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WEAK DECAYS AND CHARM SEARCHES

MASTER

Annual Progress Report
for Period March 1, 1980 - February 28, 1981

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Prepared for

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ABSTRACT

Results of statistically precise measurements of K^-p and $\bar{p}p$ scattering cross sections, discussed in my Annual Progress Report C00-4831-2, dated October 1979, were published in Physical Review and Physical Review Letters. Progress has been made in solving technical problems in a Brookhaven experiment in collaboration with experimenters from Yale and Brookhaven to measure the asymmetry parameter in the radiative decay $\Sigma^+ \rightarrow p\gamma$. An experiment has been designed in collaboration with experimenters from the Lawrence Berkeley Laboratory and Brookhaven to search for the charmed η and η' mesons.

In my 1979 Annual Progress Report, I described individual Brookhaven experiments in which collaborators from Lawrence Berkeley Laboratory, Brookhaven Laboratory and I measured K^-p backward elastic scattering cross sections, and $\bar{p}p$ total cross sections and partial cross section into $\bar{n}n$ for incident K^- and $\bar{p}$ momenta below 1.1 GeV/c. The results of these measurements are now published in Physical Review and Physical Review Letters⁽¹⁻³⁾. (Reprints of these articles have already been sent to DOE.)

Although the $\bar{p}p$ total cross section measurement, which did not find strong evidence for the S(1936) meson, was initially greeted with scepticism, particularly in Europe where two CERN measurements had claimed to have seen the S, the latest results from both CERN and Brookhaven are in general agreement with our result. Theorists at the 5th European Symposium on $\bar{N}N$ interactions suggest that the small structures, which appear in many measurements, may result from many overlapping resonances at low energies.

During the past year, I have been working on an experiment to measure the asymmetry parameter in the radiative decay $\Sigma^+ \rightarrow p\gamma$ with collaborators from Yale and Brookhaven Laboratory. To date we have made two setup runs and have discovered a variety of technical problems which we now believe are understood and are under control. These include problems with the cryogenics of the superconducting Helmholtz coil polarized target magnet which is now working satisfactorily although one coil still has a small heat leak; problems with the polarized target which now appears to work satisfactorily; problems with the wire chambers breaking wires, particularly during the last run when the humidity was excessive; and problems with the beam flux of incident K^- 's. The wire chambers are now rewired and should function well during the upcoming late fall and winter runs when the humidity will be low. Problems with the low beam fluxes, a part of the

experiment with which I have been most actively involved, appear to be due to a variety of factors which now seem to be reasonably well understood. These include difficulty with refocussing the C3 proton transport beam on the C' target in a tuning mode which allows negative pion extraction at 12 to 14 GeV, problems with multiple scatter in the proton transport, and problems with focussing kaons in the C8 beamline into a small enough spot to be contained in the active volume of the polarized target.

To control the multiple scatter in the proton transport, vacuum sections are being added to the long straight sections. Magnet tuning programs are being used to look for an optimum tune in the proton transport line consistent with the constraint that two other experiments in upstream branches of our beamline run simultaneously with our own. We are also investigating ways of achieving a better kaon final focus but at the same time we are acquiring the equipment necessary to allow us to use a larger polarized target.

Along with my work in the $\Sigma^+ \rightarrow p\gamma$ experiment, I have begun to think about a future experiment to look for η and η' mesons in the Medium Energy Separated Beam (B4) at Brookhaven in collaboration with experiments from Lawrence Berkeley and Brookhaven Laboratories. A considerable amount of work has gone into generating a proposal which was presented to the High Energy Advisory Committee at Brookhaven in early October, 1980. Although the Committee did not approve the experiment, it did express an interest in the physics and suggested questions which should be answered if the proposal is pursued. I have included a copy of the response of the Committee in this report. At the present time, there is also another proposal, by a European group at CERN, to use a jet target in a straight section of the Intersecting Storage Ring at CERN to look for charmed mesons in antiproton proton interactions. At this time, the fate

of the European proposal is not clear. I have been invited to join the CERN collaboration if it should prove to be more expedient to do one experiment by international collaboration at CERN than to try to do a separate American experiment at Brookhaven.

