

My Second Home at CPHT



WHY AM I HERE TODAY ?

- I have been a regular (long-term) visitor at CPHT since 1989 (~ 1/2 of our period ...) [TOT: 2 – 3 years]
- Much of my work has been closely linked to CPHT, or influenced by its (present and past) members.
- [New (Italian?) rules make these crucial exchanges more and more difficult today. Big damage also to students]

MY FIRST VISIT TO CPHT

- **1989:** to meet again **Ignatios ANTONIADIS (A)** and **Costas BACHAS (B)**, Junior Faculty members at the time. We had previously overlapped in the U.S., when I was a Miller Fellow at U.C. Berkeley and they were at SLAC.
- **A LEADING TRIPLET** with another former U.C. Berkeley colleague, **Kostas KOUNNAS (C)** of Ecole Normale.

A. B. C.



Ignatios ANTONIADIS
(with moustaches)

Costas BACHAS



Costas KOUNNAS
(K → C)



WHY DID MY VISITS BEGIN?

- A.B.C. had shown how to build systematically **CONSISTENT SPECTRA OF CLOSED STRINGS**. A major contribution to String Theory from CPHT – ENS.

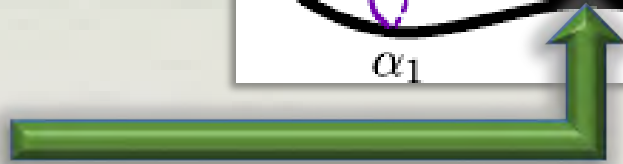
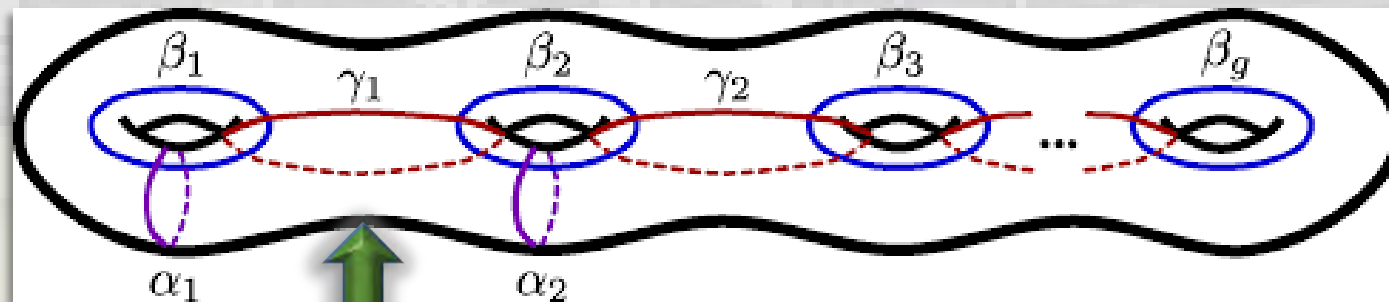
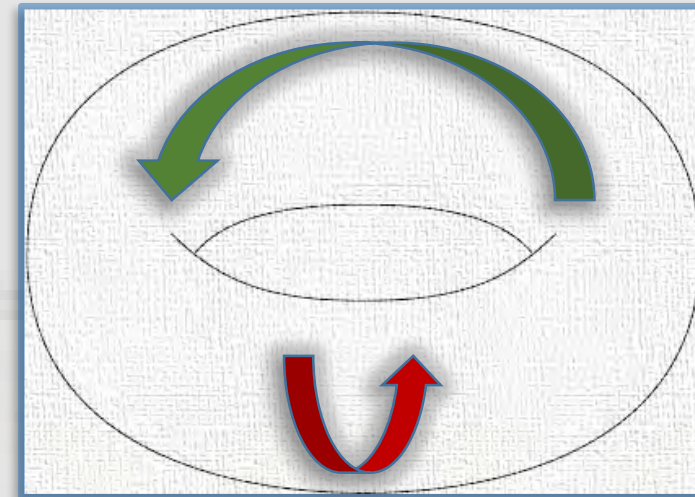
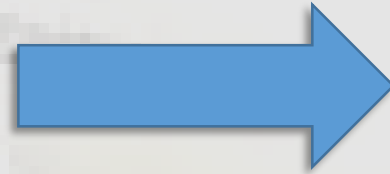
(Antoniadis, Bachas, Kounnas, 1987)

- In addition, C. had already framed their low-energy manifestation in Supergravity, the so-called **NO-SCALE** models.

