

AXION

“Vistas in Axion Physics”

Introduction & Charge to the Workshop

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Happy Birthday to the Axion – 35 this year

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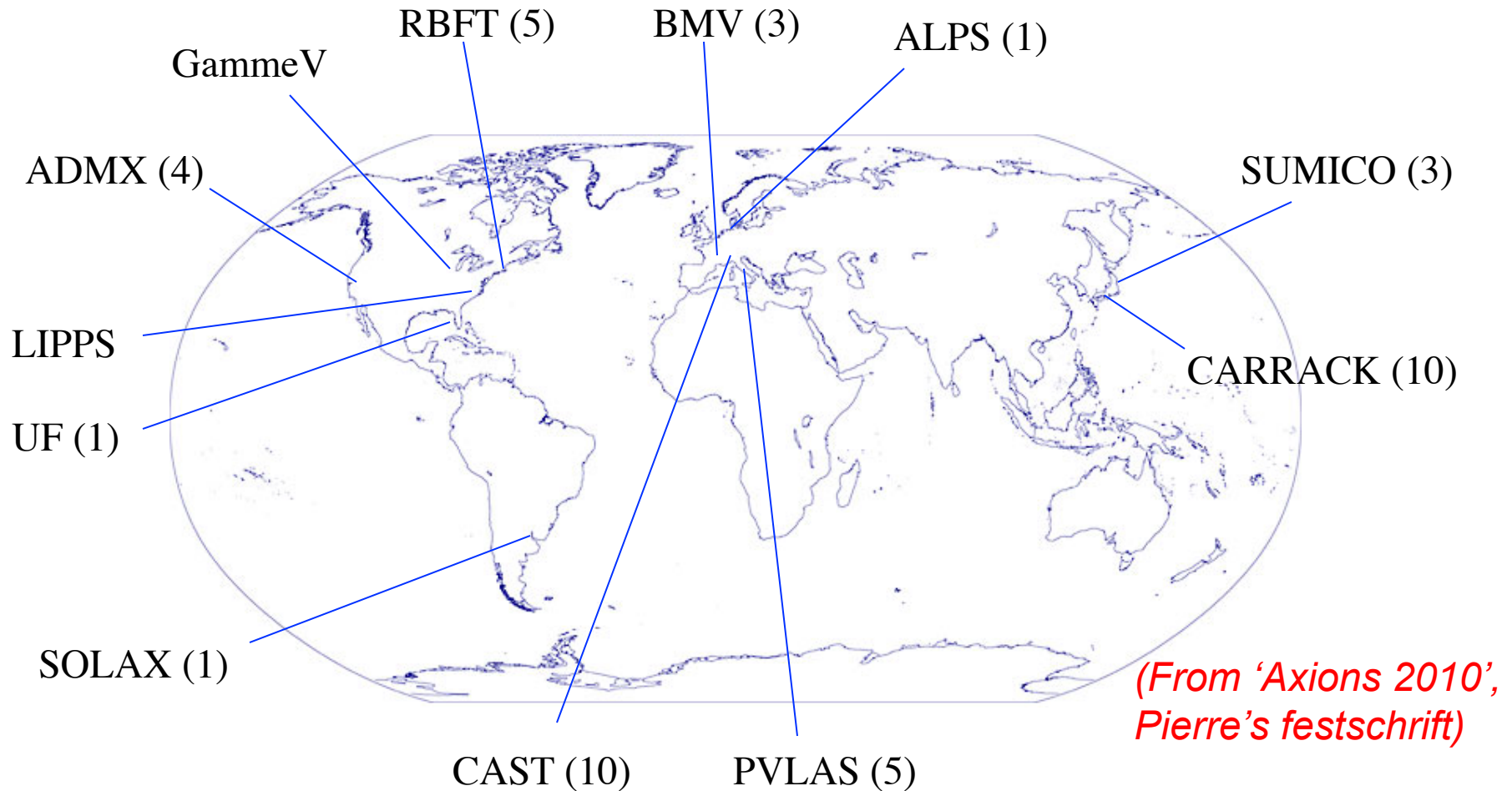
- Peccei-Quinn PRL accepted March 31, published June 20, 1977
 - The Weinberg & Wilczek PRLs followed quickly, January 23 & January 30, 1978
- Why we need a concerted effort to find the axion in the next 5 years
 - Remember Burt Richter's theological argument why it is very unlikely we will ever find Supersymmetry
- Welcome to all our visitors, especially those from afar
 - It's a sign of the maturity of the field when attendance at our workshop was cut off by the Fire Marshall

