

Jack Schneps

A Celebration of Life and Work



Alexandre Sousa
University of Cincinnati
February 19, 2021

Many thanks to the Schneps Family and
Tony Mann in helping to prepare this talk

Formative Years

- ▶ Jacob “Jack” Schneps was born on August 18, 1929 in Peekskill, New York State, to a family who emigrated from Dębica, Poland.
- ▶ While helping out in his parents' bakery, Jack completed high-school in Peekskill, and enrolled at NYU in 1947, to which he commuted daily by train.



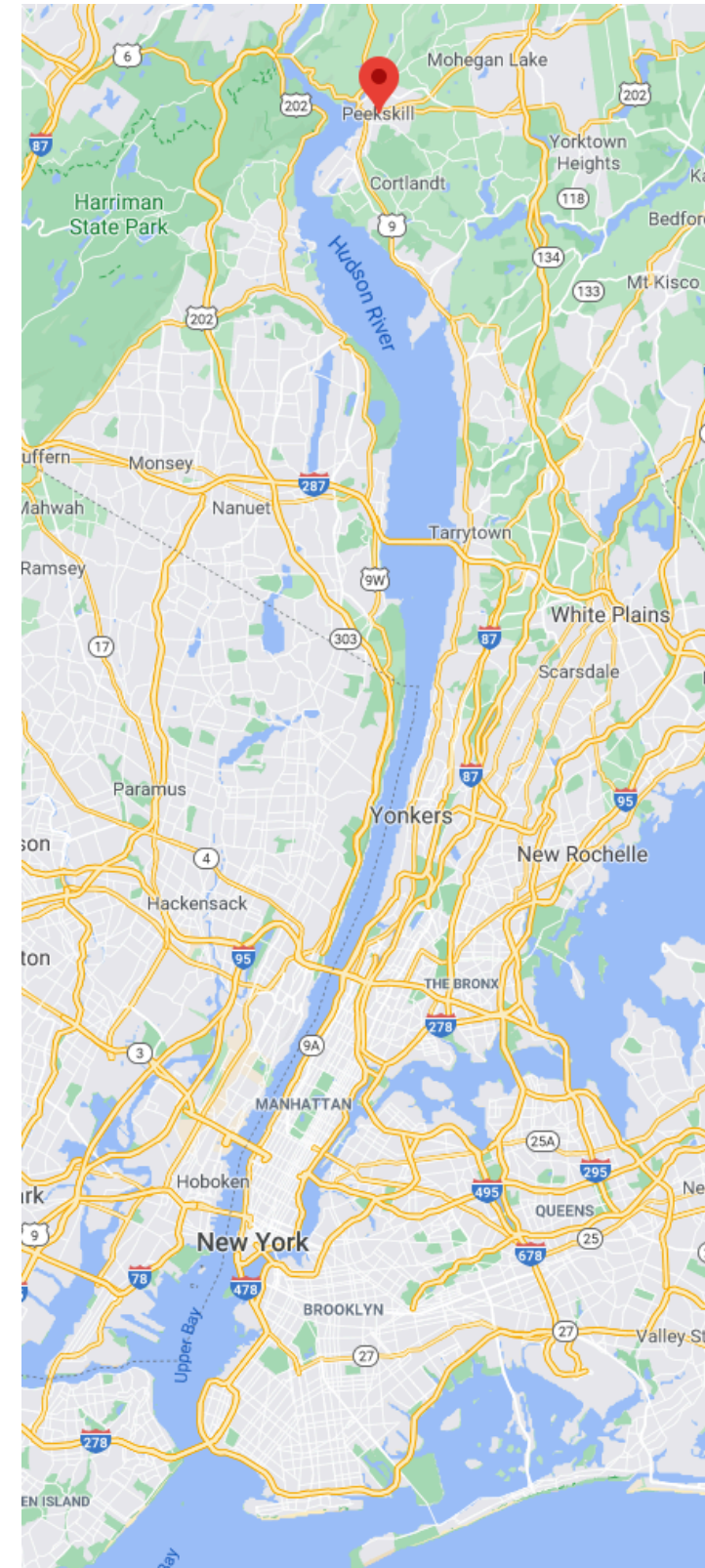
Top Notch Bakery, Peekskill, NY



Jack Schneps, High-School Yearbook, 1947

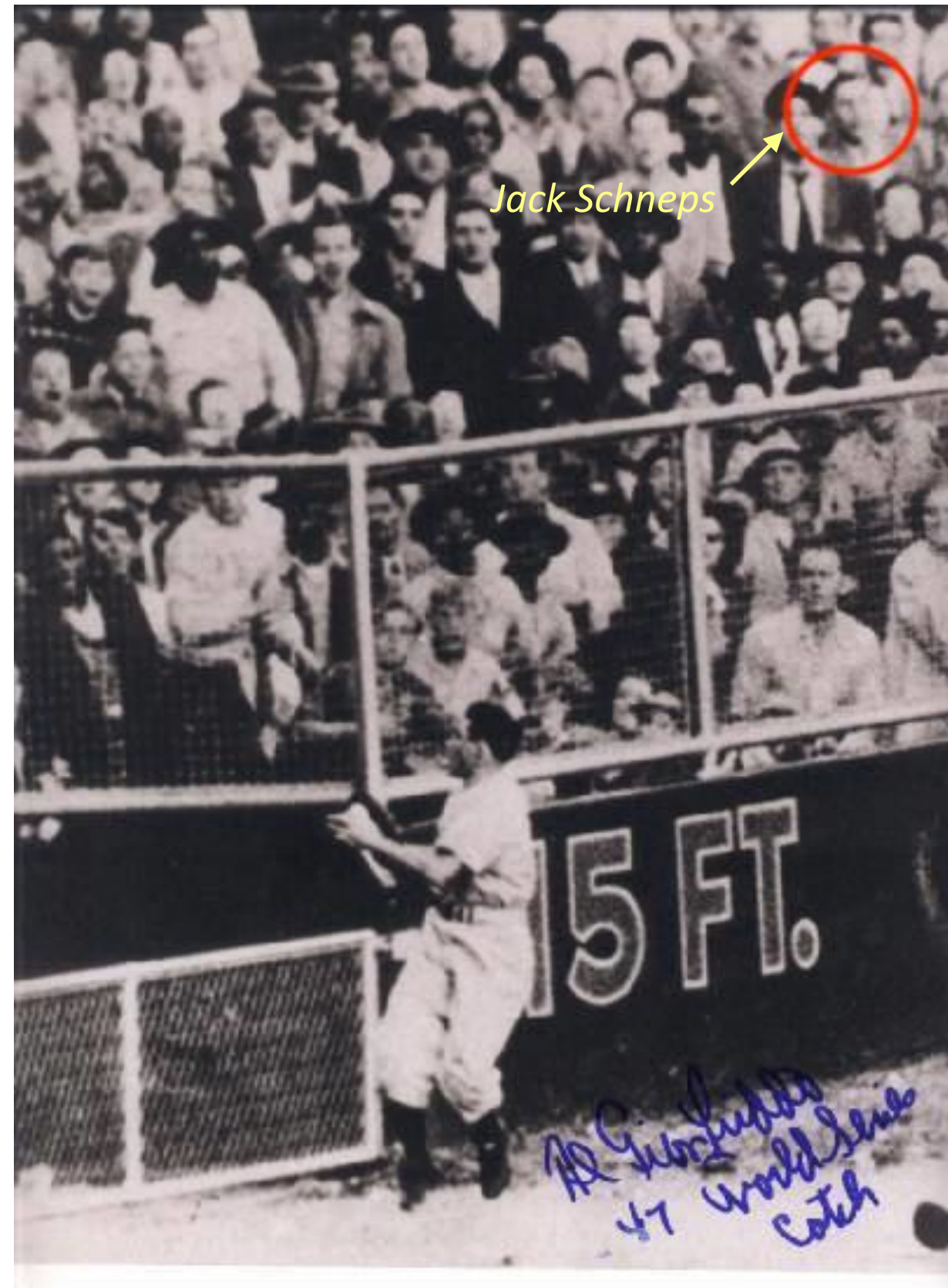


New York University



Formative Years

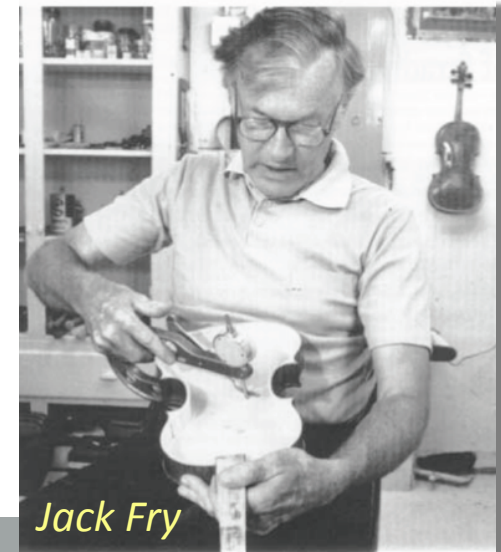
- ▶ Jack was a dedicated lifelong fan of the New York Yankees baseball team, even after living in the Boston area for over 60 years.
- ▶ Outside his Physics research work, Jack loved singing, humorous writing, classical music, and playing the mandolin.
- ▶ Video by Jack's daughter Leila with details:
<https://www.youtube.com/watch?v=K8F82mioRj4>



1947 World Series 6th Game, NY Yankees vs Brooklyn Dodgers

Work with Jack Fry's Group

- ▶ After graduating from NYU with a B.A. in Physics in 1951, Jack moved to Wisconsin-Madison for his graduate studies, and in 1952 he joined William “Jack” Fry’s newly-formed particle physics group as Fry’s first Ph.D. student.
- ▶ He defended his dissertation on “*The Production and Disintegration of Hyperfragments*” in 1956.