(Cremmer, Ferrara, Kounnas, Nanopoulos, 1983)

THE A.B.C. CONSTRUCTION

(Antoniadis, Bachas, Kounnas, 1987)



SO, IN THE SUMMER OF 1989 ...

- CPHT was in the nice "old" building. I came with **Massimo BIANCHI**, then my student. With him and **Gianfranco PRADISI** we were trying to **extend A.B.C. to spectra with both OPEN and CLOSED strings (ORIENTIFOLDS)**, which I had shown to be closely related in the simplest 10D case.

(AS, 1987)

- With A. & B. we quickly identified the first exact curved string vacuum, based on the Wess-Zumino-Witten model (a UV completion of Freedman-Gibbons "electrovac").

(Antoniadis, Bachas, AS, 1989)

THEN (1989-1992)

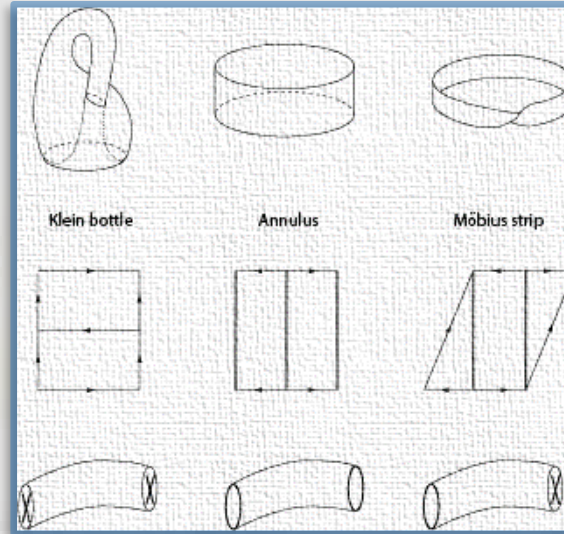
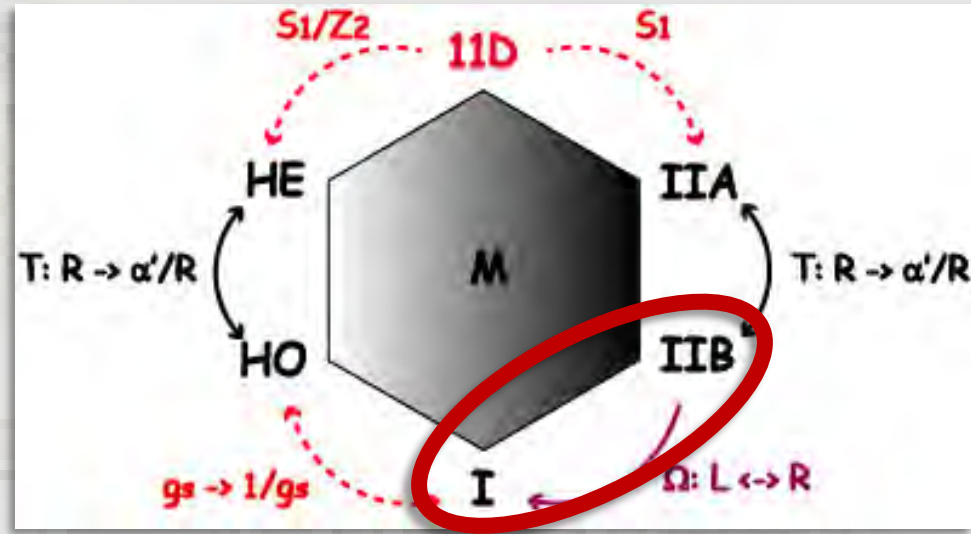
- I had had the proper intuition about what are now called "orientifolds", but filling in the details was **NO EASY TASK**. The whole story required several steps.