It is time to pay serious attention to the axion

- The axion is in no ways less well motivated than the WIMP
- But somehow we've been stuck behind the door in priority
 - Axions : WIMPS :: Avis : Hertz
 - “We're second, but trying harder”
- Funding for SUSY DM is roughly 10x that of axion DM
- In times of constrained funding, the U.S. program may no longer have the luxury of democratically covering all bets
 - Our investment strategy should be informed by data
 - We must listen carefully to important messages Nature is telling us
 - So far, no sign of SUSY at LHC or 100 kg DM detectors

Nevertheless, axions have attracted a passionate following

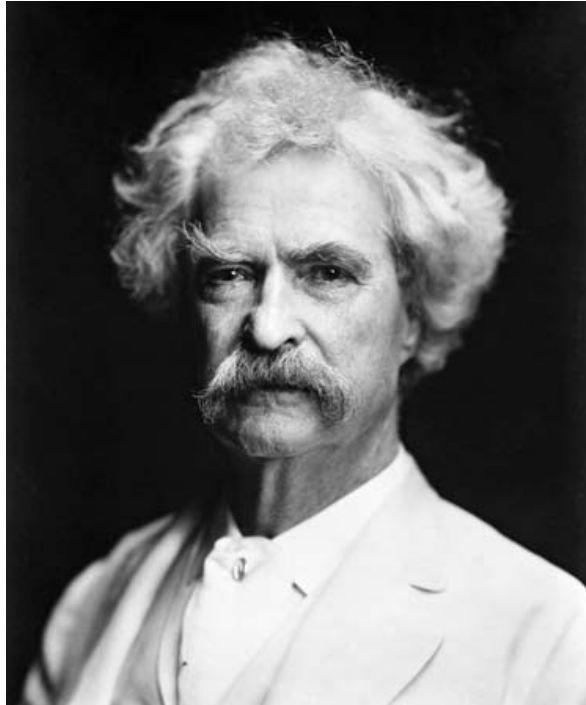
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40+ experimental Ph.D.s trace back to Pierre's '83 PRL

The Agencies have encouraged a long-term vision,
(and seem prepared to support it)

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*“The lack of money is
the root of all evil”*

Mark Twain

DOE & NSF wish to keep us free from temptation

Consequences of under-funding a program

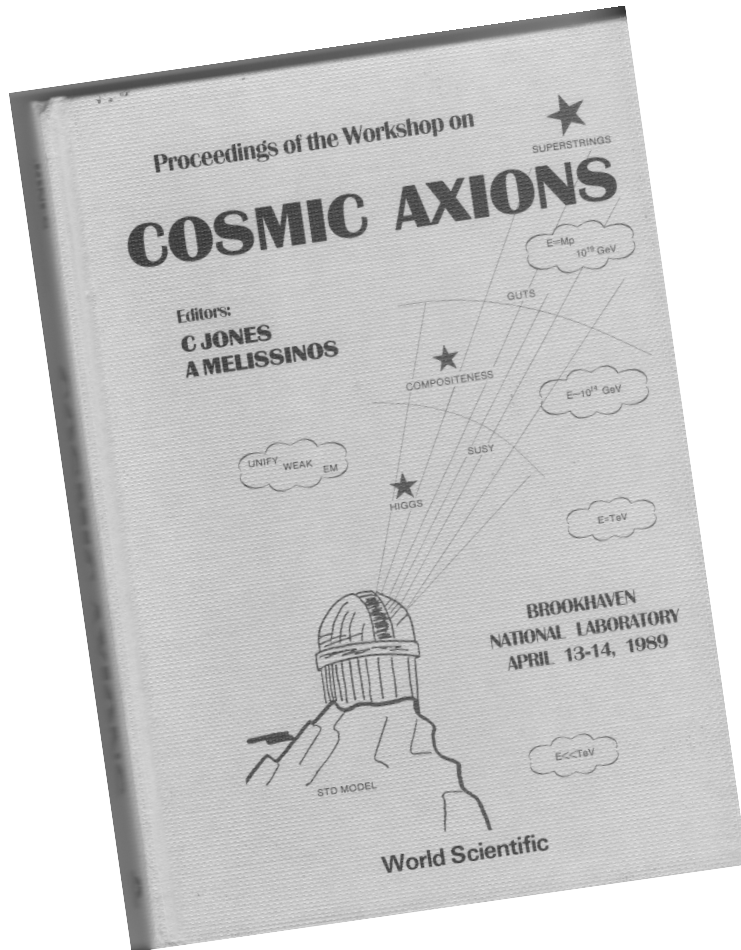
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- Projects/upgrades stretched out or stalled
- Op-Tempo suffers
- Lack of concurrent R&D
- Insufficient modeling to optimize experimental design
- Systems-level Monte Carlo is compromised
- Robust two-team analysis is forsaken
- Long-range strategic planning is lost