THE PRODUCTION AND DISINTEGRATION OF HYPERFRAGMENTS
BY
JACK SCHNEPS

A thesis submitted in partial fulfillment of the
requirements for the degree of

DOCTOR OF PHILOSOPHY

at the
UNIVERSITY OF WISCONSIN

1956

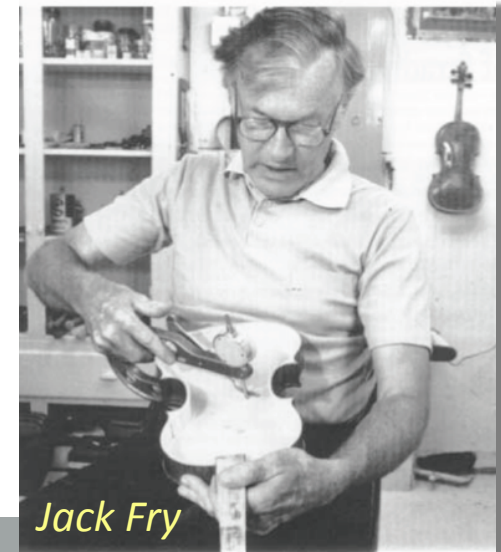
The Production and Disintegration of Hyperfragments
JACK SCHNEPS
Under the Supervision of Associate Professor W. F. Fry

A study was made of the production and disintegration of hyperfragments, a hyperfragment being a nucleus containing a bound Λ^* particle. Nuclear emulsion stacks were exposed to 6 Bev protons from the Bevatron, 3 Bev and 4.7 Bev π^- mesons from the Bevatron, cosmic rays, and K^- -mesons from the Bevatron. The ratios of hyperfragments to total number of

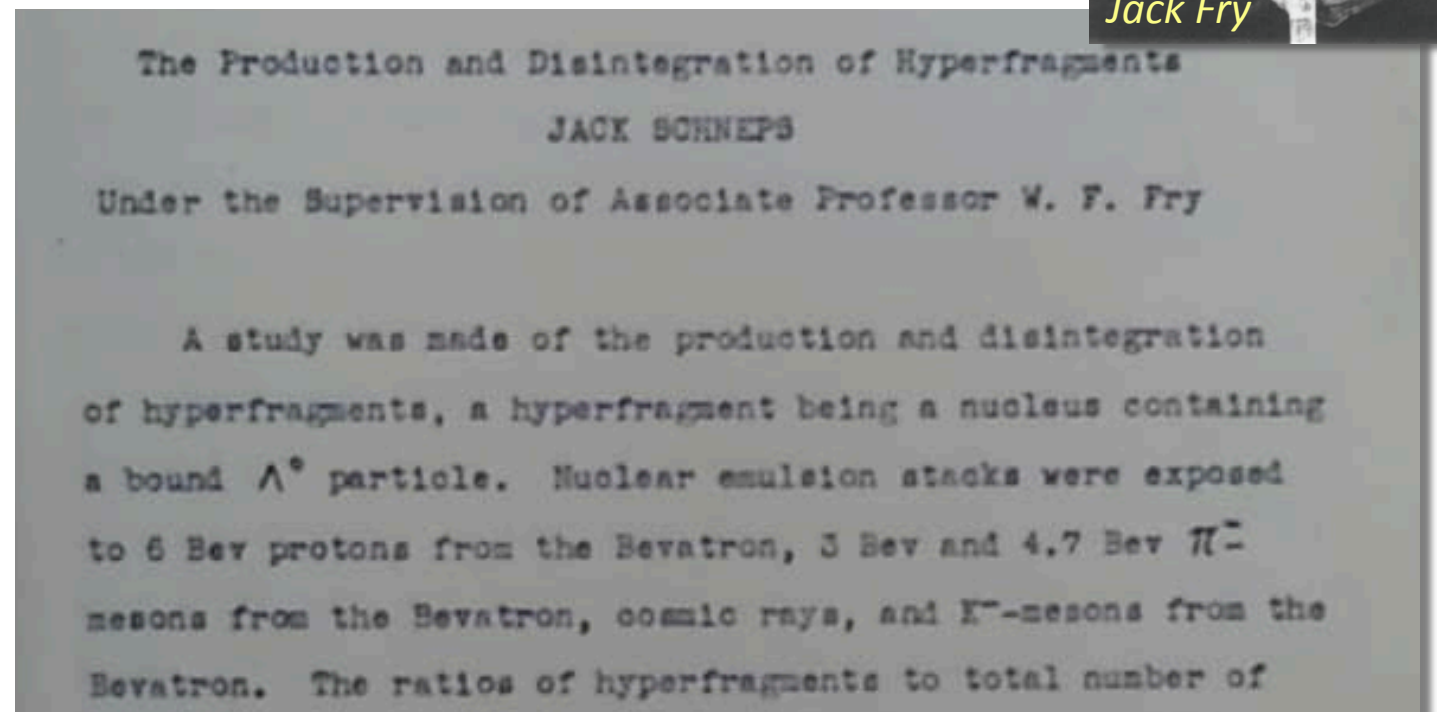
- ▶ Jack used a microscope to analyze emulsion stacks with interactions from hadrons and mesons produced at the Bevatron, at Lawrence Berkeley National Laboratory, and cosmic ray interactions from emulsions flown in balloons, to measure properties of nuclei containing a bound Λ^* particle.

Work with Jack Fry's Group

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- ▶ He defended his dissertation on "*The Production and Disintegration of Hyperfragments*" in 1956.



Jack Fry



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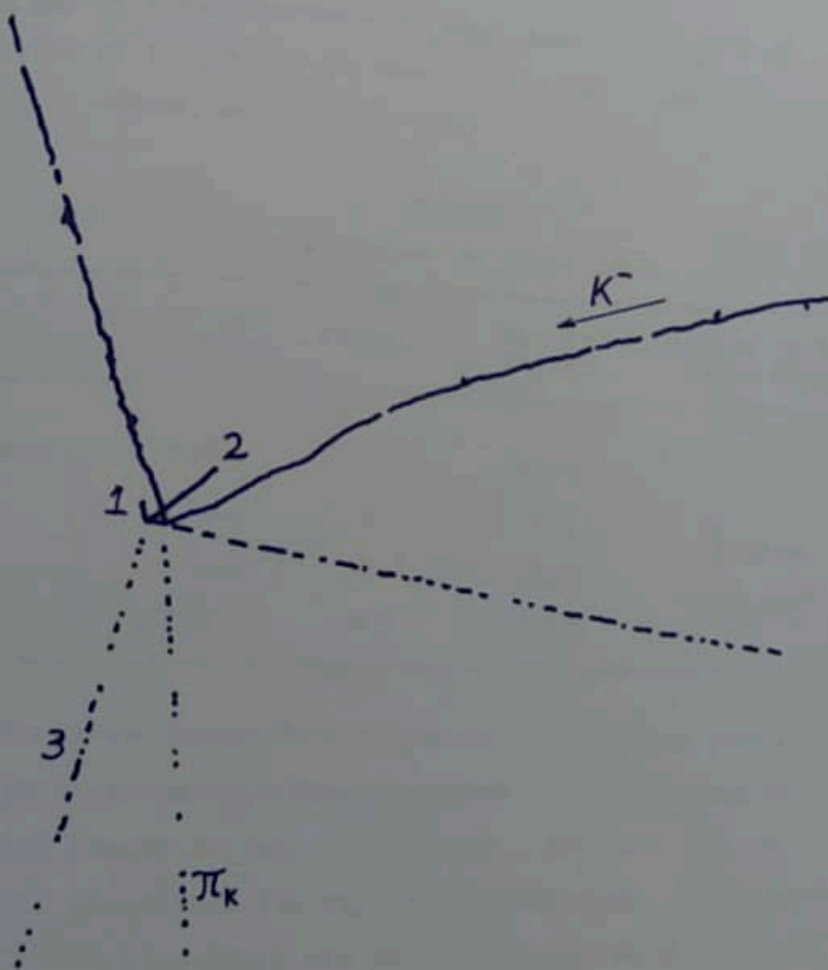
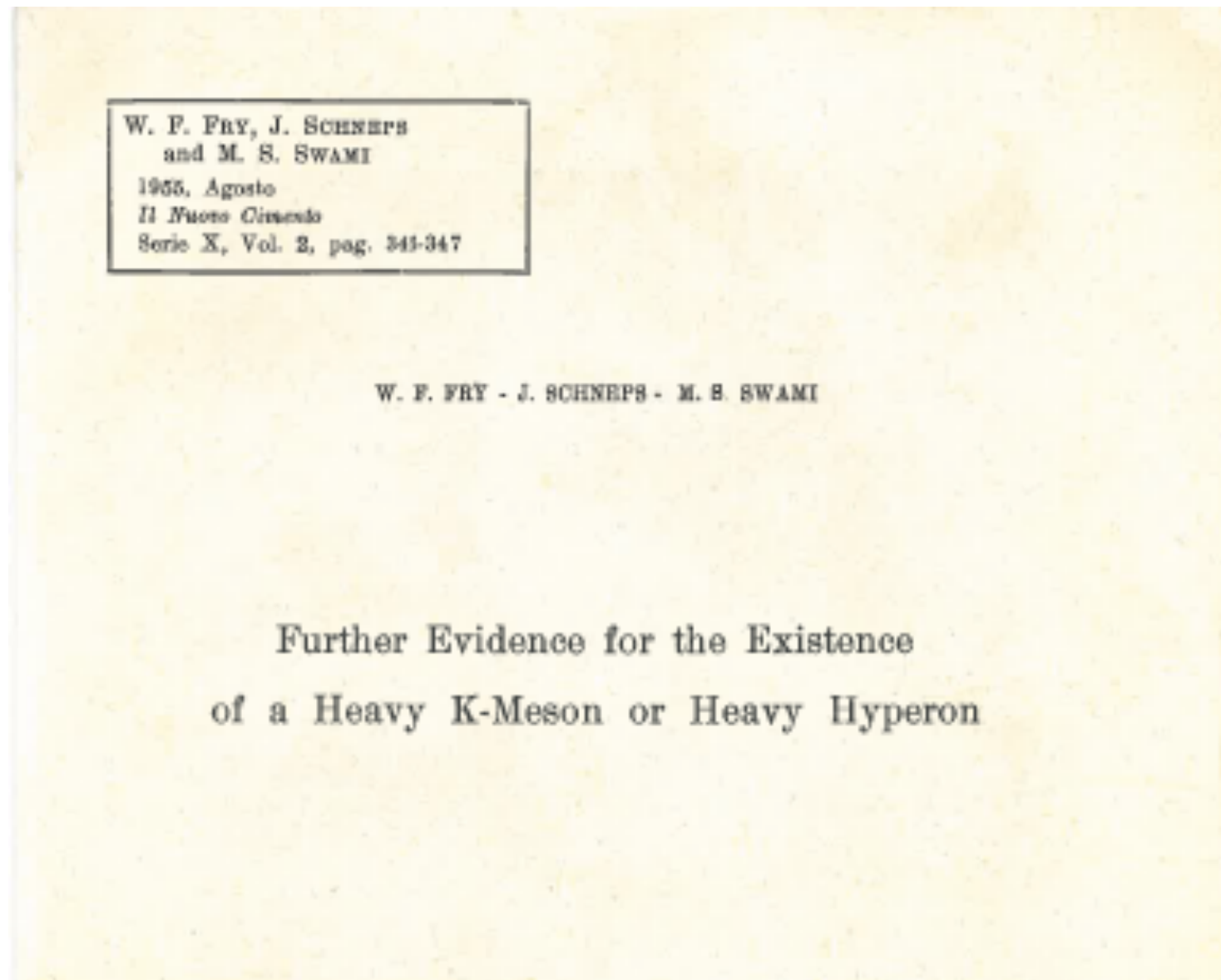


Fig. 10. A K^- -meson came to rest in the emulsion and produced a star from which emerged a ^4He hyperfragment (event 36) of very short range. It decayed into $^3\text{He}(1)$, a proton (2), and a π^- -meson (3). The track denoted π_k was due to a fast π^- -meson from the K^- star.

