Experimental particle physics

esipap
European School of Instrumentation in Particle & Astroparticle Physics

H3 analysis of classic experiments

Let's read a (classic) physics paper!

- **Form a group**
  - ✓ Ideally 3 people, as mixed as possible, with at least 1 PhD with 1 Master student → Let me know in Slack about the group
- **Choose a paper and read it!**
  - ✓ 7 papers to choose from, no duplicate allowed: 1 paper / group!
  - ✓ Negotiate amound you and let me know your choice by tomorrow
- **Discuss the experimental techniques used**
  - ✓ What accelerator, is any? What detector setup?
  - ✓ How was the signal identified?
  - ✓ What were the major experimental challenges? How were they solved?
- **Prepare a short presentation (~3 slides max, 5' show time!) where the previous points are discussed**
  - ✓ It can be a simple cut-and-paste of the most important plots and/or figures from the paper: don't waste time to write text or to make pretty slides!
  - ✓ Presentations will take place on Monday!

What papers?

- 1942 Measurement of muon decay time
- 1955 Antiproton discovery
- 1974 J/Psi discovery
- 1982 Observation of QCD jets
- 1983 W boson discovery
- 1983 Z boson discovery
- 1995 Top quark discovery

Muon decay time

1942

Experimental Determination of the Disintegration Curve of Mesotrons

BRUNO ROSSI AND NORRIS NERESON
Cornell University, Ithaca, New York
(Received September 17, 1942)

The disintegration curve of mesotrons has been experimentally determined by investigating the delayed emission of disintegration electrons which takes place after the absorption of mesotrons by matter. Within the experimental errors, the disintegration curve is exponential and corresponds to a mean lifetime of 2.3 ± 0.2 microseconds.

Antiproton discovery

1955

Observation of Antiprotons*

OWEN CHAMBERLAIN, EMILIO SEGRÈ, CLYDE WIEGAND, AND THOMAS YPSILANTIS

Radiation Laboratory, Department of Physics, University of California, Berkeley, California

(Received October 24, 1955)

J/ψ discovery

1974

Experimental Observation of a Heavy Particle J†

J. J. Aubert, U. Becker, P. J. Biggs, J. Burger, M. Chen, G. Everhart, P. Goldhagen, J. Leong, T. McCorriston, T. G. Rhoades, M. Rohde, Samuel C. C. Ting, and Sau Lan Wu
Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

and

Y. Y. Lee
Brookhaven National Laboratory, Upton, New York 11973
(Received 12 November 1974)

Discovery of a Narrow Resonance in e^+e^- Annihilation*

J.-E. Augustin,† A. M. Boyarski, M. Breidenbach, F. Bulos, J. T. Dakin, G. J. Feldman, G. E. Fischer, D. Fryberger, G. Hanson, B. Jean-Marie,† R. R. Larsen, V. Lüth, H. L. Lynch, D. Lyon, C. C. Morehouse, J. M. Paterson, M. L. Perl, B. Richter, P. Rapidis, R. F. Schwitters, W. M. Tanenbaum, and F. Vannucci‡
Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305

and

G. S. Abrams, D. Briggs, W. Chinowsky, C. E. Friedberg, G. Goldhaber, R. J. Hollebeek, J. A. Kadyk, B. Lulu, F. Pierre,§ G. H. Trilling, J. S. Whitaker, J. Wiss, and J. E. Zipse
Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720
(Received 13 November 1974)

Preliminary Result of Frascati (ADONE) on the Nature of a New 3.1-GeV Particle Produced in e^+e^- Annihilation*

C. Bacci, R. Balbini Celio, M. Berna-Rodini, G. Caton, R. Del Fabbro, M. Grilli, E. Iarocci, M. Locci, C. Mencuccini, G. P. Murtas, G. Penso, G. S. M. Spinetti, M. Spano, B. Stella, and V. Valente
The Gamma-Gamma Group, Laboratori Nazionali di Frascati, Frascati, Italy

and

B. Bartoli, D. Bisello, B. Esposito, F. Felicetti, P. Monacelli, M. Nigro, L. Paolufi, I. Peruzzi, G. Piano Mortemi, M. Piccolo, F. Ronga, F. Sebastiani, L. Trasatti, and F. Vanoli
The Magnet Experimental Group for ADONE, Laboratori Nazionali di Frascati, Frascati, Italy

and

G. Barbarino, G. Barbiellini, C. Bemporad, R. Biancastelli, F. Cevenini, M. Celvetti, F. Costantini, P. Lariccia, P. Parascandalo, E. Sassi, C. Spencer, L. Tortora, U. Troya, and S. Vitale
The Baryon-Antibaryon Group, Laboratori Nazionali di Frascati, Frascati, Italy
(Received 18 November 1974)

Observation of QCD jets

1982

OBSERVATION OF VERY LARGE TRANSVERSE MOMENTUM JETS AT THE CERN $\bar{p}p$ COLLIDER

The UA2 Collaboration

M. BANNER [f], Ph. BLOCH [f], F. BONAUDI [b], K. BORER [a], M. BORGHINI [b], J.-C. CHOLLET [d], A.G. CLARK [b], C. CONTA [e], P. DARRIULAT [b], L. Di LELLA [b], J. DINES-HANSEN [c], P.-A. DORSAZ [b], L. FAYARD [d], M. FRATERNALI [e], D. FROIDEVAUX [b,d], J.-M. GAILLARD [d], O. GILDEMEISTER [b], V.G. GOGGI [e,1], H. GROTE [b], B. HAHN [a], H. HÄNNI [a], J.R. HANSEN [b], P. HANSEN [c], T. HIMEL [b], V. HUNGERBÜHLER [b], P. JENNI [b], O. KOFOED-HANSEN [c], M. LIVAN [e], S. LOUCATOS [f], B. MADSEN [c], B. MANSOULIÉ [f], G.C. MANTOVANI [e,2], L. MAPELLI [b], B. MERKEL [d], M. MERMIKIDES [b], R. MØLLERUD [c], B. NILSSON [c], C. ONIONS [b], G. PARROUR [b,d], F. PASTORE [b], H. PLOTHOW-BESCH [d], J.-P. REPELLIN [d], J. RINGEL [b], A. ROTHENBERG [b], A. ROUSSARIE [f], G. SAUVAGE [d], J. SCHACHER [a], J.L. SIEGRIST [b], F. STOCKER [a], J. TEIGER [f], V. VERCESI [e], H.H. WILLIAMS [b], H. ZACCONE [f] and W. ZELLER [a]

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Received 25 August 1982

W boson discovery

1983

EXPERIMENTAL OBSERVATION OF ISOLATED LARGE TRANSVERSE ENERGY ELECTRONS WITH ASSOCIATED MISSING ENERGY AT $\sqrt{s}$ = 540 GeV

UA1 Collaboration, CERN, Geneva, Switzerland

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Z boson discovery

1983

EVIDENCE FOR $Z^0 \to e^+e^-$ AT THE CERN $\bar{p}p$ COLLIDER

The UA2 Collaboration

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EXPERIMENTAL OBSERVATION OF LEPTON PAIRS OF INVARIANT MASS AROUND 95 GeV/c^2 AT THE CERN SPS COLLIDER

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Top quark discovery

1995

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Observation of Top Quark Production in $\overline{p}p$ Collisions with the Collider Detector at Fermilab

(CDF Collaboration)

VOLUME 74, NUMBER 14 PHYSICAL REVIEW LETTERS 3 APRIL 1995

Observation of the Top Quark

(D0 Collaboration)