(AS, 1987; ... , Pradisi and AS, 1989; Bianchi and AS, 1990; Bianchi, Pradisi and AS, 1991; AS, 1992)

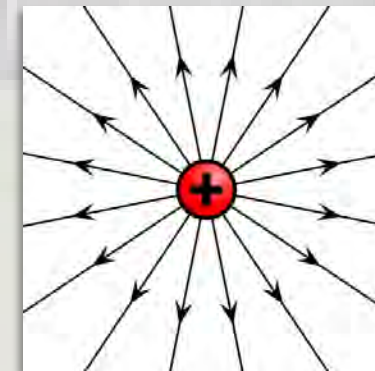
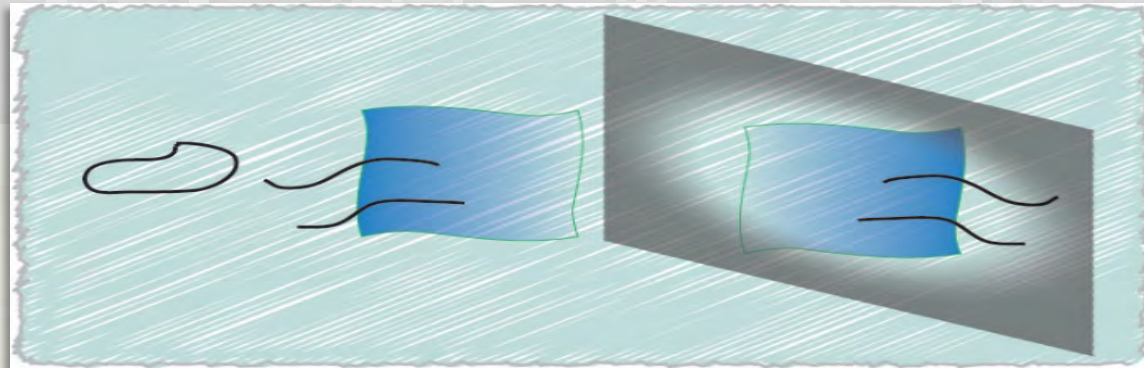
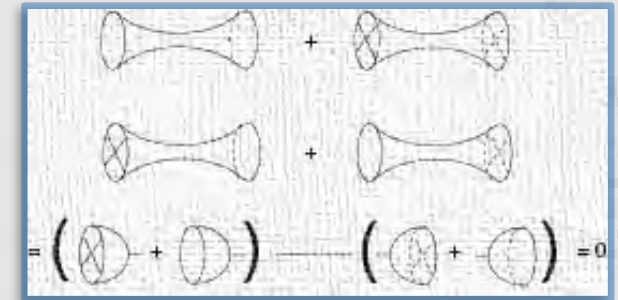
- In 1992 I came alone, during the Summer, and I was kindly hosted by **B.**, who left me his home and his car. When the car needed some repair, **C.** was ready to help. In the quiet and silent Summer I could complete a work exhibiting the generalized Green-Schwarz mechanism of orientifold vacua.

(AS, 1992)

THE ORIENTIFOLD CONSTRUCTION



(AS, 1987)
+ (Bianchi, Pradisi, Stanev, 1988-95)



(Polchinski, 1995)

THEN in 1994-95

- I was hosted again by C. during the Summer, and I recall that **George ZOUPANOS** was also there (I had the privilege to meet many Greek colleagues: for example **Costas SFETSOS** and the late **Ioannis BAKAS** were frequent guests of CPHT).
- In 1994 the late **Yassen STANEV** came to Tor Vergata. I spent three months at CPHT in 1995 with him and **PRADISI**, and we found different ways to project closed spectra in the ADE classification, and also a new 10D string. *(Pradisi, AS, Stanev, 1995; AS, 1995)*

SUSY '95 at CPHT



Yassen
STANEV

You will also recognize some other colleagues here ...