Work with Jack Fry's Group



- ▶ In 1955, Jack observed a Ω^- event 6 years before the Ω^- was predicted, and 9 years before discovery at BNL
- ▶ $M = 1672.1 \pm 1.0$ MeV, *L. Alvarez, PRD 8, 702 (1973)*

Certification of Three Old Cosmic-Ray Emulsion Events as Ω^- Decays and Interactions

Luis W. Alvarez

Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720

(Received 10 April 1972; revised manuscript received 3 May 1973)

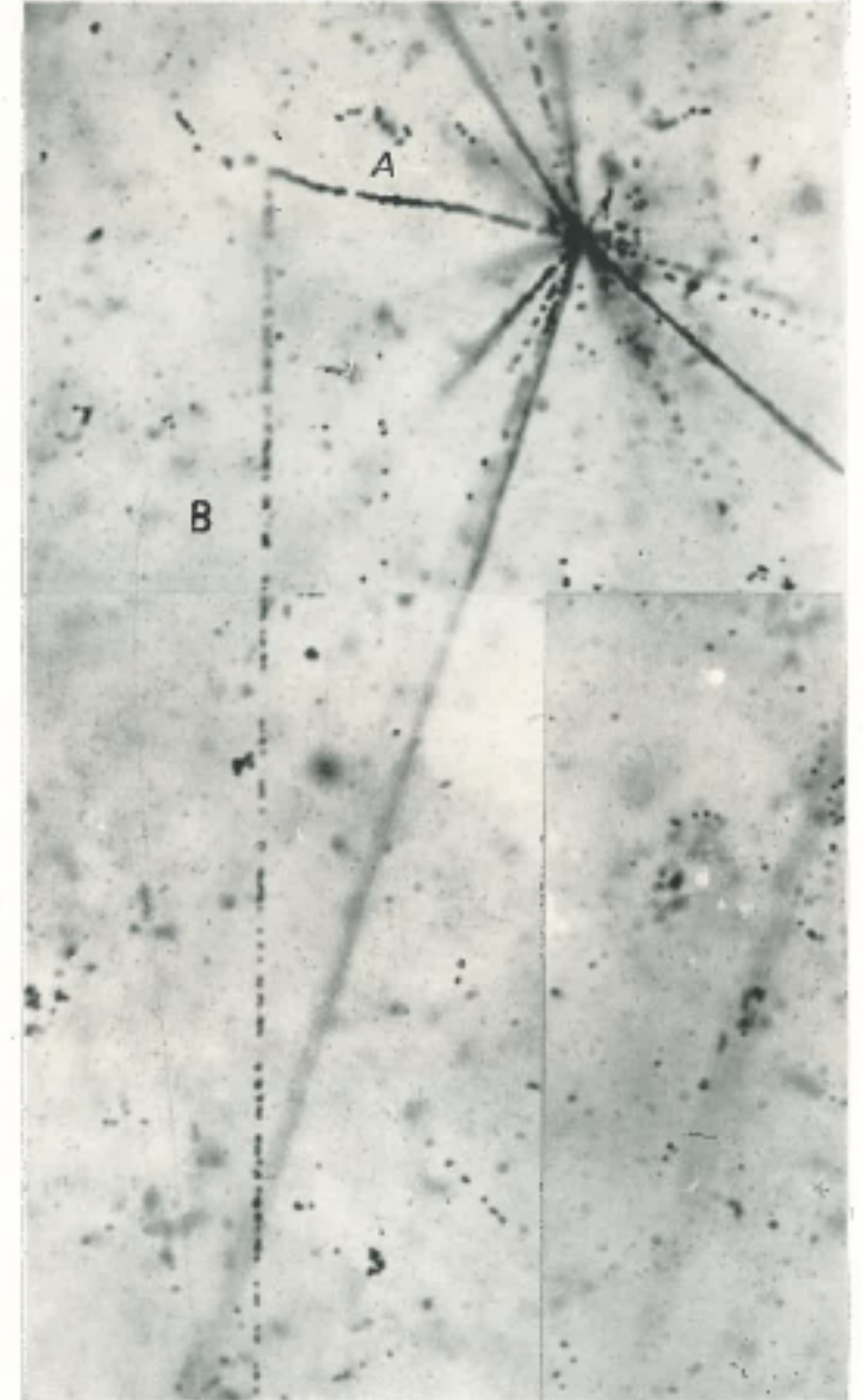


Fig. 1. - A photograph is shown above of a cosmic ray star where a slow unstable particle (Track A) seems to have stopped and produced a K-meson (Track B).

Work with Jack Fry's Group

- ▶ First evidence of K^0 - \bar{K}^0 mixing, *Phys. Rev.* **103**, 1904 (1956)

Evidence for a Long-Lived Neutral Unstable Particle*

W. F. FRY, J. SCHNEPS, AND M. S. SWAMI

*Department of Physics, University of Wisconsin,
Madison, Wisconsin*

(Received July 19, 1956)

These events can be explained by assuming that long-lived neutral K mesons were produced at the target with about the same frequency as the K^+ mesons. A small fraction of these neutral K mesons could have penetrated the shielding (about two feet of brass) between the plates and the target and then interacted in the pellicle stack. The lifetime of these particles must have been at least 10^{-8} sec. The existence of a long-lived neutral K meson was predicted by Gell-Mann and Pais.²

- ▶ Published simultaneously with *Lande et al.* *Phys. Rev.* **103**, 1901 (1956)

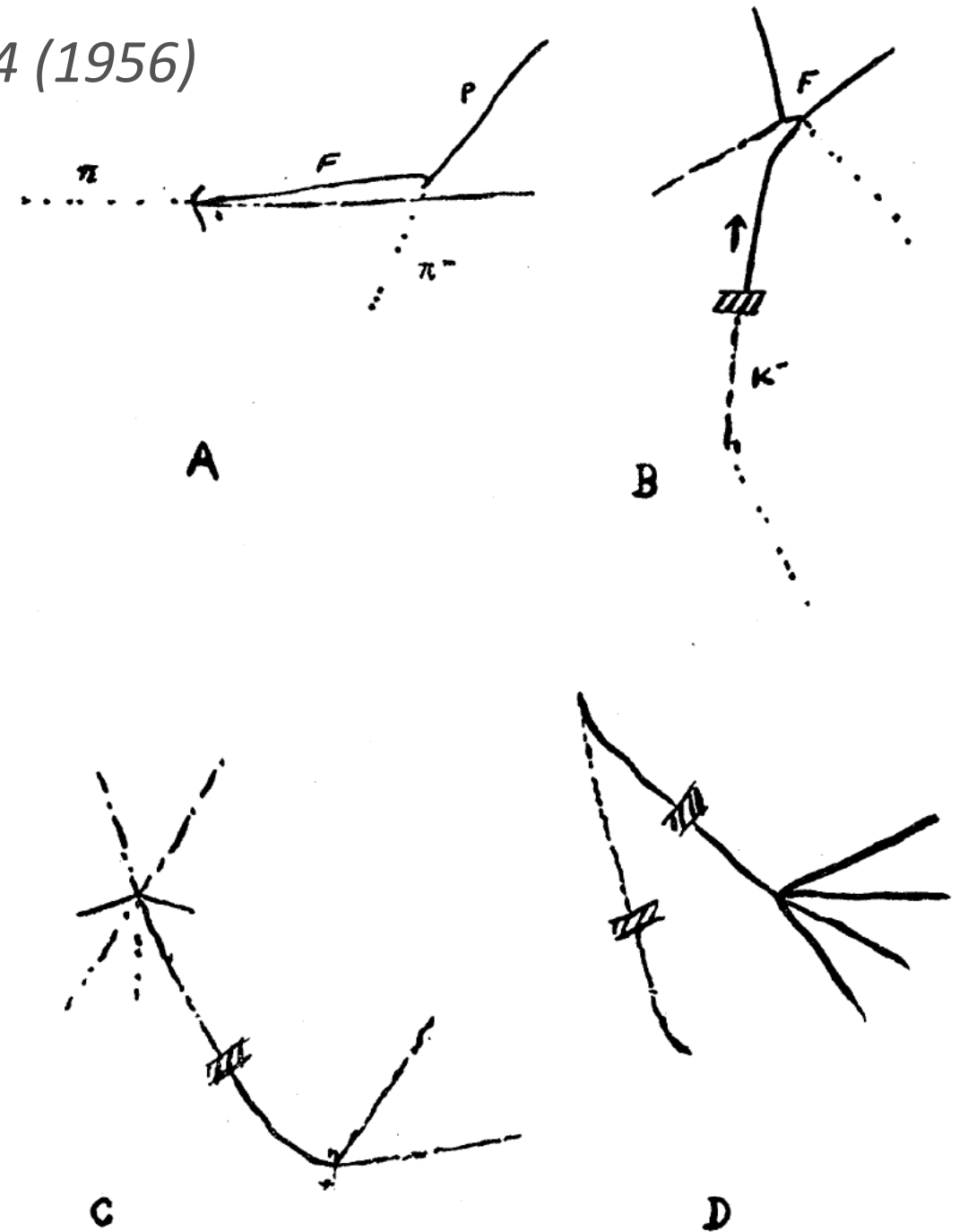
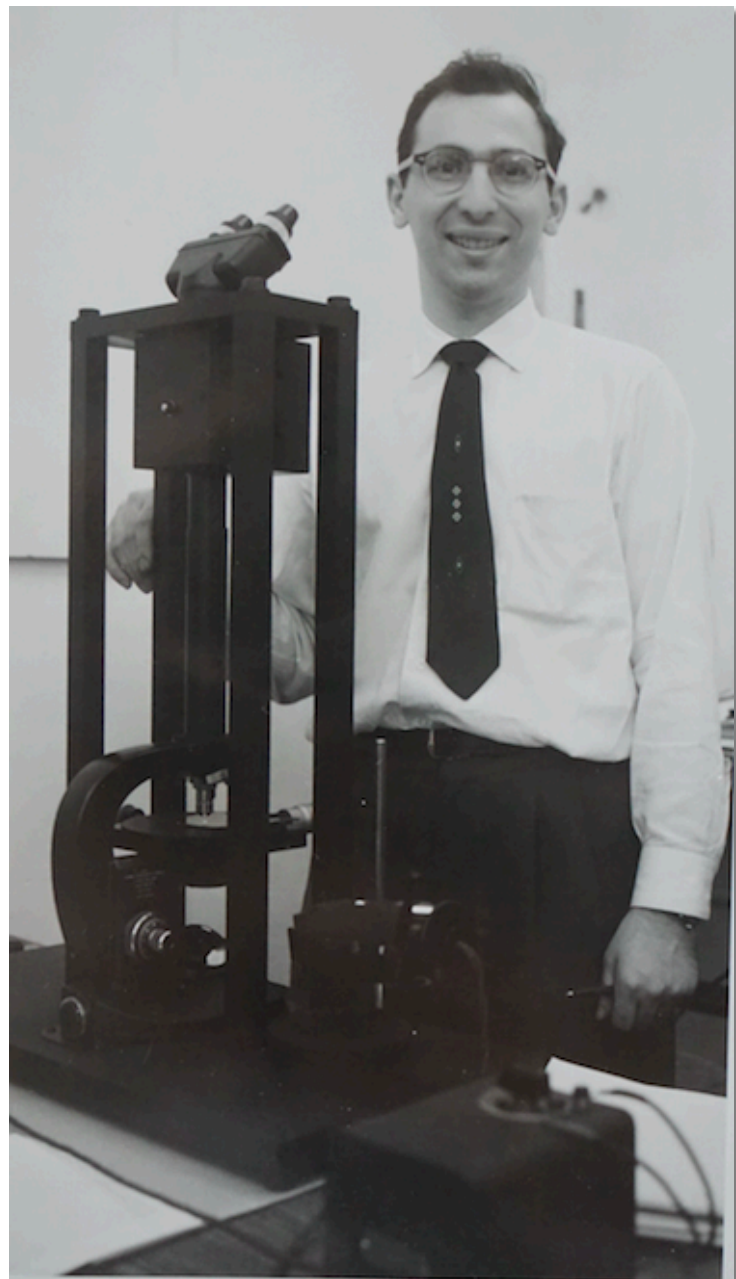


FIG. 1. Drawings of four events which were found in a pellicle stack as shown. A Δ He hyperfragment was produced in A, a K^- meson in B, probably a Σ^- hyperon in C, and a hyperfragment or a Σ^- hyperon in D.

