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DISCUSSION OF PARTICIPATION POSSIBILITIES AT KEK

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Abstract

A group of physicists at TRIUMF have been meeting irregularly since last fall (1988) to discuss options for involvement in experiments that relate closely to the physics that would be undertaken at the impending TRIUMF KAON Factory. Several TRIUMF physicists are already involved in experiments at BNL, in rare kaon decays, radiative kaon capture, kaon nuclear total cross sections, hypernuclear production experiments and strange dibaryon searches. More TRIUMF physicists will become involved in such projects as TRIUMF progresses towards the KAON Factory. This involvement will take either of two possible forms:

1. Writing a proposal for an experimental project to be carried out at BNL or KEK; finding collaborators at the proposed home institution; designing and building 'some' of the apparatus at TRIUMF that will be needed for the experiment.

2. Selection of an experimental project that has already been proposed for either BNL or KEK where a substantial contribution can still be made to the design and operation of the experiment, designing and building 'some' of the apparatus at TRIUMF that will be needed for the experiment.

Recently such a meeting of the TRIUMF Research Scientists was held to discuss the possibilities for involvement at KEK in light of the new facilities that are under construction there or proposed to be constructed as part of the JHP. The topics considered during this meeting ranged from the ion source to the kaon beams.

Byron Jennings led off the meeting with a description of his "favorite" experiment. Fig. 1 shows the resonances predicted by the non-relativistic quark model (from Capstick and Isgur[1]) and those found in phase shift analysis for odd parity S=-1 baryons. The model is in reasonable agreement with all the well known states, except the $\Lambda(1405)$, indicating that perhaps something exotic is happening with this state and indeed some people believe this state is not a three quark state but rather an anti-kaon nucleon bound state (four quarks one anti-quark). To unambiguously disentangle the nature of this state it is necessary to understand the whole region from 1600 MeV to 2000 MeV where current phase shift analysis is in strong disagreement. The structure of the higher states puts strong constraints on the structure of the $\Lambda(1405)$ through the orthogonality of the states. Measurements of the kaon-nucleon elastic and inelastic scattering in this energy range are needed.

Uli Wienands explained that TRIUMF people concerned with design of the KAON Factory accelerators are watching very closely the developements at labs such as KEK regarding the transport of polarized proton beams through synchrotrons. Following a short explanation of what causes depolarization in such machines, he said that perhaps the largest lesson has already been learned from the KEK experience is that if the original machine is built with polarized beams in mind the later achievement of these beams will be much less of a problem.