THEN in 1995-96

- The late **Joe POLCHINSKI** added a pervasive space-time picture in terms of D-branes and non-dynamical objects (orientifolds).
- In 1996 we built the first chiral 4D spectrum, and we found a completeness condition on boundary states, thus concluding the work of 1995.
(Angelantonj, Bianchi, Pradisi, AS, Stanev, 1996)
(Pradisi, AS, Stanev, 1996)
- Our student **Carlo ANGELANTONJ** joined CPHT (and then Ecole Normale).

STUDENTS, VISITORS and MEMBERS

- A.B.C. students included then Boris PIOLINE, Marios PETROPOULOS and Hervé PARTOUCHE.
- Many visitors (and group members) from many Countries, including Elias KIRITSIS, Ruben MINASIAN, Fawad HASSAN and the late Alok KUMAR.

Personal and professional links built up naturally ...

INTENSIVE COLLABORATION

- This started with **A.** at CERN, and the topic was how supersymmetry breaking would extend to open strings.
- **A NEW KEY COLLEAGUE (1998–): Emilian DUDAS**



BRANE SUPERSYMMETRY BREAKING

(Antoniadis, Dudas, AS, 1999)

- I regard it as the **MAIN JOINT OUTCOME** with CPHT.
- **KEY IDEA:** break Supersymmetry combining, in the vacuum, extended objects that cannot create classical instabilities together (anti-branes + orientifolds).
- Made sense of puzzles noticed in Rome for a while.
- **COMPLICATED DYNAMICS:** still under scrutiny ...

BRANE SUSY BREAKING (BSB)

(Sugimoto, 1999)
(Antoniadis, Dudas, AS, 1999)
(Angelantonj, 1999)
(Aldazabal, Uranga, 1999)

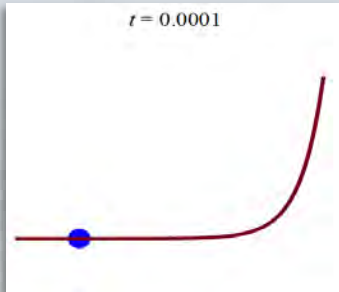


THE SECOND KEY COLLEAGUE ('99 -)

- Jihad **MOURAD** was then at Orsay (a "staircase" away, which made going EASY and coming back HARDER ...). He started to discuss matters with **Emilian**, but I soon joined in. **I am still learning from him and Emilian today.**



PRE - INFLATION FROM STRING THEORY ?