Arrival at Tufts University

- ▶ Fresh from receiving his Ph.D. in 1956, Jack was invited to become a professor at Tufts University by the recently inaugurated Physics Dept. Chair Julian Knipp.
- ▶ When accepting the offer, Jack replied: “All I need to get underway is a microscope”.



Jack Schneps and microscope, 1956

- ▶ Jack and Knipp applied for and were awarded a university-level grant by the Atomic Energy Commission.
- ▶ The \$22,000 grant was one of the first of such grants in the US, and has been renewed continuously since then.



Julian Knipp, 1960



Robinson Hall, original location of the Tufts Physics Department

- ▶ This was the first step in building up the Tufts Physics Dept. and Physics graduate program to the reputation it enjoys today.

Visiting Università di Padova

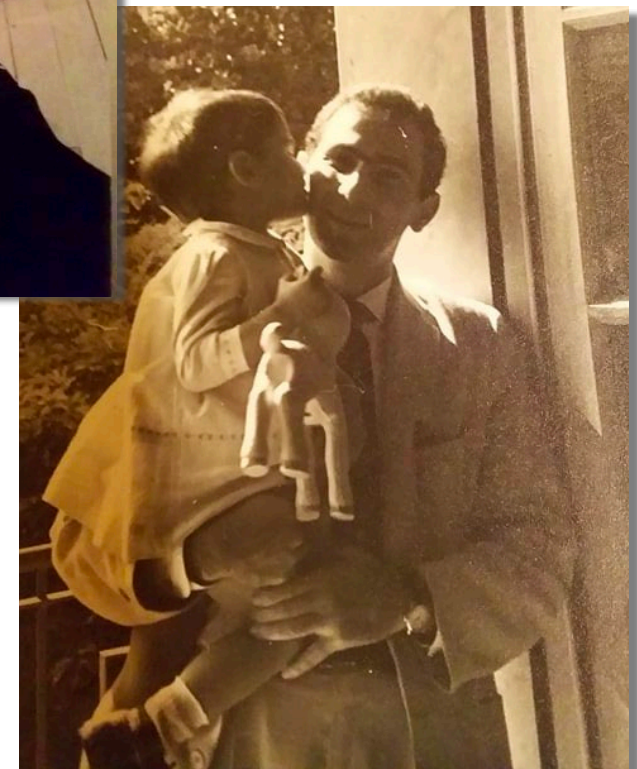
- ▶ In 1958, influenced by Fry's accounts of wonderful visits to Italy, and funded by an NSF Fellowship, Jack traveled to Padova for 2 years to work with Milla's Emulsions Group.
- ▶ He studied the properties of "cascade" Ξ hyperons, produced by high-energy K^- beams at Berkeley. See detailed account by Milla in *Annu.Rev.Nucl.Part.Sci.* **52:1–21** (2002)



Milla Baldo Ceolin's Emulsions Group, 1958



*Lucia and Lori Schneps,
circa 1960*



Jack and Lori Schneps, circa 1960

BMST and Bubble Chambers

- ▶ Jack co-founded the Brandeis-Maryland-Syracuse-Tufts (BMST) Collaboration, which made extensive measurements of the doubly-strange cascade hyperon states in the 60s and 70s using data from bubble chambers at BNL



15-foot bubble chamber at FNAL

Ξ RESONANCES IN $K^-p \rightarrow \Xi\pi K$ AT 2.87 GeV/c*

S. Apsell, N. Barash-Schmidt, L. Kirsch, and P. Schmidt
Department of Physics, Brandeis University, Waltham, Massachusetts 02154

and

C. Y. Chang, R. J. Hemingway, B. V. Khoury, A. R. Stottlemyer, H. Whiteside,† and G. B. Yodh
Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742

and

M. Goldberg, K. Jaeger, C. McCarthy, B. Meadows, and G. C. Moneti‡
Department of Physics, Syracuse University, Syracuse, New York 13210

and

J. Bartley, R. M. Dowd, J. Schneps, and G. Wolsky
Department of Physics, Tufts University, Medford, Massachusetts 02155
(Received 25 August 1969)

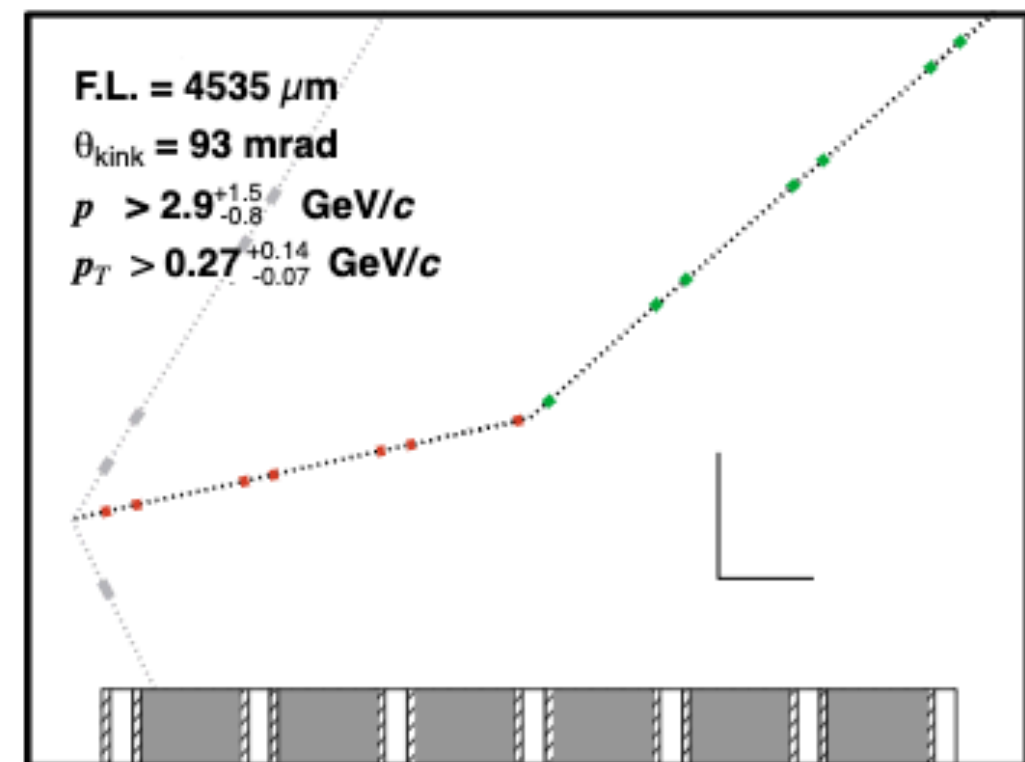
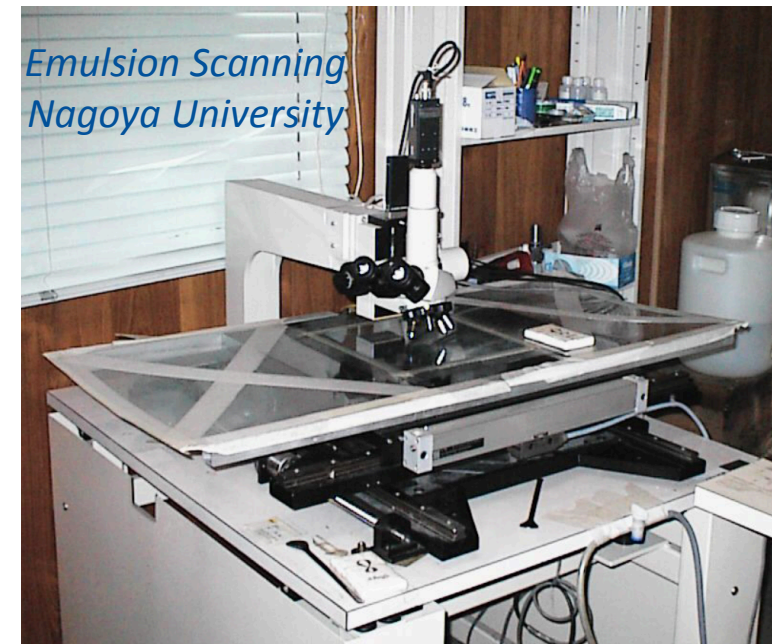
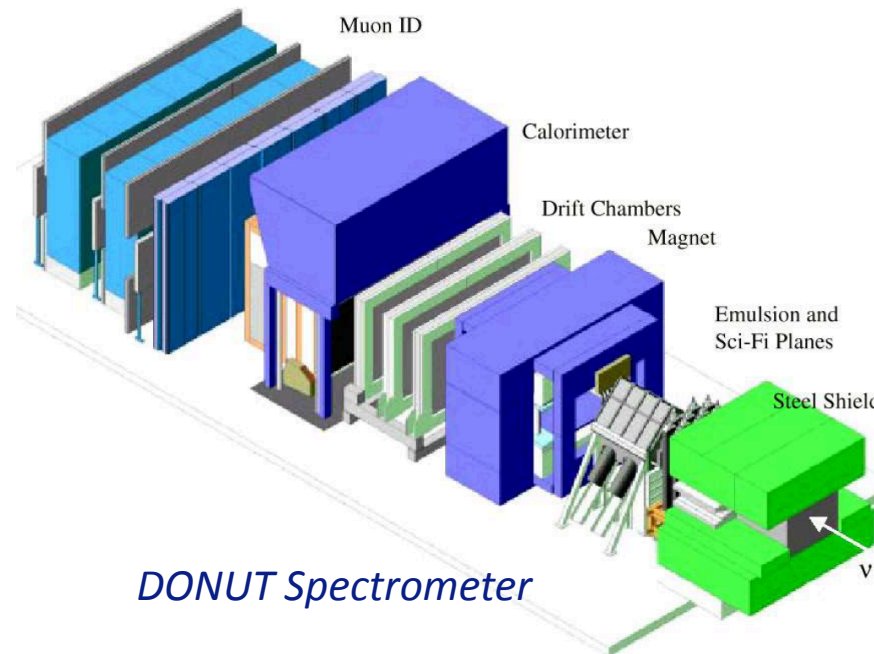
Evidence is presented for four Ξ resonances in the reaction $K^-p \rightarrow \Xi^- \pi^+ K^0$. In addition to the well known $\Xi(1530)$, significant structures are observed in the $\Xi\pi$ system at masses of 1630, 1800, and 1960 MeV, although the latter two are not statistically distinguishable from a single broad structure at 1950 MeV. No significant enhancements at these masses are observed in the $\Xi^- \pi^0 K^+$ final state.

