

Connections

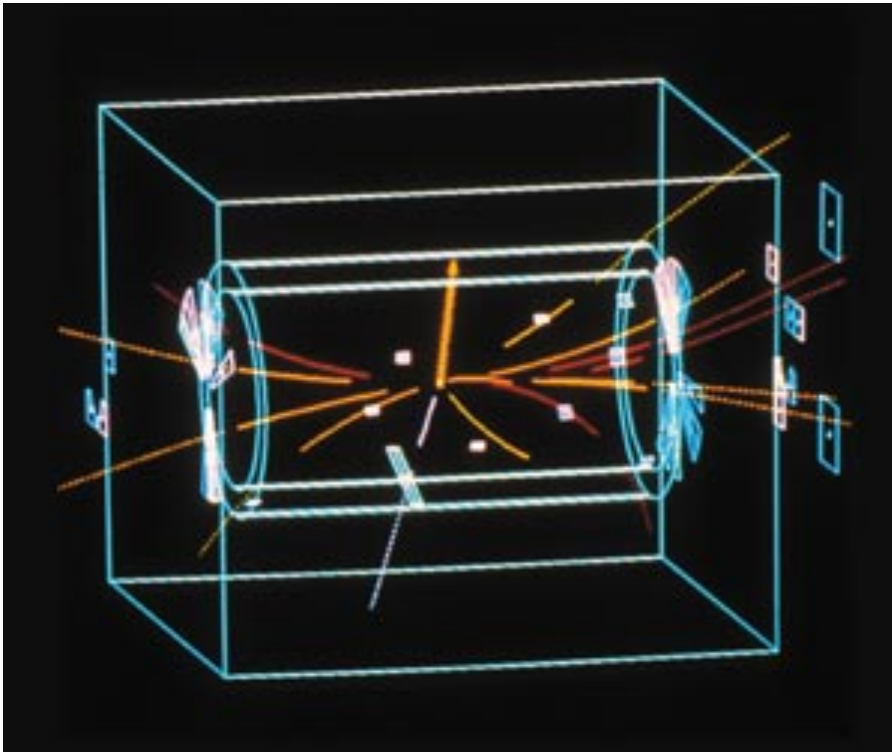
David Cline through the lens of a UA1
graduate student

Lucy Fortson

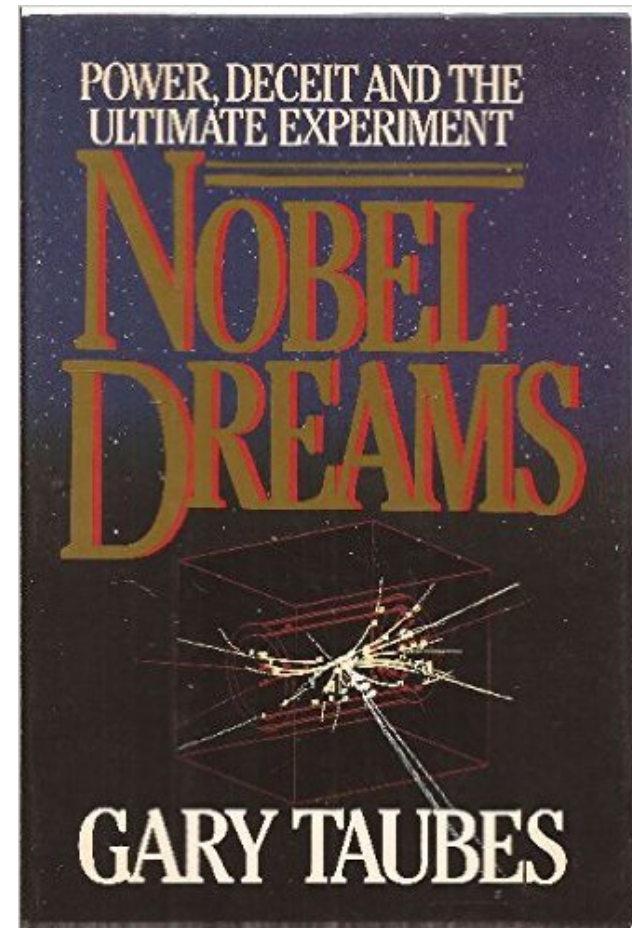
University of Minnesota

Setting the stage...

