David Cline:
a colleague, a friend and the man that changed my life

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In 1988 David and I met at Brookhaven Lab. He asked me if I would be interested in moving to UCLA to strengthen the group doing research on particle accelerators.
He was very convincing in his effort to convince me to go west and his enthusiasm for UCLA was hard to resist.
I had spent almost all my professional life in National Laboratories and the idea of moving to a University with colleagues like Dave was very attractive. Even if I already had been teaching at Stony Brook, and had a student working with me for his PhD thesis, I liked the idea of making teaching one of my primary missions. The additional freedom given by a full time University position was also a very strong point in the decision to follow David to the West Coast.

David himself moved from Wisconsin to UCLA a few years before me, in 1986. He promoted new directions of research in the UCLA department of physics, in particular the research on particle beams and accelerators in which I was involved.
Dave had always been interested and active in this field and worked hard to increase the strength of the faculty in this area.

Producing Massive Neutral Intermediate Vector Bosons with Existing Accelerators(*)

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Abstract

We outline a scheme of searching for the massive weak boson ($M = 50 - 200\ GeV/c^2$). An antiproton source is added either to the Fermilab or the CERN SPS machines to transform a conventional 400 GeV accelerator into a $p\bar{p}$ colliding beam facility with 800 GeV in the center of mass ($E_{eq} = 320{,}000$ GeV). Reliable estimates of production cross sections along with a high luminosity make the scheme feasible.

An important example of the role played by Dave in high energy physics and particle accelerators is the pioneering 1976 paper on proton-antiproton colliders, that led to the discovery of the W and Z mesons and the development of the Tevatron at Fermilab. The antiproton component was the new element that allowed to use existing accelerators.

A High Luminosity Superconducting Mini Collider for Phi Meson Production and Particle Beam Physics

David Cline et al.

At UCLA Dave proposed to build a compact mini collider for the study of Phi meson production, to study CP violation in the K-meson system.
This Phi-factory is a small system, the beam energy is around 500 MeV, and could be built in a limited space on a university campus. At the same time it requires a very large luminosity to observe the rare events of interest. All together it is small but challenging. Dave advanced the idea of using superconducting magnets to reduce the system footprint and at the same time increase the revolution freqeuency and the luminosity.
He put together a collaboration including scientists from Livermore, Berkeley Lawrence Laboratory, SSRL at SLAC, experts in superconducting magnets for fusion systems from General Dynamics, and other local companies for the radio-frequency system and other components.

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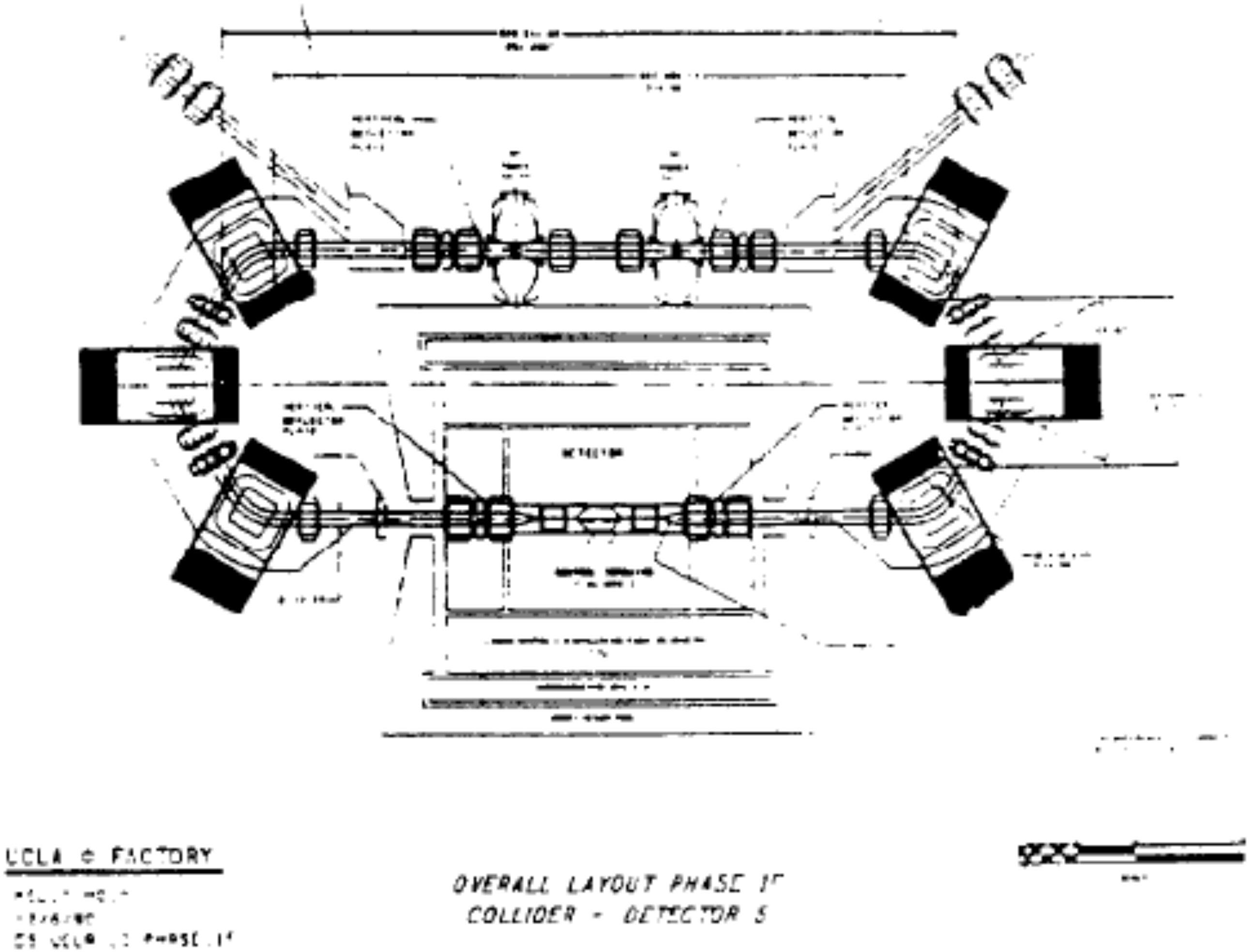