Phys. Rev. Lett. **23**, 884 (1969)

- ▶ Jack went on to use Fermilab's 15-ft bubble chamber to perform the first precision studies of neutrino-neutron scattering in deuterium (*E545 Collaboration*), and worked with his Ph.D. student Stephane Willocq on measuring interactions of 80 GeV neutrinos (Tevatron-sourced) on neon nuclei (*E632 Collaboration*), *Phys. Rev. D* **47**, 2661 (1993)

DONUT and the ν_τ Discovery

- ▶ Jack coordinated the DONUT muon catcher design and installation, as well as the Tufts Group analysis contributions.
- ▶ DONUT reported direct evidence for the tau neutrino in July 2000, with 4 candidates. A total of 9 were identified by end of data analysis

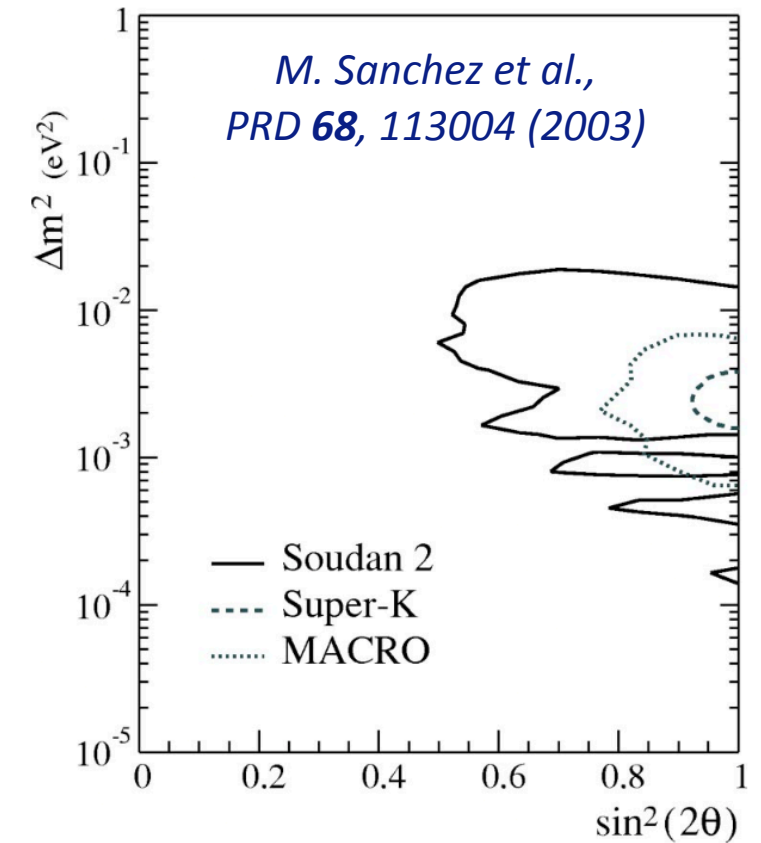


First direct observation of a ν_τ interaction
*Phys. Lett. B **504**, 218 (2001)*



Soudan 2 and MINOS

- ▶ Jack was a member of the Soudan 2 Collaboration since the early 1990s. Originally intended to search for proton decay, Soudan 2 carried out measurements of atmospheric neutrino interactions.
- ▶ Jack and his Ph.D. student, Mayly Sanchez, produced one of the first Feldman-Cousins analysis of neutrino data, confirming the 1998 Super-K results.
- ▶ Jack energetically pushed for neutrino oscillation measurements using accelerator experiments and was part of the MINOS Collaboration since its inception in 1994.

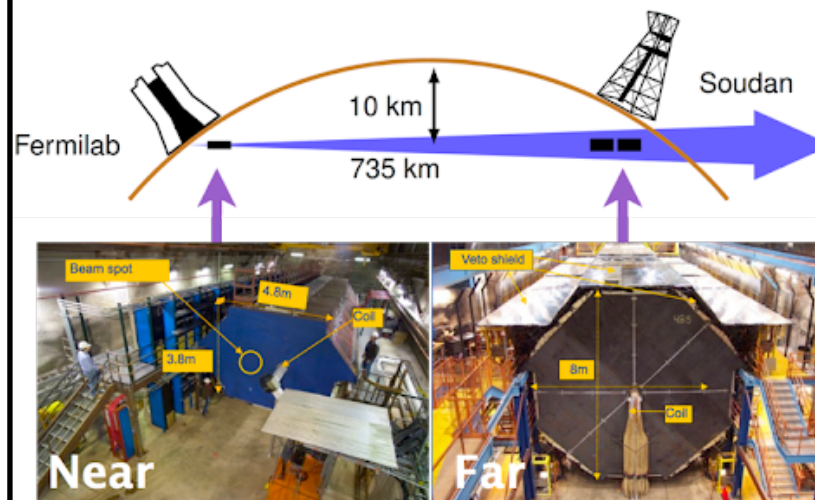


A true verification of neutrino oscillations is in principle a straightforward matter:

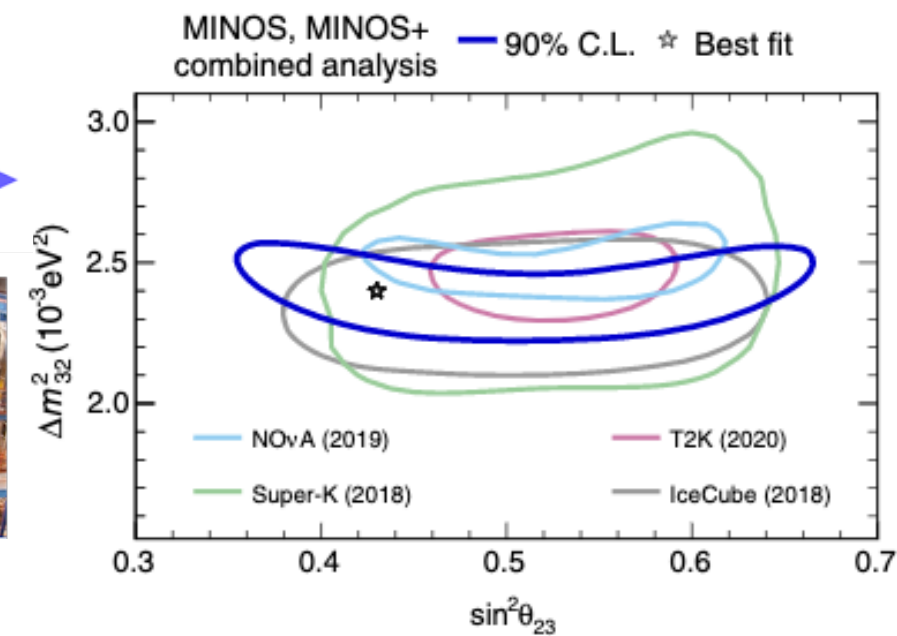
- Make a beam of one kind of neutrino, ν_a , with known parameters; flux, energy distribution, source to detector distances, background, etc.
- See ν_a disappear and another kind of neutrino, ν_b , appear ².
- This should all take place according to the well known formula

$$P_{ab} = \sin^2 2\theta_{ab} \sin^2 \left(1.27 \frac{L}{E} \delta m_{ab}^2 \right).$$

No dangerous models are necessary!



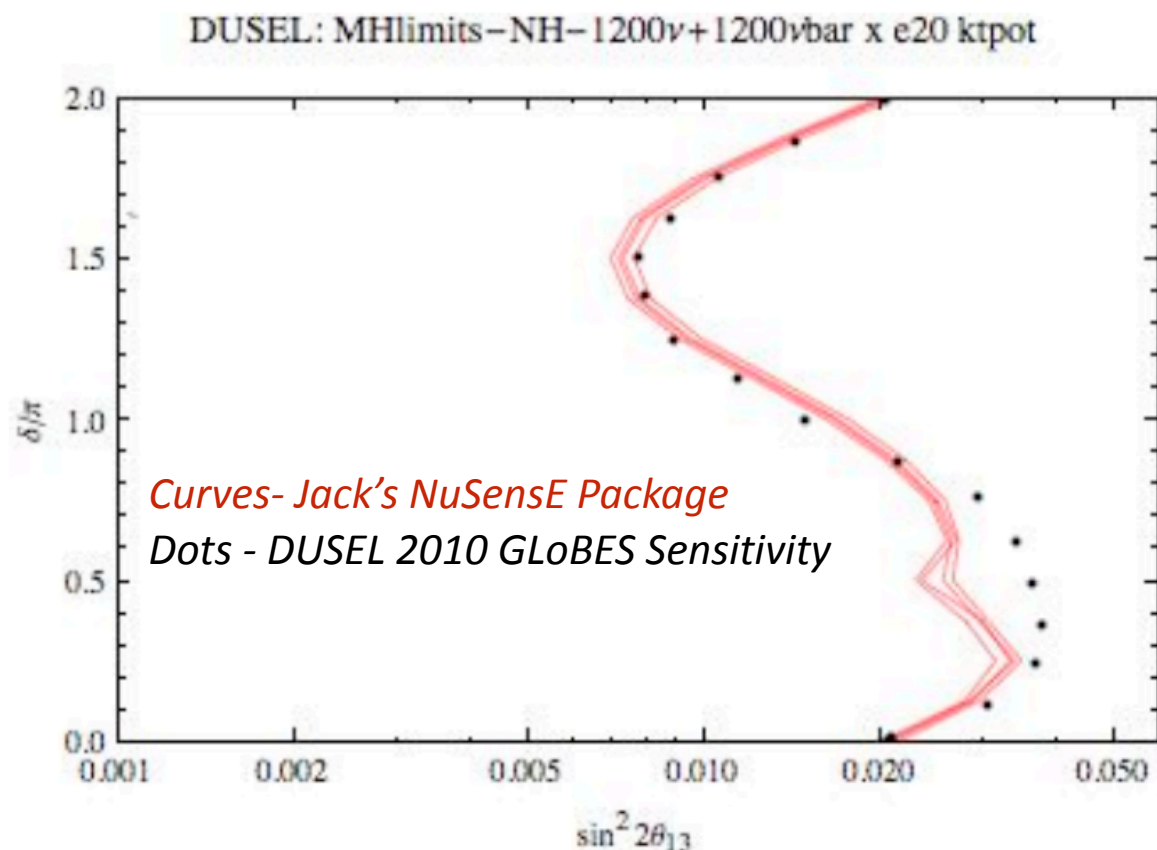
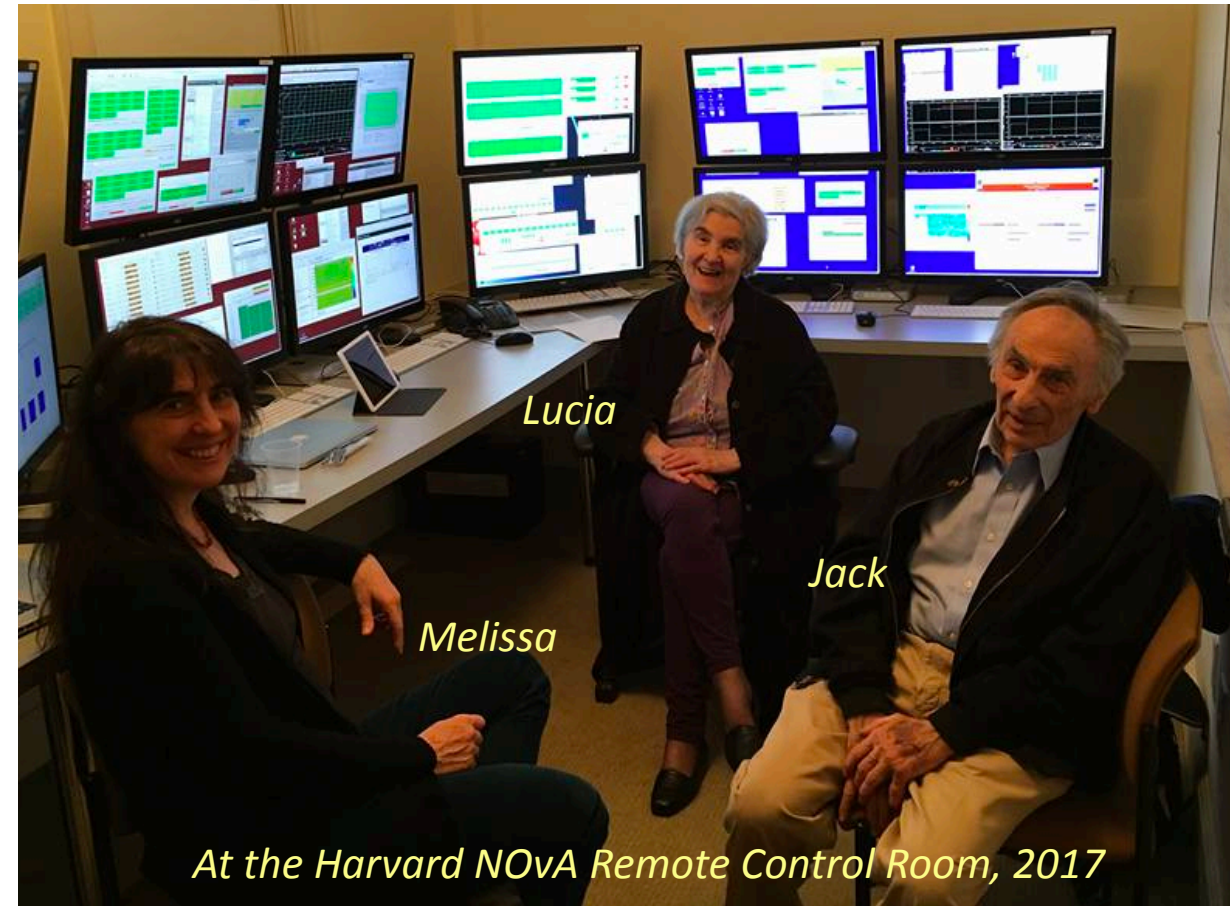
*Jack Schneps, 3rd Neutrino Telescopes,
Nuclear Physics B (Proc. Suppl.) 31 (1993)*



