In Leon’s company, it seemed that anything might be possible
Observation of Long-Lived Neutral \( V \) Particles

K. Lander, E. T. Booth, J. Imperiaulis, and L. M. Lederman,
Columbia University, New York, New York

AND

W. Clineh, Brookhaven National Laboratory, Upton, New York

(Received July 30, 1956)

Observations of the Failure of Conservation of Parity and Charge Conjugation in Meson Decays: the Magnetic Moment of the Free Muon

Richard L. Garwin, Leon M. Lederman, and Marcel Weissen
Physics Department, Nesci Cyclotron Laboratories,
Columbia University, Irvington-on-Hudson,
New York, New York

(Received January 15, 1957)

Observation of Massive Muon Pairs in Hadron Collisions

J. H. Christenson, G. S. Hicks, L. M. Lederman, P. J. Limon, and R. G. Pope
Columbia University, New York, New York 10027, and Brookhaven National Laboratory, Upton, New York 11973

and

E. Zacatini
CERN Laboratory, Geneva, Switzerland

(Received 8 September 1970)

Observation of \( \pi^0 \) Mesons with Large Transverse Momentum in High-Energy Proton-Proton Collisions

CERN, Geneva, Switzerland

B.J. Blumenfeld and L.M. Lederman
Columbia University, N.Y., USA

and

R.L. Cool, L. Litt and S.L. Segler
Rockefeller University, N.Y., USA

Received 10 August 1973

A Cloud Chamber Determination of the Lifetime of the Negative \( \pi^0 \) Meson and the Mass of the Negative Mu Meson

Leon M. Lederman

A Dissertation

Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy, Faculty of Pure Science, Columbia University

April, 1951

Observation of High-Energy Neutrino Reactions and the Existence of Two Kinds of Neutrinos

Columbia University, New York, New York and Brookhaven National Laboratory, Upton, New York

(Received June 15, 1962)

Production of Antiprotons via Nuclear Motion

Columbia University, New York, New York

and

P. Piroué and Stuart Smith
Princeton University, Princeton, New Jersey

and

J. L. Brown, J. A. Kadyk, and G. H. Trilling
Physics Department and Lawrence Radiation Laboratory, University of California, Berkeley, California

(Received 4 May 1963)

Observation of Antideuteron

Columbia University, New York, New York

(Magnetic Moment of the Free Muon

T. Coffin, G. R. Garwin, S. Perman, L. M. Lederman, and A. M. Sachs
Columbia University, New York, New York

(Received October 1, 1957)

Muon Mass and Charge by Critical Absorption of Mesonic X Rays

S. Devons, G. Gidal, L. M. Lederman, and G. Siapiro
Columbia University, New York, New York

(Received September 6, 1960)

Observation of Direct Production of Leptons in \( p\text{-Be} \) Collisions at 300 GeV

Columbia University, New York, New York 10027

and

B. C. Brown, J.-M. Gaillard, and T. Yamanouchi
Fermi National Accelerator Laboratory, Batavia, Illinois 60510

(Received 15 July 1974)

Observation of a Dimuon Resonance at 9.5 GeV in 400-GeV Proton-Nucleus Collisions

S. W. Herb, D. C. Hom, L. M. Lederman, J. C. Sens, H. D. Snyder, and J.K. Yoh
Columbia University, New York, New York 10027

and

Fermi National Accelerator Laboratory, Batavia, Illinois 60510

and

A. S. Hs, H. Joestein, D. M. Kaplan, and R. D. Kephart
State University of New York at Stony Brook, Stony Brook, New York 11794

(Received 1 July 1977)
Part II

THE TRULY NATIONAL LABORATORY (TNL)

L. M. Lederman
Nevis Laboratories, Columbia University

A. Introduction

We are facing, as a result of all the feverish activity of the sort we are having here, the onset of two or three new super-large facilities for high energy physics. The question of organization of these new laboratories is obviously of very great importance. We have examples (not in high energy physics!) of large laboratories containing unique facilities which, through poor organization, are generally considered to be flops. Another exceedingly important question relates to the role of the university in the era of the super-large laboratory, with the super-expensive hourly running cost, surrounded by the necessary highly professional on-site groups. Finally, there is the ever present competition between institutions and regions for the presumably finite number of authorizations for accelerators costing more than 100 million dollars.
RRW: “Money and effort that would go into an overly conservative design might better be used elsewhere... A major component that works reliably right off the bat is, in one sense, a failure—it is over-designed.”
“Being a professor at a university is the best invention of Western civilization. There’s where you have power, you have freedom, you can do anything you want. … Who wants to be a director where you are not free to do anything, everyone is watching you? God help you if you fall asleep, which you often do at seminars, everyone notices and puts it down.”
Securing a future for the laboratory
Oh, fancie that might be, oh, facts that are!