<http://cerncourier.com/cws/article/cern/28849>



In 1983, the UA1 detector at CERN discovered the W & Z bosons – the key prediction of electroweak theory.



Fermi-Lab 1987



Musafar Atac's Lab

Friday; 4/29/88

Dave;

In case I don't see you before you leave:

- 1) Mohammed claims there are only two UCLA budgets available at CERN:
 - a) for the Position Detector for which he has the purchase card.
 - b) account to pay the Mexican students
- 2) He believes it is impossible to have a third account set up for the Iarocci revival saying his experience in obtaining the account for the Mexicans was an extremely difficult one.
- 3) He thinks it would be fine to use just the one card for both Iarocci and Pos. Det. purchases.
- 4) I was not able to talk to Jim yesterday about all this but I asked Mohammed to double check all the above with him.
- 5) I am assuming that the money will be available from our side (UCLA) at least and am planning accordingly to set up the new gas system. Hopefully Jim or Mohammed will be able to tell me in detail where the money is coming from.
- 6) I am writing a Technical Note (with Kate's help) explaining the need for a change from the old system to the new gas system for the Iarocci's.
- 7) I am working on cancellation of my exam all together. I certainly am not taking it this spring and am planning accordingly. I would like to go to LA in August and then to Harvard for my shift at the Farm. I need you to be ready to write a formal request to Joe Rudnick asking for my release from the requirement concerning the exam.

Communicating...

JULY 5, 88

TELEFAX To Jim Kolko

UCLA

SENT \$10K NOW FROM
THE BUCHANAN/STORK DOG
FUNDS TO OUR 1731 CERN
ACCOUNT - ~~THE~~ WE (MY PART)
HAS ALREADY PUT IN \$16K
AND THE BUCHANAN/STORK SUPPORT
SHOULD BE EQUAL TO OUR SUPPORT -
THE FUNDS ARE NEEDED NOW!
(WE STILL OWE \$500 SF NOW FOR
JAPANESE WORK) DAVID CLINE

Tuesday

9/3/89

UCLA Meeting

DOE

Secty Watkins → #1 priority SSC

Future UAI? Black ~~area~~ ~~space~~ for top

CDF t limit ~ 70 GeV

~~excess~~ excess $W + jets$? No!

multi leptons, $(\mu + e)$ lepton + jets (large background)
 40μ $P_t > 12$ "golden event?"

CDF 70 GeV expect 5-6 events

UAI 70 GeV expect 1 event

Strong theoretical reasons for $m_t < m_W$

low mass dimuon $P_t \sim 3$ GeV recut data

m_t limit @ 50, 60 GeV

- two letter drafts ← Chairman
5,3 3,3 . Allan Norton
- dimuon sample rate ~~higher~~ ^{lower} but background lower also
single μ " " ["] higher but background higher also
but b sample harder than t
→ look for same sign 2μ with small opening angle
 $\sim 90^\circ$ open angle
→ can't be too small otherwise background from gluon splitting
→ unlike sign 2μ signal swamped by Drell-Yan, etc background
→ have to go down to 3 GeV P_t per μ

...big ideas ...

Aug 20, 88 ①

TO: UCLA TEAM IN VAI AT CERN

FROM: D. CLINE

SUBJECT: NEW PHYSICS POSSIBILITIES WITH TRIMUON
DETECTION USING THE IARUCCI SYSTEM

IN THE 1985 RUN WE DETECTED 5 TRIMUON
EVENTS (SEE NOTE BY D. SUMMERS ATTACHED) - THE
IARUCCI MUON SYSTEM IS ESSENTIAL FOR THIS CLASS OF EVENTS!
AN ANALYSIS OF SOME OF THE PHYSICS POSSIBILITIES
WAS CARRIED OUT AND WAS REPORTED IN VARIOUS WISC. INTERNAL
GROUP MEETINGS. ONE SPECIFIC RESULT USING THE
t SEARCH ISAJET SIMULATION TAPES WAS CARRIED
OUT BY J. RHOADES AND D. SUMMERS (SEE ATTACHED)
A SPECIFIC IDEA TO DETECT B_c STATES WAS ALSO DISCUSSED BY
THE VARIOUS PROCESSES THAT CAN CONTRIBUTE TO μ
TRIMUON PRODUCTION ARE