*Phys. Rev. Lett. **125**, 131802 (2020)*

NOvA and LBNE/DUNE

- ▶ Jack contributed to the early design decisions for the NOvA experiment starting in 2002, and even after his retirement in 2011, continued to attend weekly group meetings at Harvard, where I was a NOvA postdoc with Gary Feldman until 2012, and Jack remained a visiting scholar until 2017.



- ▶ Jack was very interested in LArTPC technology, which became the technology of choice for LBNE and soon after LBNF/DUNE

A Large Liquid Argon Time Projection Chamber for Long-baseline, Off-Axis
Neutrino Oscillation Physics with the NuMI Beam

Submission to NuSAG

September 21, 2005

Fermilab Technical Report, FN-0776-E (2005)

- ▶ In 2010, Jack taught himself *Mathematica* and single-handedly sanity-checked the DUSEL/LBNE sensitivity studies

Tufts Physics Department Chair

- ▶ During his 9 years as chair of the Tufts Physics Department, Jack established stable funding for the graduate program and ensured the continued success of the Tufts Institute of Cosmology, directed by Alex Vilenkin, by securing a \$500k endowment from the Gravity Research Foundation in 1988.
- ▶ Jack's summary timeline at Tufts
 - ▶ 1956 - Assistant Professor
 - ▶ 1960 - Associate Professor
 - ▶ 1963 - Professor
 - ▶ 1967 - APS Fellow
 - ▶ 1980 - 89 - Physics Department Chair
 - ▶ 1995 - Vannevar Bush Professor
 - ▶ 2011 - Vannevar Bush Professor Emeritus



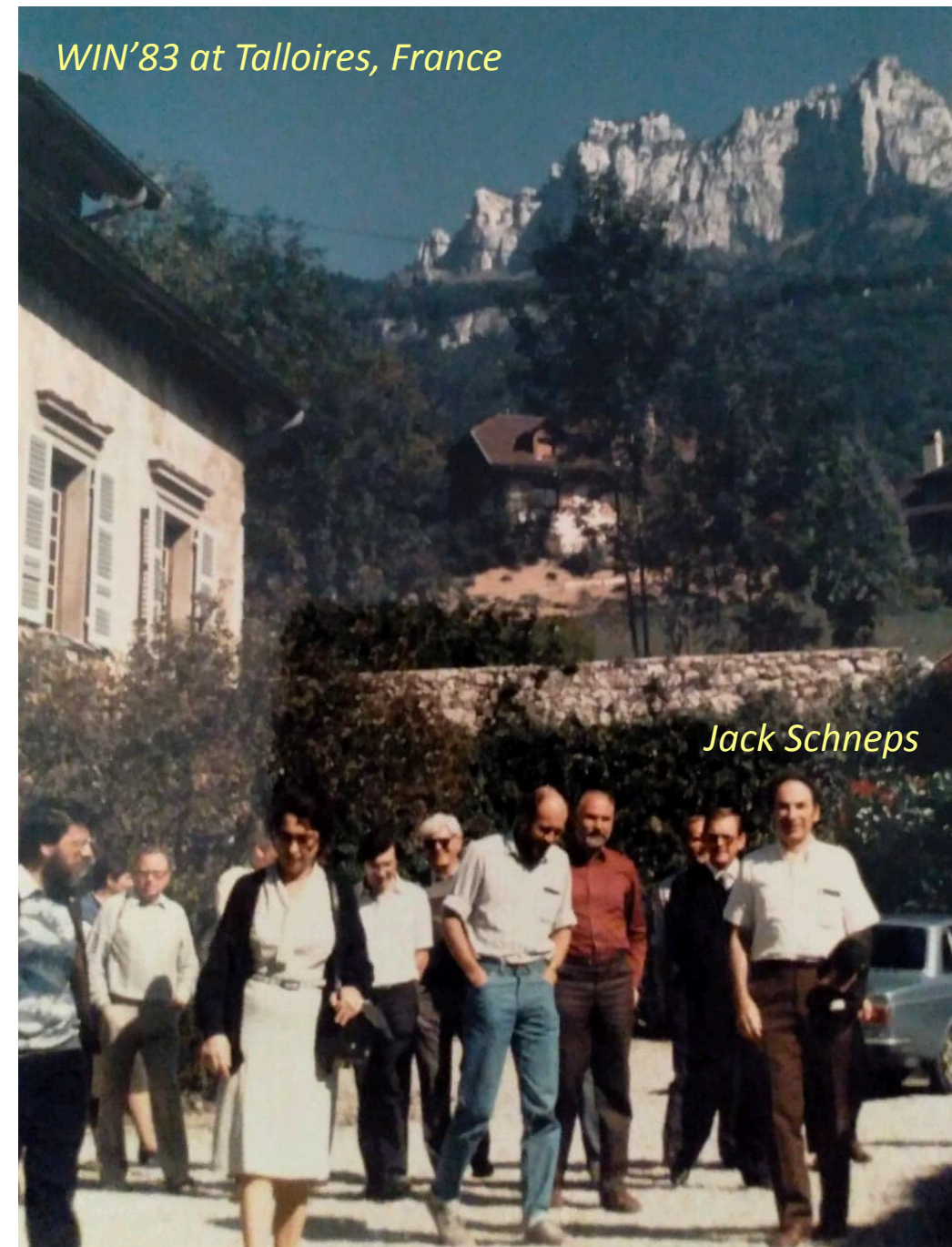
Tufts Institute of Cosmology

Department of Physics and Astronomy, Tufts University
574 Boston Avenue, Medford, MA 02155
Telephone: 617.627.5363 Fax: 617.627.3878

WIN '83 and Neutrino '88

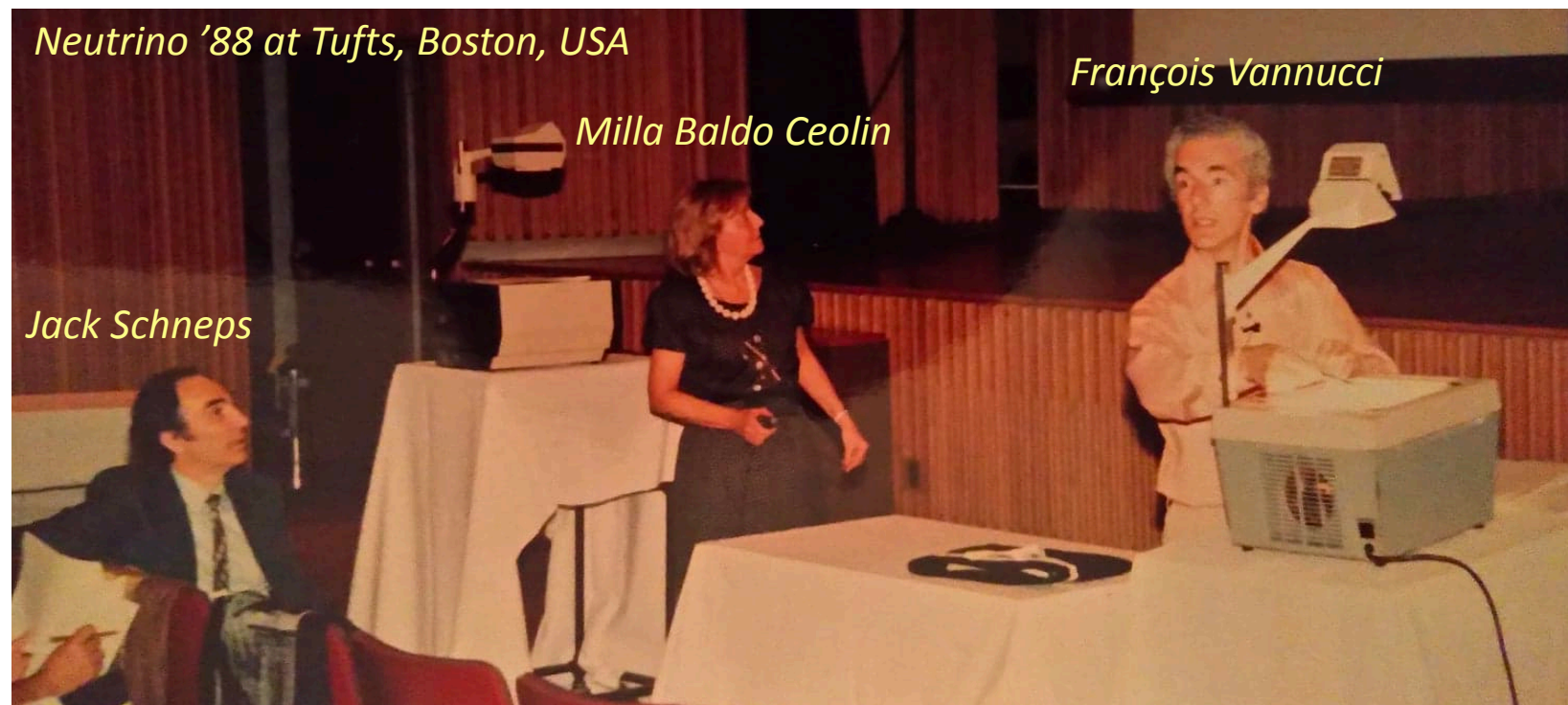
- ▶ Jack saw High-Energy Physics as an international highly-collaborative endeavor.
- ▶ During his time as Physics Dept. Chair, he co-organized *WIN '83* in Talloires, France, with Herbert Pietschmann and Violette Brisson, and was the conference chair for *Neutrino '88* in Boston, USA.

