UNIVERSITY OF ILLINOIS
DEPARTMENT OF PHYSICS
URBANA, ILLINOIS 61803

April 3, 1967

Dear Feza:

Thank you very much for your letter of March 25 and for your acceptance of our invitation for a colloquium talk.

The title you have proposed sounds perfectly alright for a colloquium talk, and the title does not impose any constraint on the content of your talk. As soon as your schedule is fixed please let me know so that I can reserve your accomodation and pick you up at the airport. I am looking forward to hearing from you about what you are doing.

Let me add a few remarks about what you asked me in your last letter. I made an assumption regarding some properties in field theory: If both $\varphi_1(x)$ and $\varphi_2(x)$ are local operators and have the same set of quantum numbers, then $\varphi_1(x)$ must be proportional to $\varphi_2(x)$ <u>provided</u> their form factors satisfy unsubtracted dispersion relations. I have two consequences of this assumption.

$$\mathcal{H}_{weak} = \frac{G}{\sqrt{2}}\left(J_\lambda^\dagger l_\lambda + J_\lambda l_\lambda^\dagger\right) + f\,\partial_\lambda K_\lambda + (\mu \to e+\nu+\nu)$$

1. $\left[\int K_0\, d^3x,\ J_\lambda(x)\right] \propto J_\lambda(x)$.

This eq. implies $CP(\partial_\lambda K_\lambda)(CP)^{-1} = -\partial_\lambda K_\lambda$, and if $K_\lambda = \sigma f^5_{3\lambda} + \beta(\sigma f^5_{6\lambda} + \sigma f_{6\lambda})$, we get $\beta = \frac{-1}{4}\tan 2\theta$.

2. In $K_L^0 \to 2\pi$, $\phi_{II} = \frac{1}{2}$ is forbidden, so that $\eta_{00} = -2\eta_{+-}$.

2 have also determined f from the S wave decay of hyperons and K_S meson and obtained

$$|f| = 4.7 \times 10^{-3}.$$

This gives an excellent agreement with experiment in the order f^3, and the decay rates $K_L \to 2\pi$ are reproduced within factor 2 or so.

With best wishes to your family,

Yours,

Kazuhiko

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March 17, 1967

Dear Feza:

David Pines asked me to write to you and to inquire of you about a possibility of your visiting us here for a colloquium talk.

I would be very happy if you could accept this invitation so that I could see you again before I leave US for Tokyo at the end of May. Right now, the open dates are April 20, May 11 & 18.

I am eager to hear from you about what you are doing now. I am also eager to hear your opinion about what I am doing. I came to the conclusion that both CP-conserving and -violating non-leptonic decays can be described in terms of one Hamiltonian

$$H_{NL} = f\,\partial_\lambda K_\lambda,$$

where $K_\lambda = \sigma F^5_{3\lambda} + \alpha(\sigma F_{6\lambda} + \sigma F^5_{6\lambda}) \sim \pi^0 + K_2^0$.

H_{NL} is given in this four-divergence form as a consequence of field equations including strong and electromagnetic interactions. Because of the divergence form

$$(S_1)_{\beta\alpha} = -i f \int \langle \beta | \partial_\lambda K_\lambda | \alpha \rangle\, d^4x = 0.$$

Notice that $CP\, H_{NL} (CP)^{-1} = -H_{NL}$. $S_2 \sim f^2$, then describes the usual CP-conserving leptonic decays and $f \sim 10^{-3}$. Therefore, $f^3/f^2 \sim 10^{-3}$.

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In the third order CP is violated and $K_2 \to 2\pi$ occurs.
$S(K_2 \to 2\pi) / S(K_1 \to 2\pi) \sim f \sim 10^{-3}$ agrees with experiment.
I made further detailed calculations, and I hope that you can visit us soon. With my best regards to Suha and Tsuef.

Sincerely,

Kazuhiko Nishijima