$$\begin{aligned} \bar{p}p &\rightarrow t \bar{b} \text{ (W DECAY) } + \\ &\quad \downarrow \mu \\ &\quad \downarrow \mu + b + \nu \\ &\quad \quad \downarrow \mu \end{aligned}$$

u d s t
c b

$$\begin{aligned} \bar{p}p &\rightarrow t \bar{t} + \\ &\quad \downarrow \mu + \bar{b} + \nu \\ &\quad \downarrow \mu + b + \nu \\ &\quad \quad \downarrow \mu \end{aligned}$$

$$\begin{aligned} \bar{p}p &\rightarrow b' \bar{b}' + \quad \text{if } M_{b'} > M_t \\ &\quad \downarrow \mu + \bar{t} + \nu \\ &\quad \downarrow \mu + t \dots \quad \downarrow \mu + b \dots \text{ etc} \\ &\quad \quad \downarrow \mu \dots \text{ etc} \end{aligned}$$

if $M_{b'} < M_t$ replace $t \rightarrow c$

...big ideas ...

$$\begin{aligned}\bar{p}p &\rightarrow b\bar{b} + \\ &\quad \downarrow \mu + c + \nu \\ &\quad \downarrow \mu + c \\ &\quad \quad \downarrow \mu\end{aligned}$$

Note $\bar{B}B$ MIXING

CAN IN PRINCIPLE

GIVE 4 SAME

SIGN ~~3~~ MUON EVENTS

$$\begin{aligned}\bar{p}p &\rightarrow B_c \bar{B}_c + \\ &\quad \downarrow (\bar{b}c)\end{aligned}$$

TRIMUONS ALL ON ONE SIDE

NOTE: (THE B_c STATE HAS NOT YET BEEN DISCOVERED)

$$\begin{aligned}&\downarrow \mu c c \dots \\ &\quad \downarrow \mu \quad \text{etc} \\ &\quad \downarrow \mu\end{aligned}$$

$\bar{p}p \rightarrow$ SUSY PROCESSES

ETC / ETC

\downarrow MULTIMUONS

YOU CAN SEE THAT THIS IS AN EXTREMELY RICH AREA OF PARTICLE PHYSICS!

NOTE FROM THE RHODES / SUMMERS REPORTS THAT THE JARROCCITUBE SYSTEM IS THE ONLY WAY TO DETECT 3μ EVENTS IN THE 1988-89 RUNS WE MAY EXPECT OF ORDER

50 - 100 TRIMUON EVENTS - THIS COULD LEAD

TO 2 THESIS TOPICS AT LEAST. NOTE THAT THE CDF DETECTOR AT FERMILAB HAS NO CHANCE TO SEE TRIMUONS -

TO BE SPECIFIC I PROPOSE THAT INTERESTED

STUDENTS GET HOLD OF THE RHODES / SUMMERS

ANALYSIS AND USE THE $\sim 66K$, 3μ ISAJET EVENTS

TO LEARN OF THE POTENTIAL FOR ~~2~~ EXTRACTING INTERESTING PHYSICS FROM THE FUTURE TRIMUON

EVENTS. LATER WE CAN GO BACK AND PUT OTHER

PROCESSES INTO ISAJET (FOR EXAMPLE $b\bar{b}$ PRODUCTION)

AND SIMULATE TRIMUONS FROM THESE PROCESSES. J. RHODES CAN HELP WITH THIS EFFORT WHEN NEEDED. (SHE IS AT CDF NOW)

THIS IS ALSO A GOOD WAY TO GET INTO THE METHODS

OF ~~RECONSTRUCTING~~ RECONSTRUCTING 3μ EVENTS IN THE NEXT RUN - IN 1989 WHEN THE JARROCCIS ARE PUT INTO THE TRIGGER THE RATE COULD INCREASE.

Just out
Get over
done by you
De

UA1/TN 87-30
10 March 1987

ISAJET MONTE CARLO TRIMUONS

J. Rhoades and D. Summers
University of Wisconsin - Madison

We have made a sub-sample of trimuon events using the very large Monte Carlo generation which was done for the top analysis (D. Charlton et al., Monte Carlo Production Using ISAJET 5.23, UA1/TN 86-97). An outline of the procedure which was followed to select trimuons is given on the following pages. Histograms are also included of momentum distributions and the masses of pairs of muons. Note that the muons coming from a single $b \rightarrow c$ cascade will have opposite sign (assuming no D^0 mixing) and will typically be in the $1 \rightarrow 3 \text{ GeV}/c^2$ mass range (see fig. 10). Also note that there are very few trimuon events with $p_T > 3 \text{ GeV}/c$ for all 3 muons (see fig. 5). There are a large number with $2 < p_T < 3$.