WIN'83 at Talloires, France



Jack Schneps

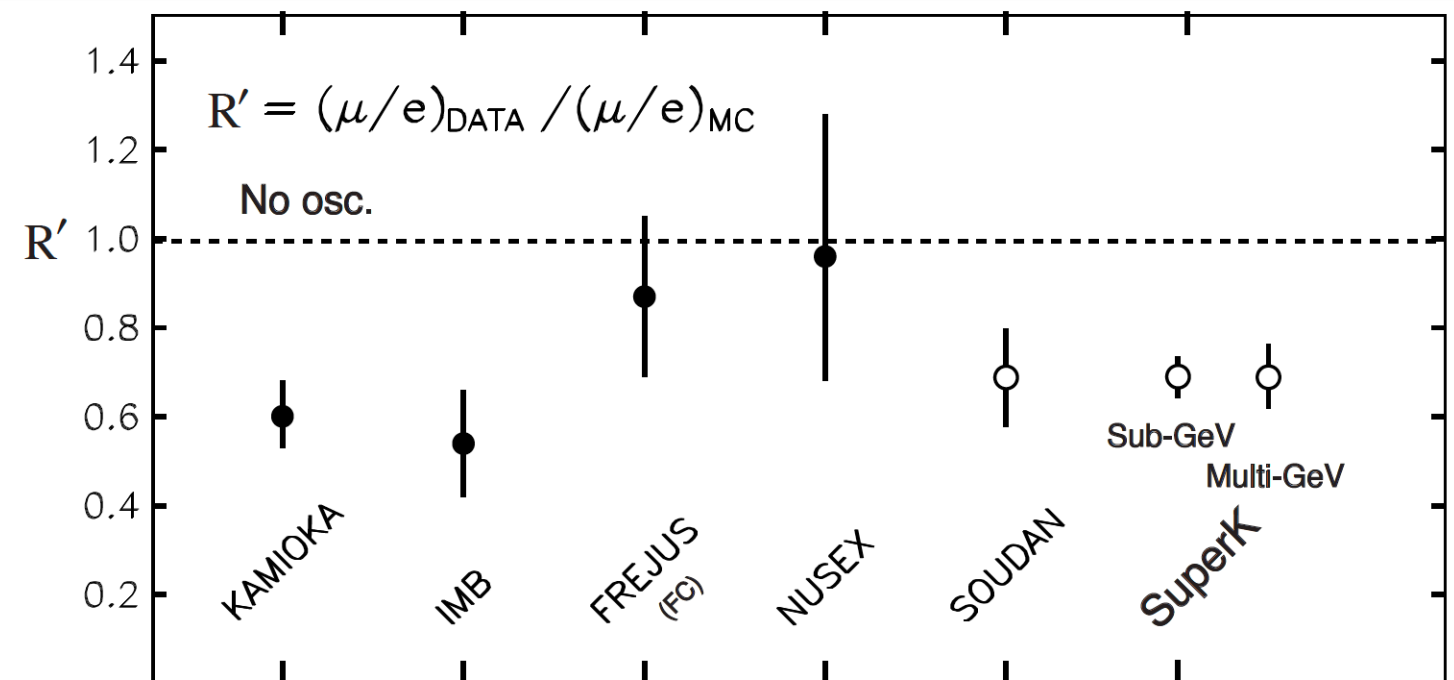
Neutrino '88 at Tufts, Boston, USA



Jack Schneps

Milla Baldo Ceolin

François Vannucci



W. A. Mann, Int. J. Mod.Phys. A15S1, 229 (2000)

W

- ▶ Jack saw High-Ene
- ▶ During his time as
- Herbert Pietschm
- for Neutrino '88 in

NEUTRINO '88

88

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Organizing Committee

J. Schnepf	Tufts
B.L. Goshaw	Harvard
T. Kufus	Tufts
L.S. Kirsch	Stanford
W.A. Mann	Tufts
P. Nath	Northwestern
L.S. Odell	MIT
B. Sakita	Tufts
L.R. Sulak	Boston
S. Whitaker	Boston
*Chairman	

International Advisory Committee

J.D. Bjorken	Fermilab
K.C. Chou	Beijing
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M.G.K. Menon	Delli
A. Morales	Zaragoza
D.R.G. Mariani	CERN
L.B. Okun	ITEP Moscow
D. Perkins	Oxford
V.Z. Peterson	Hawaii
A. Pomansky	INR Moscow
F. Reines	Irvine
S.P. Rosen	Los Alamos
F. Sciulli	Columbia
G. Steigman	Ohio State
F. Vannucci	Paris
G. Zetsepis	INR Moscow

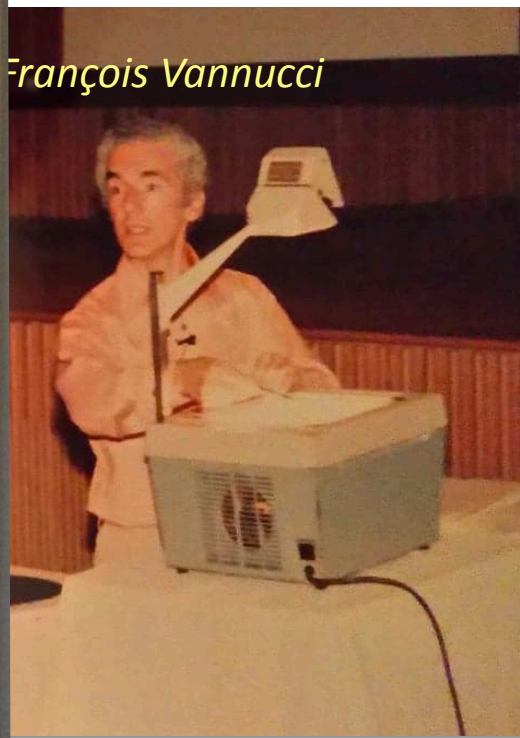
13th International Conference on Neutrino Physics and Astrophysics
Boston
June 5-11, 1988

- Topics:
- Neutrino Mass and Mixing
 - Double beta Decay
 - Solar Neutrinos
 - Neutrinos in Cosmology and Astrophysics
 - Supernova 1987 A
 - Neutrino Physics at Accelerators
 - W, Z and the Standard Model
 - Nucleon Decay
 - Future Prospects

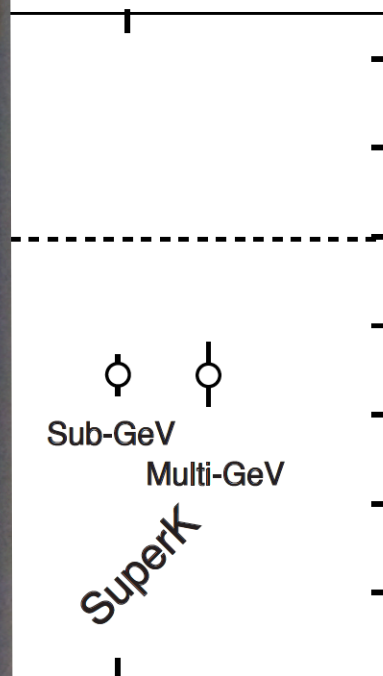


For More Information:
Neutrino 88
Tufts University Department of Physics
Medford, Massachusetts 02155 USA
BITNET: HIPHY88 @ TUFTS
Telephone: 617/381-3029 or 617/381-3219
Telex: 710 328 1128 FLETCHER MEDF
Telefax: 617/381-3744

Participation By Invitation Only



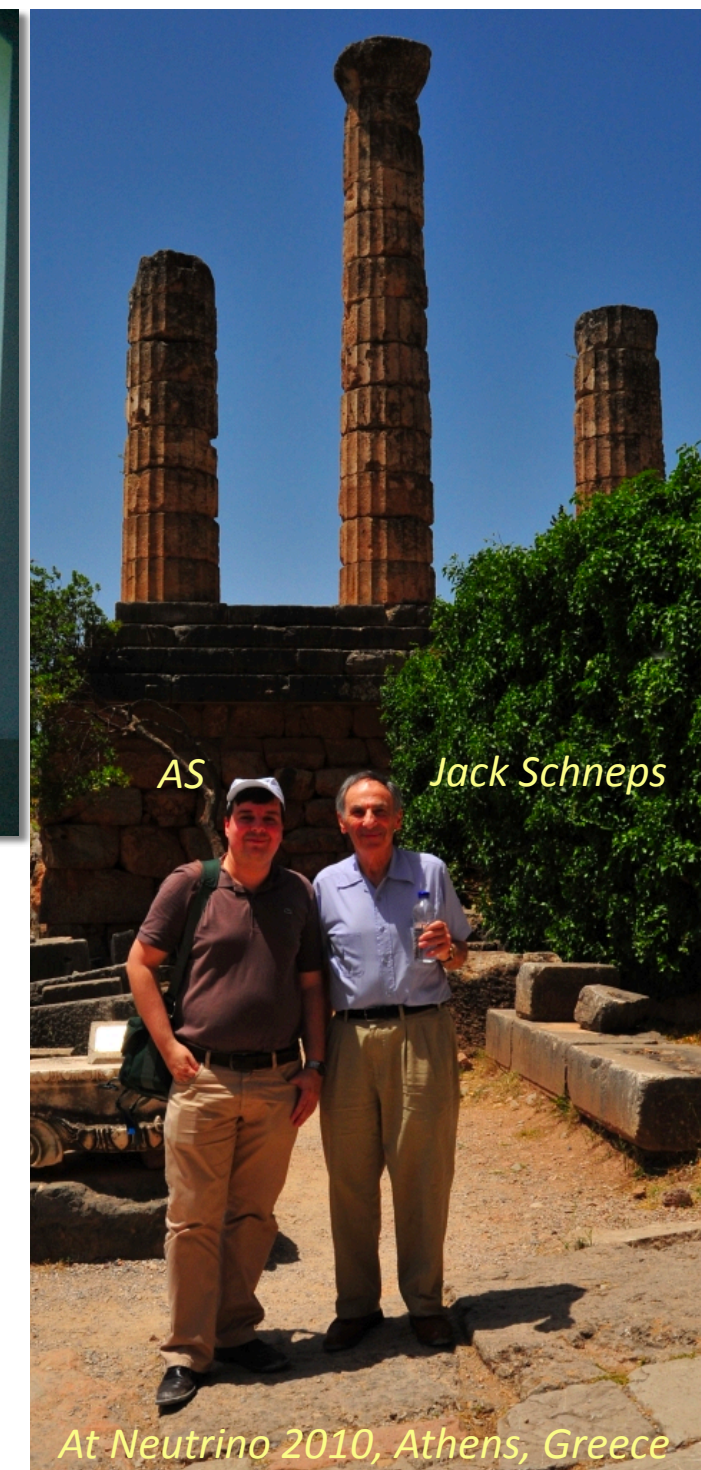
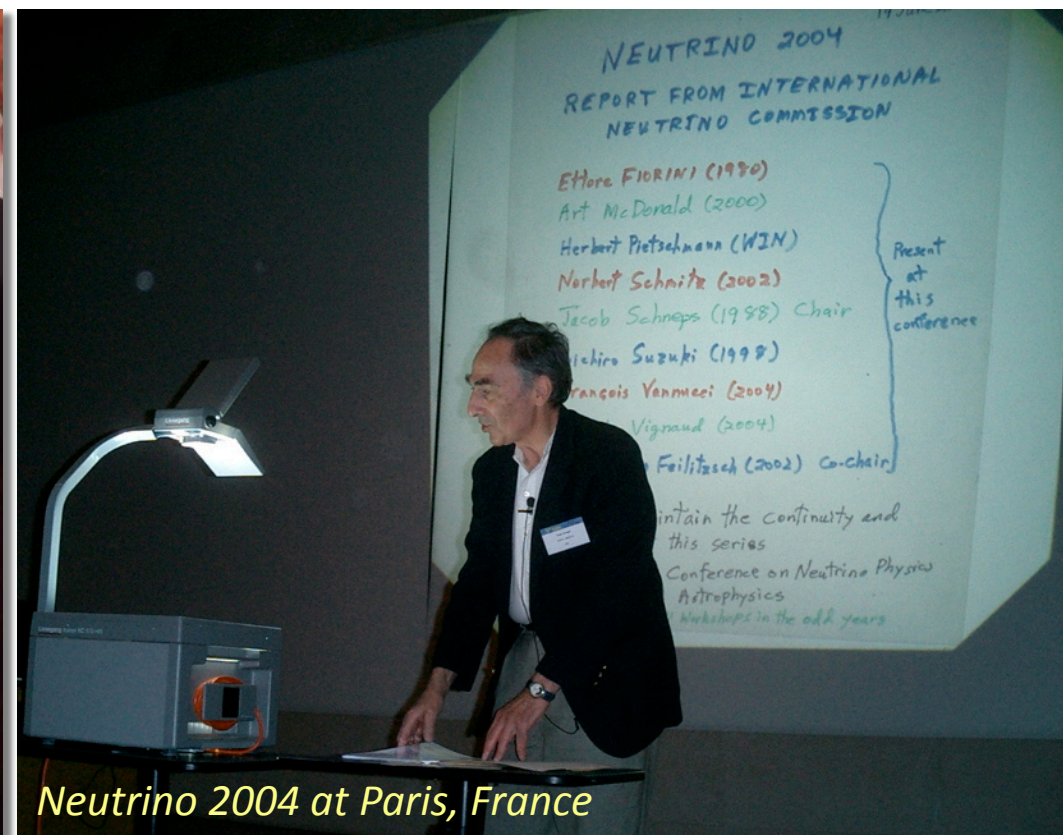
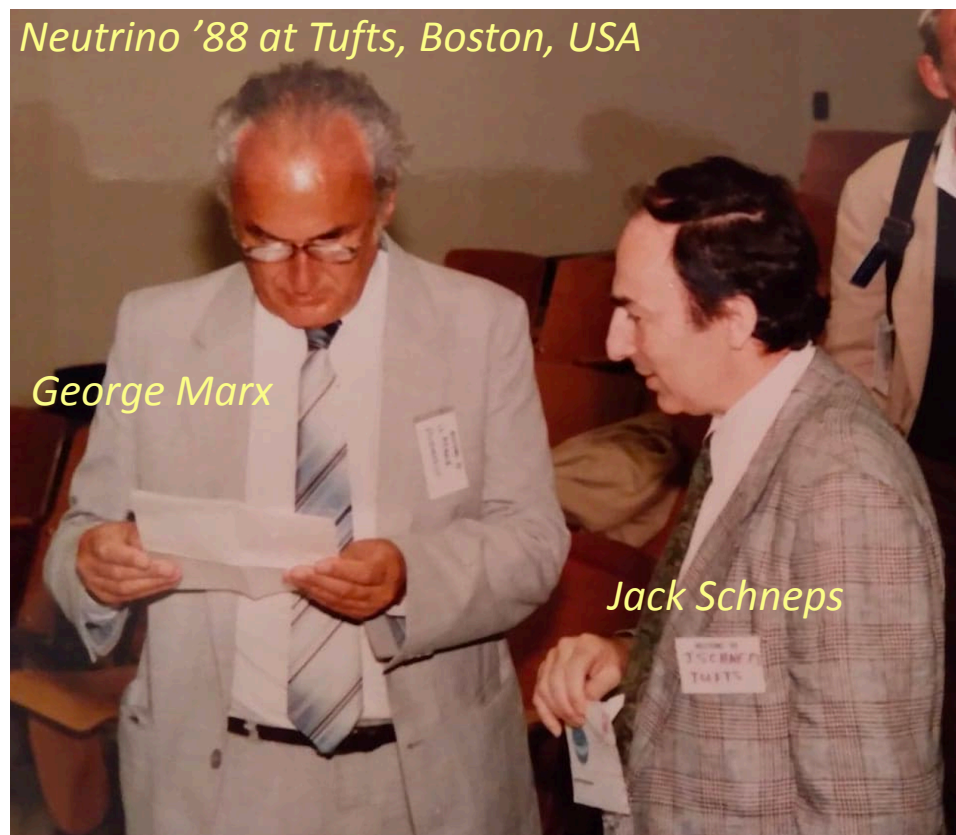
François Vannucci