(Browning, 1889)

I. FOREWORD

Fancies can be fantasized for fabricating future facilities at Fermilab, but fulfillment will depend on the unfolding of physics, on finding funds, on the focus of other laboratories, on forceful personalities and fierce fights; but most of all it will depend on new facts, new findings, new fancies. Thus Fermilab physicists might find it futile to feel their way to 5 TeV, might find it more fun to fill in facts about physics at 50 GeV, or they might find more felicitous the flowering of photon physics at 500 GeV. In the following phantasmata, let me first figure on the most fruited fulfillment, let me flounder in a veritable fantasia of physics facilities; for realistic factors finally “little by little will subtract faith and fallacy from fact.”

II. INTRODUCTION

The Fermi National Accelerator Laboratory was established in 1967 after the dramatic selection of a 7000 acre site located near Chicago, Illinois from the many sites presented throughout the nation. Figure 1 shows the site as it now appears; it is very flat and roughly rectangular, 5 km on a side. The proton synchrotron shown in Fig. 1 was brought into operation at 200 GeV in March 1972. It has supplied protons to the four experimental areas, also shown, which have successively been brought into operation. The synchrotron was designed to accelerate $5 \times 10^8$ protons per pulse (ppp) to 500 GeV. Although the accelerator did reach an energy of 500 GeV, it regularly operates at 400 GeV and at intensities of about $2 \times 10^9$ ppp, the maximum so far being $2.6 \times 10^9$ ppp at a cycle time of about 10 seconds.

The characteristics of the accelerator and the experimental areas have been described in detail in a review article by J. B. Sanford (1976). As of July 1978 some 250 experiments had been completed of the 300 proposals for experiments which had then been approved.

The results of those experiments have been published in about 225 articles. (Half of the articles about experimental particle physics appearing in Physical Review Letters during 1977 were about work done at Fermilab).
CONCLUSION: By 1981, the FNAL 400 GeV program no longer viable

SOLUTION: Go to 1000 GeV

STAGE I: 2500 GeV and 40 MW, less power

II: 1000 GeV - collapse

III: 1000 GeV x fixed target

Gives us energy lead until ~1970

(CERN 3 TeV)

Advances superconducting technology for more future
Bringing dignity to the office
Enhancing the Quality of Life
Enriching the scientific environment
SEMINARS TO COVER PARTICLES AND COSMOLOGY

Seven seminars will be given at Fermilab covering the general theme of particles and cosmology.

About the middle of this decade, Fermilab expects to be able to slam 1 TeV protons into 1 TeV antiprotons for center-of-mass collisions of 2 TeV, the most powerful ever created by scientists. These energy levels are so high that for the moment they remain the playground of theoreticians.

In order to gain some hint of what may happen when particles of those energies collide, Fermilab has organized this series of seminars devoted to the connections between particle physics, cosmology and cosmic rays.

Two of the seminars already have been given. They were Prof. James Peebles of Princeton University, who spoke on Oct. 29 about "Cosmology, New Physics and Old," and Prof. William Fowler of the California Institute of Technology, who spoke on Nov. 5 about "Nucleosynthesis in Supernovae."

1980–81

The remaining five lectures are:

Prof. Tom Gaisser, Bartol Research Foundation, University of Delaware, "Particle Collisions Above 10 TeV as Seen in Cosmic Rays," December, -(he will give four talks);


Prof. Malvin Ruderman, Columbia University, "Elementary Particles and Superdense Matter," Feb. 12;

Prof. Gordon Baym, University of Illinois, "How Can We Learn About Particles From Neutron Stars," March 11;

Prof. Steven Weinberg, "The Very Early Universe," sometime in April.
ASTROPHYSICISTS HOST SPACEY CONFERENCE

by Rocky Kolb and Michael Turner

During the first week of May, the theoretical astrophysics group at Fermilab hosted an international conference on science at the interface of particle physics and cosmology. The conference focused on current research, particularly on the inflaton, a scalar field that could have driven inflation. The possibility that most of the mass in the Universe resides in a yet-to-be-detected sea of elementary particles which are relics of the earliest moments of the Universe. Marc Davis (UC Berkeley) gave an observer's view of the large scale structure of the Universe. and presented recent findings on the cosmic microwave background.
Scientific Advisory Group & Junior SAG

Director’s Coffee Break

Visits to experiments, Main Control Room

Hyper-CP

“High-Energy Experiments” @ Les Houches 1981

1985–: Joint University–Fermilab Doctoral Program in Accelerator Physics and Technology
Director's Special Colloquium