A study of the origin of each muon is in progress. Detector simulation and reconstruction have not yet been done, but the $p_T > 0.75 \text{ GeV}/c$ and $p > 2 \text{ GeV}/c$ cuts do approximate the UA1 detector to some extent.

Acknowledgements

We would like to thank M. Mohammadi for many helpful discussions.

...multiple thesis topics...

SEARCH FOR A 4th GENERATION, CHARGE ($-\frac{1}{3}$)
QUARK WITH THE UA1 DETECTOR AT THE
SPBS COLLIDER AT $\sqrt{s} = 630$ GeV

PRESENTED BY: LUCY FORTSON

ON: AUGUST 22nd 1991

FOR: QUALIFYING ORAL

OUTLINE

INTRODUCTION

PRODUCTION OF b' QUARKS IN $p\bar{p}$ COLLISIONS

SIGNATURE OF b' QUARK DECAY

BRIEF LOOK AT SPBS COLLIDER AND UA1 DETECTOR

DATA SAMPLE FOR SEARCH

BACKGROUND TO PREDICTED b' DECAY SIGNATURE

SEARCH FOR b' IN ISOLATED MUON EVENTS

SEARCH FOR b' USING LIKELIHOOD METHOD

FINAL RESULTS

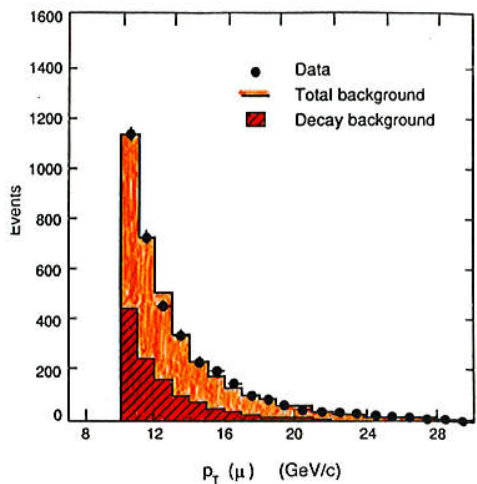
The art of the transparency circa 1990

BACKGROUND TO PREDICTED b' DECAY SIGNATURE

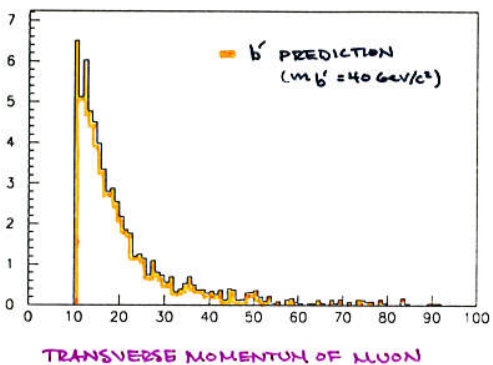
CONTROL REGION CUTS

- $10 \text{ GeV/c} < P_T^{\mu} < 15 \text{ GeV/c}$, $|\eta^{\mu}| < 1.5$
- $E_T^{\mu} > 12 \text{ GeV}$, $|\eta^{\mu}| < 1.5$
- 1ST SECOND JET $E_T^{\mu} > 7 \text{ GeV}$, $|\eta^{\mu}| < 2.0$