Any one of these could cost you a discovery

The efficacy of road-mapping – the story of ADMX

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- Workshop organized by Adrian in 1989
- Brought together physicists & technologists
- Everything was foreseen
 - Identified T_{sys} & amplifiers as the key issue
 - Set the scale of the experiment
 - Laid out the R&D program
- Formed a new collaboration from the two pilot experiments, RBF & UF plus newcomers

We are benefitting from that 1989 meeting to this day

Attendees at the 1989 Axion Workshop

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BAGGETT, N., Brookhaven
BOCKO, M. F., University of Rochester
CAMERON, R., University of Rochester
CARLSMITH, D., University of Wisconsin
DABHOLKAR, A., Princeton University
DAVIS, R. L., Tufts University
DERUJULA, A., CERN
DOWRICK, N. J., Oxford
FOWLER, W. B., Fermilab
HAGMANN, C., University of Florida
HALAMA, H., Brookhaven
HUGHES, V., Yale University
INAGAKI, S., KEK
IWAMOTO, N., University of Toledo
LAZARUS, D., Brookhaven
MARKIEWICZ, W. D., Intermagnetics Int'l.

MARTOFF, J., Temple University, Stanford
MELISSINOS, A. C., University of Rochester
MO, L. W., Virginia Polytechnic Institute
MOLTZ, D. M., LBL
MOSKOWITZ, B., Brookhaven
NEZRICK, F. A., Fermilab
PRODELL, A., Brookhaven
QUASHNOCK, J., Princeton University
RADEKA, V., Brookhaven
ROGERS, J., University of Rochester
SADOULET, B., Univ. of California, Berkeley
SAMPSON, W., Brookhaven
SHELLARD, P., MIT
SECKEL, D., Bartol Research Inst.
SEMERTZIDIS, Y., University of Rochester

SIKIVIE, P., University of Florida
SLONCZEWSKI, J. C., IBM
SUDARIKOV, A., Moscow Engineering Physics Inst.
SULLIVAN, N. S., University of Florida
TANNER, D., University of Florida
TRUEMAN, T. L., Brookhaven
TURNER, M. S., Fermilab, Univ. of Chicago
VAN BIBBER, K., Lawrence Livermore National Lab
WEINREB, S., Martin Marietta Labs

A propitious omen during the workshop – we received news that SLAC had seen its first resonantly produced Z^0

The importance of a community that works well together *AXION*

If the Agencies are going to place a very big bet on Axions, they need to be convinced that they are dealing with rational actors

- I want to thank & congratulate all our colleagues in the axion enterprise world-wide
- It is a great community that has openly shared information and experience, and has encouraged one another
- Axions have brought people together (maybe because they're bosons)
- There has been no (bad) drama in the axion business so far, and hopefully there will never be

But the Agencies will possibly also want to see more consolidation nationally & internationally

