NAL PROPOSAL NO. 77

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Proposal to Study High Energy Hyperon Physics at NAL

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Bubble chamber

PROPOSAL TO STUDY HIGH ENERGY HYPERON PHYSICS AT NAL

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We propose to study hyperon production and hyperon interactions as a function of energy in the bubble chamber facility at NAL. We want to irradiate a thick heavy metal plate or a sequence of heavy metal plates inside the bubble chamber and to study the interactions in liquid hydrogen of the hyperons produced in the plate(s).

For proton energies from 4 to 12 GeV the total lambda production cross section seems roughly constant and $\sim$ 0.5 mb. (The same is true of kaon and pion beams). Because of angular symmetry, lambdas produced in proton-proton collisions have the highest energies. With this cross section, for a heavy metal plate of 1.5" thickness, about 3/8 visible lambdas are produced per photograph with 15 beam tracks each, for lambdas up to 4 GeV/c. At the high energies of NAL, the longer lifetime of lambdas provides a higher survival rate to escape the plate.

In 250,000 photographs, with the above assumptions, there will be about 1000 lambda-proton interactions measureable.

If production of Ξ and Ω are peripheral, then their production cross sections from lambda-proton interaction may be an order of magnitude larger than that from the kaon-nucleon interaction because of exchange of one less strange meson.

Knowledge of hyperon-nucleon interaction is fundamental to an understanding of strong forces. We are undertaking a long range program of this study as a function of energy. By the time of initial operation of the NAL facility we hope to have better information on this experiment and some cross sections at higher energies.