I worked on a variety of aspects of the charm search proposal but particularly on the detector design and calculation of backgrounds. I developed a Monte Carlo program which has the detector geometry in it and which looks at the efficiency of the detector in rejecting the principle backgrounds due to the reactions $\bar{p}p \rightarrow \bar{\pi}^0 \pi^0$ and $\bar{p}p \rightarrow \bar{n}n$ as well as a variety of smaller backgrounds. The complete proposal is appended to my Renewal Proposal which is submitted along with this report.

REFERENCES

1. Backward K^-p Elastic Scattering at $0^\circ \Sigma^- \pi^+$ Production, Physical Review D 21, 1191-1205 (1980). With M. Alston-Garnjost, R.P. Hamilton, R.W. Kenney, D.L. Pollard, R.D. Tripp and D.M. Lazarus.
2. Measurement of the $\bar{p}p$ Charge-Exchange Cross Section from 0.119 to 1.046 GeV/c, Physical Review Letters 44, 1179-1181 (1980). With R.P. Hamilton, T.P. Pun, R.D. Tripp and D.M. Lazarus.
3. Search for the S Meson, Physical Review Letters 44, 1182-1185 (1980). With R.P. Hamilton, T.P. Pun, R.D. Tripp and D.M. Lazarus.

BROOKHAVEN NATIONAL LABORATORY
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Office of the Director

September 23, 1980

A G E N D A

High Energy Advisory Committee

October 2, 1980, 1:00 p.m., Seminar Room, Physics Bldg.

	Hours Requested
<u>#747 BNL/CCNY</u> - ϕ and $\phi\phi$ from π^-p and K^-p	600
<u>#751 Brandeis/SEastern Mass</u> - Measurement of hyperon radiative decay	600
<u>#762 BNL/DOE/Mich.State/Syracuse</u> - Search for narrow structures in the pp annihilation cross section from 1900 to 1940 MeV	400
<u>#763 LBL/Mt.Holyoke/BNL</u> - Search for η_c and η'_c mesons	1250
B R E A K	
<u>#764 BNL/Brown/KEK/Osaka/Penn/SUNY/Tokyo</u> - Sensitive search for oscillations between ν_μ and ν_e	600
<u>#765 BNL/Catholic U/Cincinnati/NRL/Syracuse</u> - Movable detector to search for neutrino oscillations in neutrino beam	Parasitic
<u>#766 Columbia/U.Mass/U.Mexico</u> - Study of charm	2000

PLEASE NOTE: Public presentations of proposals begin at 1:00 p.m.

BROOKHAVEN NATIONAL LABORATORY
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Upton, New York 11973

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Office of the Director

October 10, 1980

Dr. Ting Pun
Lawrence Berkeley Laboratory
University of California
Berkeley, CA 94720

Dear Dr. Pun:

Re: #763

I am writing to confirm our telephone conversation regarding your proposal #763, "Search for η_c and η_c' in $pp + \eta_c(\eta_c') + \gamma\gamma$." Although the High Energy Advisory Committee recognized the physics merit of your proposal, it was not approved on the basis of certain technical questions.

If you wish to pursue this proposal, the Committee requests that you respond to the following comments and questions. Your response should be in writing, addressed to R. Ronald Rau, and should be received before the next meeting of HEAC on March 5-6, 1981, or sooner.

1. The proposal assumes a width of 20 MeV, which appears to be high, leading to an overestimate of the event rate.
2. There are significant uncertainties about the antiproton beam intensity at the two proposed energies and about the shape of the antiproton spectrum. Can you experimentally test the true $\bar{p}$ flux?
3. It appears that the total particle flux, including π^- 's will be too high for your beam chambers if the $\bar{p}$ flux is in fact 6×10^5 as requested.
4. The Committee members were not totally convinced that you could separate the two showers, for example, in the case of asymmetric production of $\pi^0 \gamma$. If not, what would be the impact on the experiment?
5. In general the Committee felt that whenever there was a range of uncertainty in some parameter, the most optimistic assumption was made. How do you respond to this?

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6. HEAC recognized that a fine-grained shower detector was essential for defining the shower structure. Although economies in the cost of the ADC's could be achieved by ganging proportional tubes, such a change should be approached very cautiously, especially in the front half of the device.
7. Please discuss existing or planned experiments which would compete with this proposal.

If you have any questions, please don't hesitate to call Ronnie Rau. We look forward to hearing from you.

Sincerely,

Neil Baggett

Neil V. Baggett

cc. D.I. Lowenstein
L.W. Smith
G.H. Vineyard
R.W. Kenney