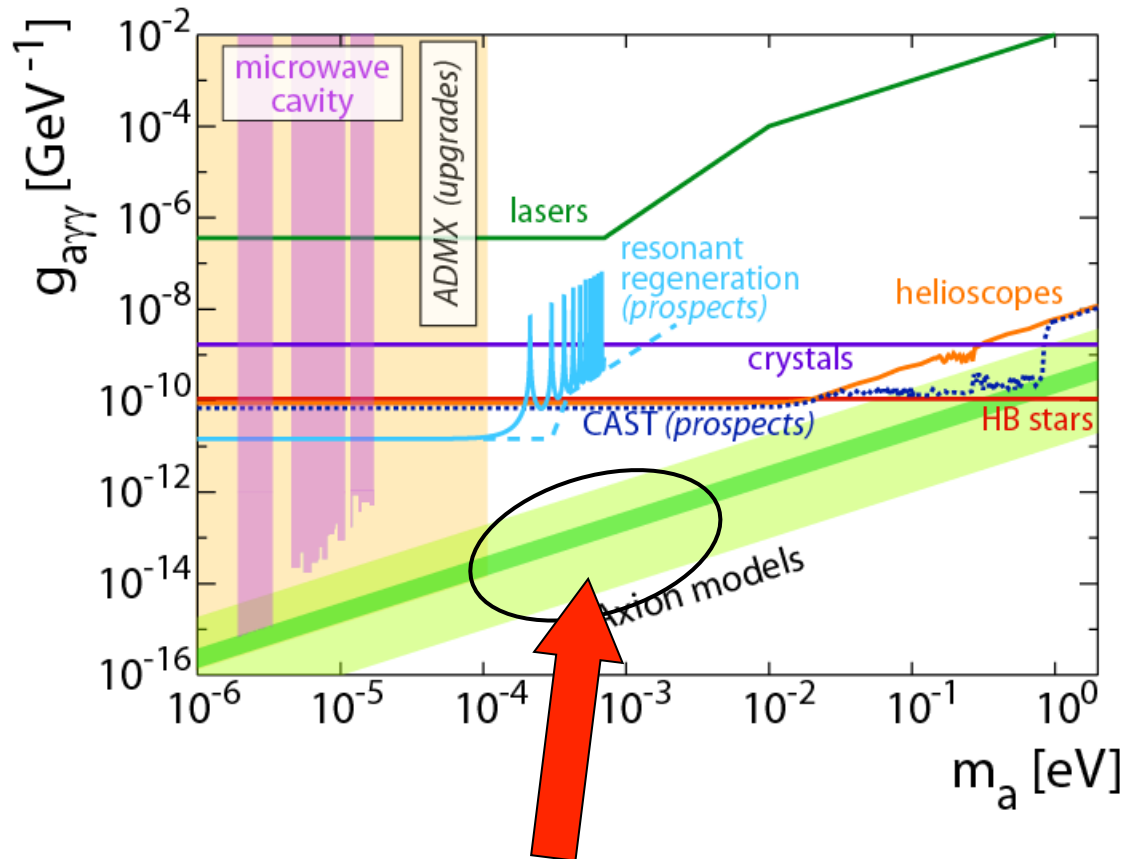
The charge to the Working Groups & Rapporteurs

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- We are here to envision the next- & next-next-generation experiments in three areas – dark matter, solar & purely laboratory searches
- By Thursday, your group should address the following questions:
 - What is the scientific potential of such an experiment?
 - What is the technological roadmap?
 - What can be extrapolated with confidence
 - What needs to be invented (don't be afraid of requiring a miracle)
 - How long will it take and what will it cost
 - When can the experiment be built, and how much will it cost
- Fast, impressionistic but complete answers are what is needed now

The working groups should be spontaneous in nature, with the emphasis on short, very informal & preliminary contributions

Charge to Working Group (II)



The axion from hell

- The “Theoretical Frontiers & New Concepts” is a very important group
- We are in need of innovative concepts
- *In particular, we don't know how to find the 0.1-10 meV range, nor neV axions from string theory*
- We also need new theoretical, cosmological & astrophysical guidance constraining the axion

