

NAL PROPOSAL No. 285

Scientific Spokesman:

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A SEARCH FOR A NEW STATE OF MATTER IN THE
ANALYSIS OF A NAL BEAM DUMP

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February 19, 1974

Send to [unclear]
ALH

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February 19, 1974

Dr. Robert Wilson
Office of the Director
National Accelerator Laboratory
P.O. Box 500
Batavia, Illinois 60510

Dear Bob:

This letter is a proposal to carry out a simple experiment (insofar as NAL is concerned) designed to test a speculative implication of a recent theory due to T.D. Lee and G.C. Wick. Briefly, they discuss a possible new state of matter that could result in high density, high energy nuclear matter. A solution of their field equations implies the possible formation of an esoteric object with very high baryon number ($N > 400$) which is stable and whose constituents are \sim low effective mass baryons. Such a state could be induced by collisions of high energy uranium on uranium nuclei.

While waiting for the super heavy ion accelerator problem to be solved, it occurs to me that a uranium beam dump which has suffered the impact of $\sim 10^{18}$ 300 GeV protons could result in a sizable number of such collisions - via a two stage process:

$p + U \rightarrow U^* + p$ (backwards)

$U^* + U \rightarrow \text{fame} + \text{glory}$.

This gives an upper limit kinetic energy of ~ 270 GeV U. Of course, we do not know the probability of such a coherent recoil; it could be very low. However, even if it were $\sim 10^{-10}$ of the p-uranium total cross section, we would have 10^8 interesting collisions.

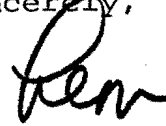
The proposal has two parts: 1) To make available a suitable piece of whatever high Z beam dump or target material has already been bombarded with $\gg 10^{17}$ protons - probably tungsten and 2) to permit the installation of a piece of uranium, suitably encased in a low Z container

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(e.g. aluminum) in a convenient beam dump for exposure to NAL protons. We would hope to find ways of successive separation (concentration via diffusion and centrifuge processes followed by mass spectrometer work) in order to look for "funny" objects. We would, of course, promise to send all extraneous objects that show up (monopoles, quarks, etc.) to the group holding the appropriate licence.

Sincerely,



Leon M. Lederman

at
cc: J. Sanford