Bruno Zumino
University of California
Berkeley, California

Supersymmetry, Gravity, and Unification

Frank Wilczek
Institute of Theoretical Physics
Santa Barbara, California

The Ongoing Search for Dark Matter Candidates

John Schwartz
Toward a Unified Theory Of All Interactions

Director's Special Colloquium

Norman Christ
Columbia University

A Supercomputer for Lattice Gauge Theory: Results and Prospects

Jim Cronin
University of Chicago

CP, Past, Present and Future

Edward Witten
Princeton University

Superstring Theory

Val Fitch
Princeton University

Strange Matter

Being a series of colloquia on specific topics in high energy physics given by outstanding practitioners and designed to be comprehensible to graduate students, administrators and abstract string theoreticians

Fermi National Accelerator Laboratory
Ramsey Auditorium
Thursday, January 23, 1986, 3:00 p.m.

Fermi National Accelerator Laboratory
Ramsey Auditorium
Friday, February 14, 1986, 4:00 p.m.
Physics Colloquium

Victor F. Weisskopf
Professor of Physics
Massachusetts Institute of Technology

The Population Explosion in the Vacuum

Wilson Hall Auditorium
Wednesday, May 20, 1981, 4:00 p.m.
Fermi National Accelerator Laboratory

Colloquium

I. I. Rabi
Professor Emeritus
Columbia University
Nobel Laureate - 1944

Physics at Mid-Century
1933 - 1967

Norman Ramsey Auditorium
Fermi National Accelerator Laboratory
Wednesday, May 25, 1983, 4:00 P.M.

Special Colloquium

Marvin Minsky
MIT

Professor Minsky is a founder and seminal thinker in the field of artificial intelligence

The Society of Mind

Fermi National Accelerator Laboratory
Ramsey Auditorium
Friday, February 13, 1987, 4:00 p.m.

*Note Special Day!
Creating the Pan-American Connection
Creating the Pan-American Connection with colleagues from South of the Border

First Pan-American Symposium on Elementary Particles and Technology
Cocoyoc (Morelos) Mexico, January 1982


*LML, "Fermilab and Latin America"*
Creating the Pan-American Connection
with colleagues from South of the Border

First Pan-American Symposium on Elementary Particles and Technology
Cocoyoc (Morelos) Mexico, January 1982

Leon + J. D. Bjorken, G. Charpak, R. Feynman, S. Glashow,
R. Marshak, M. Moravcsik, B. Richter, A. Tollestrup,
N. Samios, W. Panofsky, R. E. Taylor and R. R. Wilson.

*LML, "Fermilab and Latin America"

1984: “The U.S. should offer our Latin American neighbors
a massive graduate fellowship program in science and engineering.”
Looking over the horizon: From the Desertron to the SSC
In the late '80's, the Fermilab Collider should operate at 2 TeV. It is now abundantly clear that these energies are not adequate to reveal nature's secrets at high energy. We need a 20 TeV hadron-hadron collider.

S. Glashow, Rome Workshop, October, 1981

"Do not ask theorists at which energy to aim for the next generation of high energy accelerators. Aim at the highest possible.

A. Salam, Paris Conference, 1982

"The outstanding problem in today's theory of particles is that none of the projections beyond the standard model can be considered with any confidence. What we need is experimental guidance; exposure to the no man's land of lepton-lepton or quark-quark collisions up to the mass range of 1 TeV and beyond.

W. Veltman, SLAC Accelerator Summer School, 1982.

All of this led me to consider the problem: how can we break out of the aging lab and inadequate lab site constraints -- how can we creatively leapfrog the world and get to the multi TeV domain? The possibility of near-term (less than 4 years) technological breakthroughs seems very remote. Our experience with SAVER magnets and the complexities of 12 TeV magnets indicates that here, we face a long R&D program, with no assurance that we will break through on costs (see below). We were then led to consider old technology: iron magnets with radical innovations in fabrication, mass production, installation, etc., as so to bring the costs per meter down substantially more than the ratio of magnetic fields. Since the operating costs are also relevant, the iron would have to be energized by superconductors; i.e., we are talking about an old idea, superferric magnets.

Since we are now dealing with state-of-the-art systems, it seemed plausible that a 0.2 year R&D program could yield a very good assessment of the possibilities. Now, with 2-3 tesla magnets, we are talking about a very large site -- clearly a new laboratory which would become 150 U.S. High Energy lab. It would have to contain a ring of 15-20 km radius, and if shallow trenching (instead of conventional tunnels) is the mode, then the site must be very flat, sparsely populated, yet near a good, international airport. Hence the accolade, "Machine-in-the-desert."