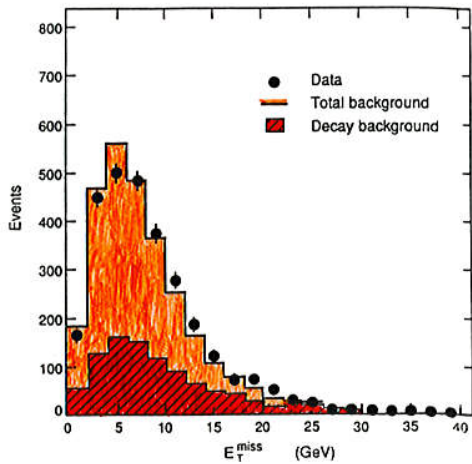
CONTROL REGION CUTS



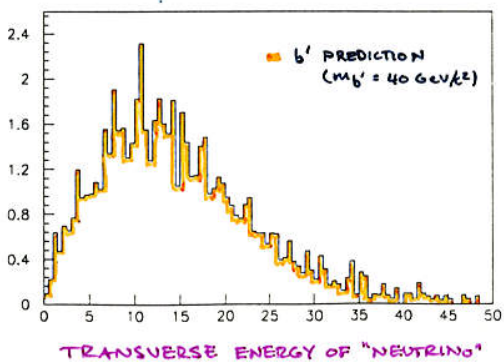
CONTROL REGION CUTS



CONTROL REGION CUTS



CONTROL REGION CUTS



Physics Colloquium

THURSDAY, December 5

1220 KNUDSEN HALL

Refreshments start at 3:45 pm
in Kn 2-222 (Leonard Lounge)

Talk starts at 4:00 pm

Featuring:

Professor David Cline

Department of Astronomy and Physics
U C L A

**"Weak Neutral Currents:
One Million Z^0 's and Quark Flavors"**

Abstract: We trace the early development of the standard model of elementary particles and the search for weak neutral currents culminating in the discovery of the Z^0 's in 1983.

The next step in this field is the study of 10^6 's of millions of Z^0 's and the ultimate search for flavor changing weak neutral currents, both of which will help elucidate the nature of quark flavors and physics beyond the standard model.

PRL

~ 1963-64

work

SEARCH FOR NEUTRAL LEPTONIC CURRENTS IN K^+ DECAY*

U. Camerini, D. Cline, and W. F. Fry
Physics Department, University of Wisconsin, Madison, Wisconsin

and

W. M. Powell
Lawrence Radiation Laboratory, University of California, Berkeley, California
(Received 4 August 1964)

4
AUTHORS

A basic assumption of most present models of the weak interaction is that primitive neutral leptonic currents, to first order in the weak coupling constant, do not exist.¹ However, some models propose the existence of neutral nonleptonic currents in order to explain the $|\Delta T| = \frac{1}{2}$ rule.² Recently it has been suggested that primitive neutral leptonic currents of strength comparable to that of charged currents might exist, but some reactions where they would appear could be inhibited by selection rules among the strongly interacting particles.³ Even if primitive neutral currents do not exist, the combined effects of weak and electromagnetic interactions can cause induced neutral currents which may be observable.^{4,5}

In order to look for evidence of neutral currents in strangeness-changing interactions, the possible decay mode

$$K^+ \rightarrow \pi^+ + e^+ + e^- \quad (1)$$

has been searched for in a sample of 1.7×10^8 stopped- K^+ decays. The K^+ mesons were stopped in the Lawrence Radiation Laboratory 30-inch heavy-liquid chamber filled with C_2F_6 . No unambiguous events have been found corresponding to decay mode (1).

The detection procedure consisted of initially scanning for three-track decays that were not examples of the ordinary τ decay of the K^+ . About two thirds of the film was scanned twice. Each event was then carefully looked at again on the scanning table and was classified in one of the following three categories: (a) ordinary Dalitz pair with obvious missing momentum; (b) apparent momentum-conserving event; (c) electron pairs which converted very near the K^+ decay.

The events in categories (a) and (b) were used to compute the absolute scanning efficiency from the number of Dalitz decays expected. About

SEARCH FOR $K^+ \rightarrow \pi^+ e^+ e^-$

and

$$K^+ \rightarrow \pi^+ \nu \bar{\nu}$$

FLAVOR CHANGING
WEAK NEUTRAL
CURRENTS

SENSITIVE FIRST B PHYSICS SEARCH FOR FCWNC

A search for rare B meson decays at the CERN SpS Collider

UA1 Collaboration, CERN, Geneva, Switzerland

Aachen–Amsterdam (NIKHEF)–Annecy (LAPP)–Birmingham–Boston–CERN–Helsinki–Kiel–Imperial College, London–Queen Mary Westfield College, London–Madrid (CIEMAT)–MIT–Padua–Paris (Collège de France)–Rome–Rutherford Appleton Laboratory–Saclay (CEN)–UCLA–Vienna

* (THESIS)

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UCLA • How
STUDENTS join!