The Prize for finding the Axion

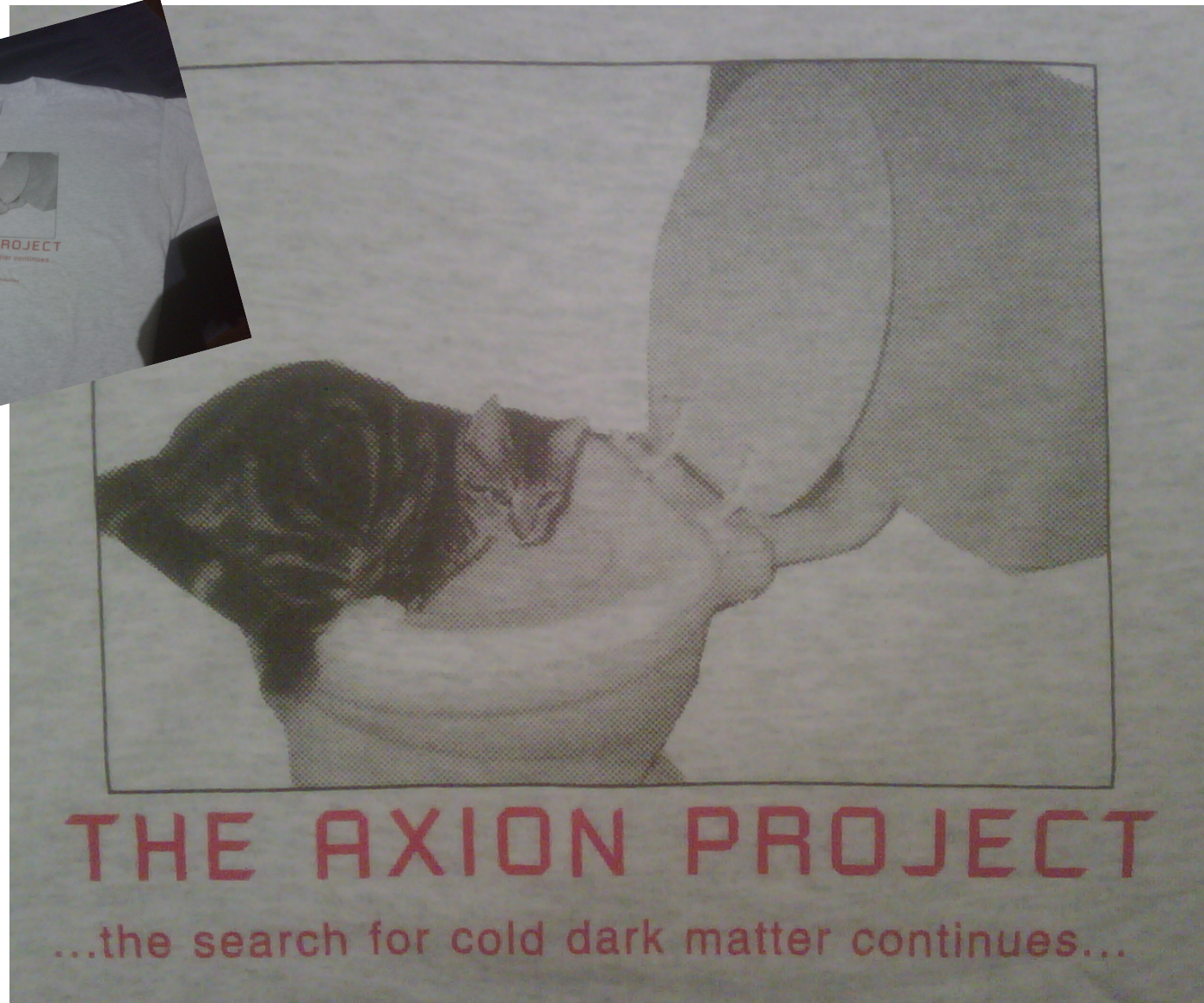
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- Like Captain Ahab nailing a gold doubloon to the ship's mast for the first sailor to spot the White Whale, a prize is hereby posted
- In 1995, Chris Hagmann's wife created a limited edition of 50 Tee-shirts entitled "The Search for Cold Dark Matter Continues"
- It's a somewhat unflattering photograph of their cat Axion
- A year later, it was struck by a car, and decayed into 2γ
- I have the last one in mint-condition, appraised at thousands

Find the axion, and the Tee-shirt is yours

Axion immortalized

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Conclusion

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- This is the time for the axion
- We can get the job done
- We look forward to working with the agencies to structure the program

Let's have a great workshop!

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