As proposals for the late '80's, all four laboratories have been proposing on projects which may not, in my opinion, provide "sufficiently bold thrusts into the unknown" and, in this sense, do not seem to me to promise to provide the excitement which draws the best and brightest. In particular, I fear that these proposals do not promise to dramatically enlarge the domain of observations when we consider the world's activities. Specifically, I believe it is important to at least examine the possibility that the machine for the late '80's be, in fact, a very bold advance. We need to ask ourselves hard, introspective questions: are we, as a community, growing old and conservative, and if so, what are the dangers of compromising the traditional dynamism we have surely enjoyed in the past three decades?

All of this led me to consider the problem: how can we break out of the aging lab and inadequate lab site constraints -- how can we creatively leapfrog the world and get to the multi TeV domain? The possibility of near-term (less than 4 years) technological breakthroughs seems very remote. Our experience with SAVER magnets and the complexities of 12 TeV magnets indicates that here, we face a long R&D program, with no assurance that we will break through on costs (see below). We were then led to consider old technology: iron magnets with radical innovations in fabrication, mass production, installation, etc., as so to bring the costs per meter down substantially more than the ratio of magnetic fields. Since the operating costs are also relevant, the iron would have to be energized by superconductors; i.e., we are talking about an old idea, superferric magnets.

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In contemplating the late 80’s, where will the breakout opinion, theoretical physics beyond the standard model this time, will be? By the early 1990’s there will be a European initial comments are made as a citizen-physicist. My imaginative? Are we settling into a comfortable, I began to have nightmares. Dare we be any less up to the mass range of 1 TeV and possible. "Do not ask theorists at which energy to beyond." And what are the scientific imperatives? In my experience with SAVER magnets and the complexities of innovations in fabrication, mass production, 1-2 year R&D program could yield a very good assessment. my nightmare, into the unknown" and, in this sense, do not seem to me the machine for the machine for the 20 TeV hadron-hadron collider. We need to ask ourselves hard, introspective questions: have we been good citizens, not providing the excitement which drives the best and brightest. In particular, I fear that these things do promise to dramatically enlarge the domain of observations when we consider the world's sensitivity to small signals. I believe it is important to at least examine the possibility that the machine for the microbe, in fact, a very bold advance. We need to ask ourselves hard, introspective questions: are we biologically, geologically old and conservative, and is there a chance that we are missing the train we have always enjoyed in the past three decades? All of this led me to consider the question: how can we predict the luminosity gain from other site constraints -- how can we creatively Laospew the world of new techniques, we can’t predict the possibility of near-term (less than ~1 years) fluctuations and particles that are not very experience with SAVEX magnets and the complexities of studying the corresponding high energy, this can consider old technology: iron magnets with radical fields. Since the operating costs are also relevant, the iron magnets from U3S experiments would work with an assurance that we will break through this threshold. This threshold is the physicists, in general good agreement that we consider old technology: iron magnets with radical field strengths. Since the operating costs are also relevant, the iron magnet would work with an assurance that we will break through this threshold. This threshold is the physicists, in general good agreement that we consider old technology: iron magnets with radical field strengths. Since the operating costs are also relevant, the iron magnet would work with an assurance that we will break through this threshold. This threshold is the physicists, in general good agreement that we consider old technology: iron magnets with radical field strengths. Since the operating costs are also relevant, the iron magnet would work with an assurance that we will break through this threshold. This threshold is the physicists, in general good agreement that we consider old technology: iron magnets with radical field strengths. Since the operating costs are also relevant, the iron magnet would work with an assurance that we will break through this threshold. This threshold is the physicists, in general good agreement that we consider old technology: iron magnets with radical field strengths.
Physics at the 
Superconducting Super Collider 
Summary Report
Answering the Call
Tending the flock
Hats Off to Waxahachie
Passing the baton

“Ten years is a good round number.”
Savoring the afterlife
Delighting in talent
26/27 FÉVRIER 2016
Emission officielle du timbre à l'effigie de Georges Charpak
CERN - Site de Prévessin

En vente
au bureau de poste temporaire,
CERN, Site de Prévessin,
D35, 01280 PRÉVESSIN-MOENS

Accès libre - Visites guidées et exposition
horaires d'ouverture : mercredi 14h-17h, samedi 10h-17h
Making us smile
Engaging young minds: Saturday Morning Physics
Powerpoint presentation with handwritten notes on the blackboard.

- Energy
- $10^{-10}$
- $\text{Suggested Reading for next week}$
- "Time for the Stars"
- $\text{Rain, eat, fire, food, life} \quad T \approx 24$ day
In Leon’s company, it seemed that anything might be possible.

Thank you, Leon!
For archival materials, I am grateful to
Reidar Hahn, Valerie Higgins, Karin Kemp,
Ellen Lederman, Kate Metropolis, Karen Seifrid,
Fermilab Creative Services