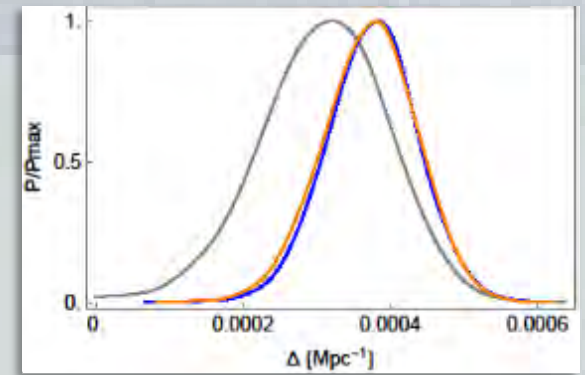
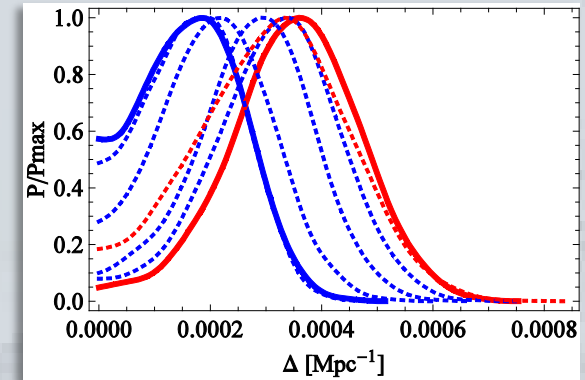
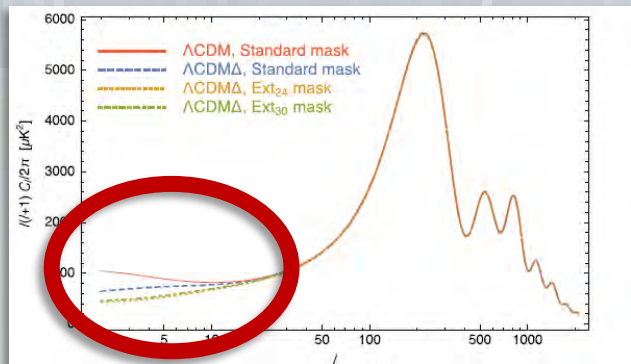
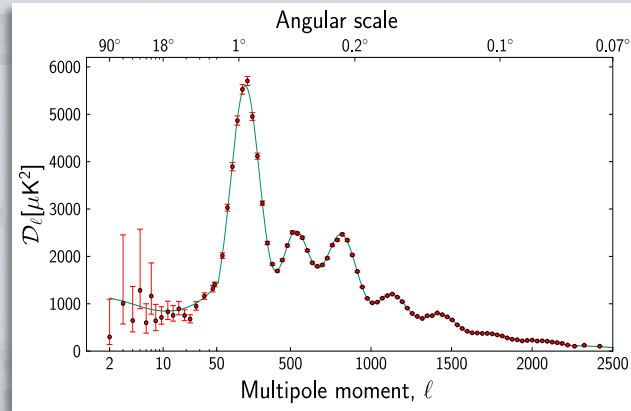
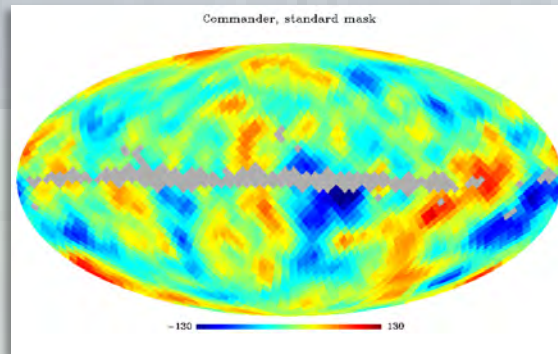
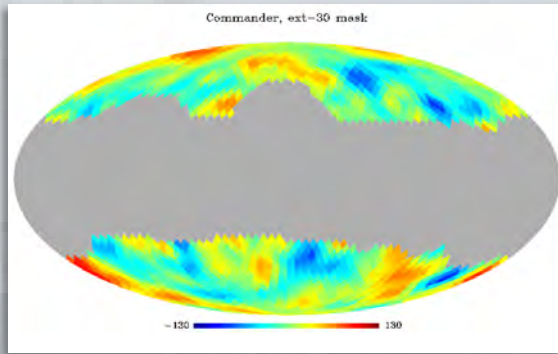


$$V(\varphi) = V_0 \left(e^{2\varphi} + V(\varphi) \right)$$

$$P(k) = k^{n_s-1} \rightarrow \frac{k^3}{[k^2 + \Delta^2]^{2-\frac{n_s}{2}}}$$

....
 (Dudaş, Mourad, 2000)
 (Russo, 2004)

(Dudaş, Kitazawa, (Patil), AS, 2010-12)
 (Gruppuso, Kitazawa, (Lattanzi) Mandolesi,, Natoli, AS, 2016-18)



CONCLUSION

I have had the privilege to find a second home at CPHT. I have strived to profit from its atmosphere, from the stimulus and the joy conveyed by interactions with its members, and from what its quiet environment has always granted me.

Let us strive to maintain these opportunities in the future, forcing our Administrations to respect them!

Thank you CPHT, and Best Wishes!