8/9	Return travel to Oak Ridge

### Material Acquired

Copy of transparencies of plenary talk of F. Dyak on results from  $e^+e^-$  colliders.

**- END -**

**DATE FILMED**

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