FUTURE PROJECTS

W. Paulik

Higgs boson, Nature of Mass, New quarks, New states of matter

High Energy
Frontier
SSC
LHC (CERN)
~~NEO (??)~~

FUTURE
COLLIDERS AND
ACCEL IN
HEP

B PHYSICS AT
SSC/LHC

~ 8000 M\$ SSC

500 M\$

50 M\$

LEP
→ 10⁷ 20

T.O.E.

High Precision
Frontier
 ϕ Factory
(g-2) μ

Frascati/
UCLA ...

ϕ FACTORY

High Rate
Frontier
K Factories
B, τ Factories

B/E/C
FACTORIES
/ KEK
(CERN)
SPAIN

Rare B & K decays
CP violation in B decays
Lepton number violation
Flavor changing, weak
neutral currents

Origin of CP violation
CPT violation
Very Massive virtual states

DM 02

DM 02

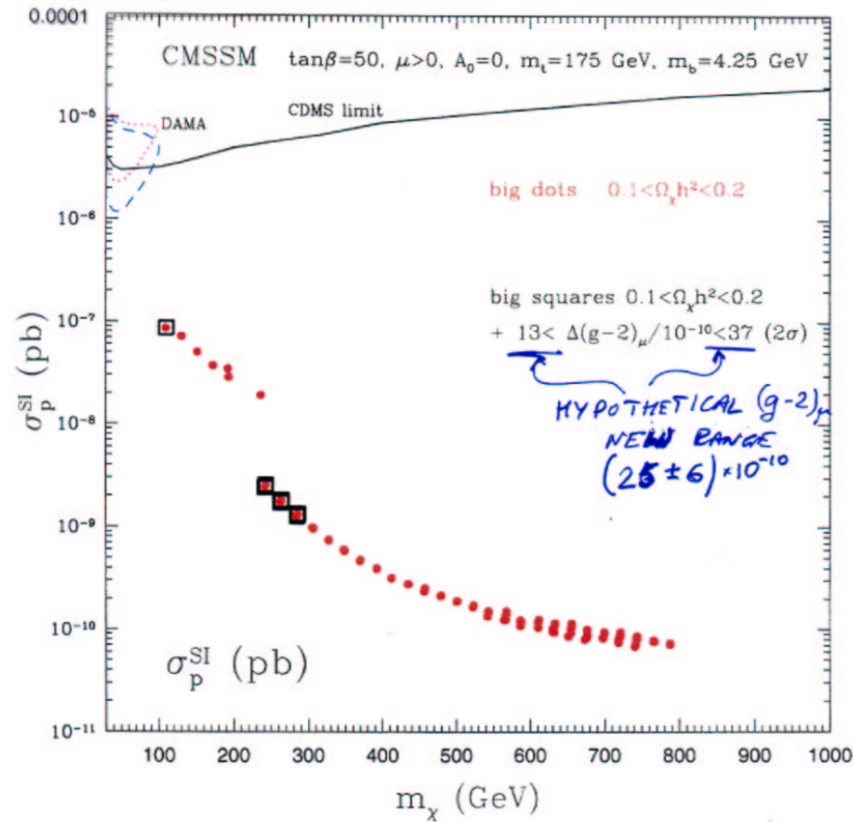
Marina

PRELIMINARY

Del Rio

Rosenowski et al Feb 02

CMSSM



'PREDICTED' CROSS SECTIONS!

the search for Dark Matter

Dark matter is usually thought of as something "out there." But we will never truly understand it unless we can bring it down to earth

By David B. Cline

Writing for the Public

THE AUTHOR

DAVID B. CLINE has now written seven articles for *Scientific American*, a new record for a researcher. Cline is professor of physics and astrophysics at the University of California, Los Angeles. His research has addressed the most important topics in particle physics: high-energy neutrinos, proton decay and the *W* and *Z* bosons, carriers of the weak nuclear force. More recently, his interests have turned to the search for dark matter. He works with the CMS detector at CERN near Geneva, which could one day produce dark matter.