229 (2000)

International Neutrino Commission Chair

- After *Neutrino 2002*, in Munich, Jack succeeded George Marx as International Neutrino Commission Chair, a position he served on until *Neutrino 2014*, in Boston.



Brief History of 'Neutrino', The International Conference on Neutrino Physics and Astrophysics

Jacob Schneps^{1,a)}

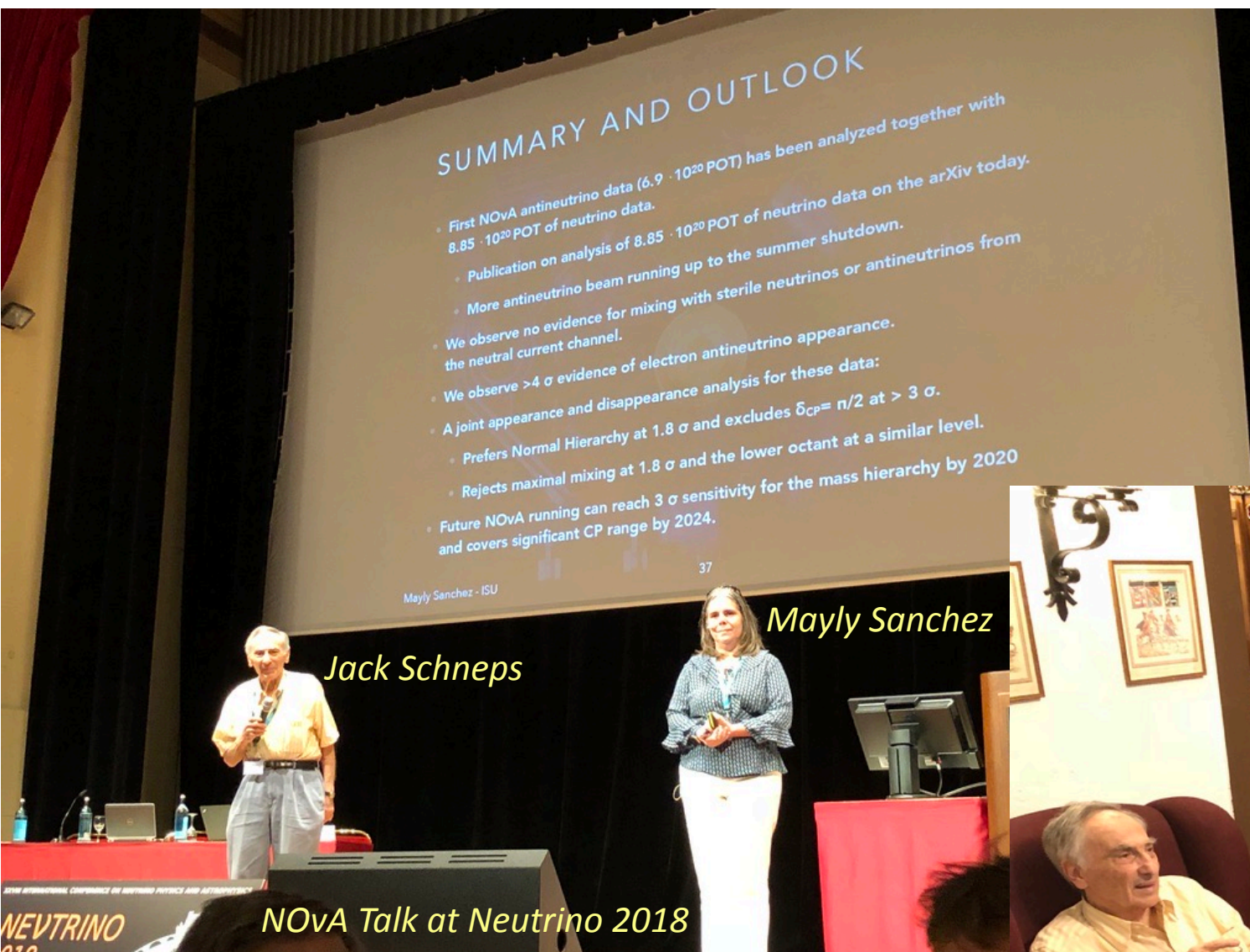
¹⁾Department of Physics and Astronomy
Tufts University
Medford, MA 02155

^{a)}jschneps@tufts.edu

Jack Schneps, AIP Conference Proceedings 1666, 190002 (2015)

Abstract. We briefly review the history of the NEUTRINO conferences that began in 1972, with preludes taking place starting in 1965. We touch upon highlights, some un-highlights, various individuals, and the topics of interest.

At Neutrino 2018, Heidelberg, Germany



- ▶ Jack remained very active following Neutrino 2014 and continued to attend the *Neutrino* conferences

Jack and NeuTel/NO-VE

- ▶ From Jack's own words at Neutrino Telescopes 2013:
For me the year with Milla's group in Padova was UNFORGETTABLE! I always called Milla "my old boss" and when she started "Neutrino Telescopes" in 1988, and then NO-VE she told me I must come, and I have never missed one yet.

Jack Schneps, Proceedings of Science (Neutel 2013)



Jack Schneps, Jack Fry, Milla Baldo Ceolin, and Dieter Haidt



Nicola Dallaporta, Jack Schneps, and Jack Fry



Jack and Lucia, Padova, March 2011

Mentorship and Family

Alex Sousa
Ph.D. 2006
Assoc. Prof. at
U. Cincinnati



Nowhan Kwak
Ph.D. 1962
Prof. Emeritus
at Kansas U.



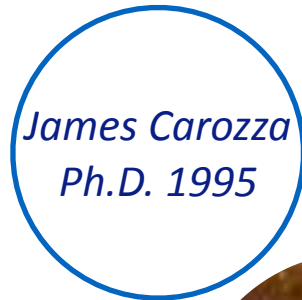
Art Greene
Ph.D. 1968



Mayly Sanchez
Ph.D. 2003
Prof. at Iowa
State U.



James Carozza
Ph.D. 1995



Elias Katsoufis
Ph.D. 1978
Prof. Emeritus
Nat. Tech. U. of
Athens



Lucia



Stephane Willocq
Ph.D. 1992
Prof. at U.Mass.
Amherst



C.C. Chang
Ph.D. 1981



Melissa



Leila



Lori



Ariel



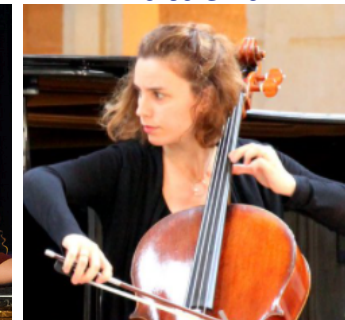
Raphael



Coralie



Natacha



Alexandre



Mélisande



Summary

- ▶ Jack remained ever active after his retirement in 2011, so his sudden departure in July 2019 was a shock to all who knew him and loved him.
- ▶ He remained a scientific leader in the rapidly changing field of Particle Physics over more than 5 decades.
- ▶ His vision of advancing knowledge through fostering of new collaborations and wide-ranging scientific discussions was instrumental into forging the vibrant global Neutrino Physics community we enjoy today.
- ▶ Jack's unwavering love of life will endure in all the great memories and moments he so generously shared with us. May we soon gather again in Venice to raise a toast to his wonderful life and career!