The major physics aim of the Phi factory is the observation of direct CP-violation in K_L decays. The luminosity needed to obtain this result is $L \sim 5 \times 10^{32}$ cm^{-2} s^{-1}.

Designs and proposal for the Phi factory were also developed at Novosibirsk, KEK and Frascati.

The UCLA proposal was very competitive and introduced new ideas. It was presented at several conferences and was finally submitted to the Department of Energy for initial funding. It was reviewed by a Panel of the US Department of Energy. Unfortunately the panel and DOE did not support the project, mostly claiming that the University did not have the management capability and technical infrastructure needed for a project of this size. However the work on the Phi Factory led to other interesting developments for accelerator physics. One example is the zero momentum compaction storage ring, the subject of the thesis of my Stony Brook/UCLA student David Robin, that has been used in work on specialized rings for synchrotron radiation sources and FELs.

In the end a Phi factory was built at Frascati, and successfully carried out measurement of CP violations in the K-meson system.

Quasi-isochronous storage ring *

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The work on the Phi Factory bring me to remember another important legacy of Dave, the many graduate students in accelerator physics that were supervised by him, or did their work in areas inspired by him. Many of these students have important positions today and have given important contributions to our field. He was the original advisor of James Rosenzweig before leaving for UCLA, and he suggested me to offer Jamie the new position of Assistant Professor in Accelerator Physics when I moved here. After working on the Phi Factory my own interest shifted to X-ray Free-electron Lasers. Together with Jamie we started the Particle Beam Physics Laboratory here at UCLA. The work we did led to the proposal to build an X-ra Free-electron Laser at SLAC, which is now leading atomic and molecular science at a new level of understanding. I continued to discuss these developments with Dave and he was always an enthusiastic supporter.

The disappointment for the Phi Factory did not decrease Dave enthusiasm for searching new avenues to further high energy physics and his next move was the development of the muon collider.

The muon collider: Dave was a pioneer of the muon collider concept. In 1992 he organized a workshop in Napa to discuss the physics potential and the technical challenges of a muon collider. I was one of the participants and remember very well the energy and the ideas that came from him.

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Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment

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Physics potential of a few hundred GeV $\mu^+\mu^-$ collider

David B. Cline

Abstract

There is growing evidence that both a Standard Model and a SUSY Model Higgs should exhibit one resonance at a mass less than $2M_Z$. This is precisely in the mass range that is very difficult (but not impossible) to detect at the LHC and possibly beyond the reach of LEP II. At a $\bar{\mu}\mu$ collider the direct channel $\mu^+\mu^- \to h^0 \to b\bar{b}$ can be used to search for the Higgs. We discuss the collider requirements for this search on the $\mu\bar{\mu}$ collider luminosity and the detector. These results arose from a $\mu^+\mu^-$ Collider Workshop held in Napa Valley, California, November 1992.

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Simulation prediction and experiment setup of vacuum laser acceleration at Brookhaven National Lab-Accelerator Test Facility

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Abstract

This paper presents the pre-experiment plan and prediction of the first stage of vacuum laser acceleration (VLA) collaborating by UCLA, Fudan University and ATF-BNL. This first stage experiment is a proof-of-principle to support our previously posted novel VLA theory. Simulations show that based on ATF's current experimental conditions the electron beam with initial energy of 15 MeV can get net energy gain from an intense CO_2 laser beam. The difference in electron beam energy spread is observable by the ATF beam line diagnostics system. Further, this energy spread expansion effect increases along with an increase in laser intensity. The proposal has been approved by the ATF committee and the experiment will be our next project.

SCIENCE + TECHNOLOGY

Physicists demonstrate the acceleration of laser in a vacuum

UCLA Newsroom | February 27, 2013

RECOMMEND TWEET in SHARE EMAIL PRINT

Accelerating a free electron with a laser has been a longtime goal of solid-state physicists.

David Cline, a distinguished professor in the UCLA Department of Physics and Astronomy, and Xiaoping Ding, an assistant researcher at UCLA, have conducted research at Brookhaven National Laboratory in New York and have established that an electron beam can be accelerated by a laser in free space.

This has never been done before at high energies and represents a significant breakthrough, Cline said, adding that it also may have implications for fusion as a new energy source.

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NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH
Section A

Micro-bunching diagnostics for inverse Cherenkov acceleration by coherent transition radiation

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NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH
Section A

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Neutrino-factory storage ring with multiple baselines

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To summarize, Dave has given important contributions to the development of particle accelerators for high energy physics, introducing new ideas on how to best utilize existing systems, studying new beam diagnostics and novel methods of acceleration. His contributions also include the general support that he gave to the field with his vision, enthusiasm and by supervising many graduate students. He always had great dreams, and followed them throughout his life. He was the person that started and helped the growth of accelerator physics here at UCLA. And in the process he changed my life and I will always be grateful for that and will miss him, his vision and love of physics.

Looking at his family here I want to tell them all that Dave had a great impact on physics and on many people. His life was well spent.