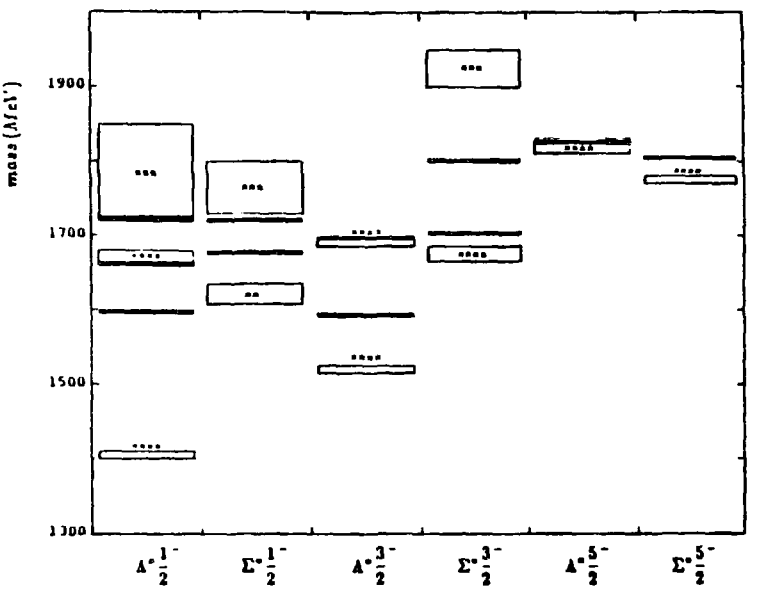

Figure 1: The Negative Parity S=-1 Excited Baryons of the N=1 Band

Some TRIUMF physicists are already "connected" to programs at KEK. For example Paul Schmor described the close cooperation presently occuring among the people working at TRIUMF, LANL, and KEK on the development of laser pumped polarized ion sources. He also mentioned developments in volume cusp H^- sources where TRIUMF, LANL, LBL have been working cooperatively while the KEK people have been watching very closely the developements.

George Mackenzie told the meeting that a cooperative effort is already underway to study the problems that high intensity beams will present for the maintenance of H^- stripping foils. In the case of KAON these foils are used at the point where the beam is injected into the accumulator (A-Ring) while at JHP they will be used in the compressor. A set of foils is to be tested at LANL by personnel from TRIUMF, LANL, KEK and RAL. A discussion of whether current accelerator physics cooperative efforts are "collaborations" in the same sense as that term is applied to fundamental physics experiments followed.

The cooperative program that is presently underway between physicists in

Japan interested in "Radioactive Beams" and the TISOL group at TRIUMF was described by John D'Auria. He told the meeting how he is presently pursuing an expansion of this cooperation into a full blown collaboration that will extend well into the future, whether a radioactive beam facility is finally built at TRIUMF or at JHP. A fuller description of these facilities and the cooperative efforts is found elsewhere in these proceedings[2].

The new beam lines (K5, K6) and spectrometers being constructed at KEK were discussed in light of what types of experiments might be run there in the time before KAON is completed. The fact that LESB-I at BNL is occupied by a kaon rare decay experiment that will likely be running for several more years, means that K1 at KEK will be the only facility where the production of hypernuclei via the (π^+,K^+) reaction can be profitably pursued. With this fact in mind Dave Gill described two possible experimental programs that might be undertaken using the substantial π fluxes available from this beam line. These π's along with the SKS spectrometer presently being constructed should make it possible to study;

1. The production of Σ hypernuclei via the (π^+,K^+) reaction.

2. The Quasi-Free (Q-F) production of Λ's,Σ^+'s,Σ^0's and Σ^-'s.

Both of these experimental undertakings would use the SKS spectrometer to detect the production of a hyperon; both would also require a further detector system. In the case of the Σ hypernuclei search this secondary detector system would be used to supress the Q-F Λ background. In the Q-F production experiment the extra detector system would be used to study the hyperons that were being produced, i.e. to measure such things as their polarization.

Dave Gill also described a low energy kaon scattering experiment that may be possible with 600 MeV/c kaons from the K5 beam line. It would be the first measurement of iT_{11} in the Kd system. It would require a polarized deuterium target of sufficient size to assure that all the kaon beam could be made to pass through it. If such a target were available (one is presently under developement at PSI) the TOF apparatus presently used at TRIUMF for measurements of this type in the πd system could be transported to Japan and the experiment possibly completed in as little as 1000 hours of beam time.

Chris Oram discussed a new type of π^0,γ detector that could be used for (K^-,π^0) experiments. Such experiments would lead to the identification of new hypernuclei and would require π resolutions of the order of 1 MeV. A Liquid Argon Detector should make such resolutions possible for 100 MeV γ-rays. A detector of this type might be used jointly with the Torroidal Spectrometer at KEK's K5 beam line. The production of the Hypernucleus would be detected through the π^0 decay γ-ray showers in the liquid argon while the decay of that nucleus would be followed with the spectrometer.

Some TRIUMF physicists decided to pursue these ideas further and if necessary combine forces at a later date to carry the one that proved to be the most practical to fruition.

References

1. S. Capstick and N. Isgur, Thesis, University of Toronto UTPT-85-34.

2. J.D'Auria, (these proceedings).