Leszek Roszkowski and his team at the University of Lancaster in England recently carried out a complete calculation of the rates of neutralino interactions with normal matter. The rates are usually expressed as the number of events that would occur in a day in a sin-

SnowPAC 2012

[2012 Home](#)[SnowPAC 2012](#)[SnowDOG 2012](#)[SnowTIGER 2012](#)[Other Workshops](#)

SNOWDOG 2012 PROGRAM OF TALKS

March 24-26, 2012

Saturday, March 24, 2012

Event	Speaker	Slides
Welcome	Dave Kieda, U. of Utah	PDF
Indirect Dark Matter Searches with the Fermi-LAT	Matthew Wood, SLAC	PDF
Implications for Cosmology of Gamma-Ray Searches for Ultracompact Minihalos	Pat Scott, McGill U.	PDF
Indirect Evidence for Light WIMPs	Dan Hooper, FNAL/U. Chicago	
VERITAS Observations of the Galactic Center	Brian Humensky, Columbia	
The Fermi-LAT View of the Inner Galaxy	Troy Porter, SLAC	
VERITAS Observations of Fermi Unidentified Targets,	Manel Errando, Barnard/Columbia	PDF
Dark Matter Spikes: Fermi Constraints	Douglas Spolyar, FNAL	PDF
Dark Matter Annihilation in the Extragalactic Gamma-Ray Background	Tracy Slatyer, IAS	
Dark Matter Searches with H.E.S.S.	Bjorn Opitz, U. Hamburg	PDF

Sunday, March 25, 2012

Event	Speaker	Slides
Measuring Mass in Dwarf Galaxies	Matthew Walker, Harvard U.	PDF
Constraints on the pMSSM from LAT Observations of Dwarf Spheroidal Galaxies	Randel Cotta, Stanford/SLAC	PDF
Constraints on Low-Mass WIMPs from Dwarf Galaxies	Alex Geringer-Sameth, Brown U.	
VERITAS Searches for Dark Matter in Dwarf Spheroidal Galaxies	David Staszak, McGill U.	
Dark Matter Searches with MAGIC	Michele Doro, U. Autonoma de Barcelona	
Constraints on Dark Matter from VERITAS Observations of the Coma Cluster	Lucy Fortson, U. Minnesota	
Dark Matter Annihilation in Phase Space	Francesc Ferrer, Washington U.	
Constraining Dark Matter with Gamma Ray Data	Eric Baxter, U. Chicago	PDF
The Prospects of Discovery of Dark Matter in the Near Future	David Cline, UCLA	

Monday, March 26, 2012

Event	Speaker	Slides
New Constraints on Primordial Black Holes Abundance from Femtolensing of Gamma-Ray Bursts	Anna Barnacka, N. Copernicus Astro. Center	PDF
Measurement of the Cosmic-Ray Positron Spectrum Using the Fermi LAT & the Earth's Magnetic Field	Justin Vandenbroucke, Stanford	
Deviant Dark Matter: Signals at Low-Energy Gamma-Rays & Constraints from High Energies	Kevork Abazajian, UC Irvine	
Dark Matter & Fundamental Physics with CTA	Michele Doro, U. Autonoma de Barcelona	
Closing Remarks	Andy Smith, U. of Utah	

My proudest moment

Final Connections

Not our David Cline!!



The screenshot shows the Wikipedia article for David Cline. A red box highlights the title "David Cline" and a red arrow points to the first sentence of the lead paragraph, which is circled in red. The lead paragraph reads: "David Cline (January 8, 1947 – September 14, 2007) was an American anti-war and veterans rights activist. He was best known as National President of Veterans For Peace (VFP) from 2000 to 2006, Chapter Vice President of Alan Reilly - Gene Glazer VFP Chapter 21, and co-founder of the Vietnam Agent Orange Relief and Responsibility Campaign.^[1] Cline was featured in the 2006 film *Sir! No Sir!*, which documented the GI antiwar movement during the Vietnam war as well as in the book "Winter Soldiers: An Oral History of Vietnam Veterans Against the War" by Richard Stacewicz.^[2]

The article also includes a "Contents" section with links to "Personal information", "Start of career", "See also", "References", and "External links". The "Personal information" section is expanded, showing that Cline was born in Buffalo, New York, drafted into the U.S. Army in 1967, and served in the 25th Infantry Division as a rifleman and machine gunner. He was wounded three times, the third time seriously enough to be sent back to the army hospital at Fort Dix, New Jersey in 1968. He received three Purple Hearts and a Bronze Star during his service.

Call to action: what an amazing wikipedia article we could write together!