

In Memory of Costas Kounnas

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Corfu Summer Institute – Kounnas Memorial Day

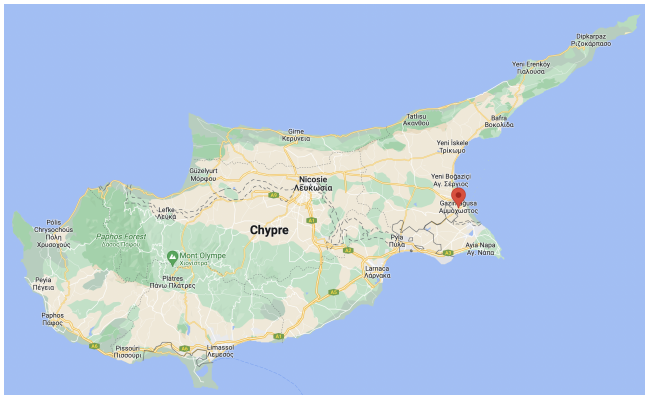


■ Our friend and colleague Costas passed over in January, just before his 70th birthday.



■ Strange feeling to present very few aspects of his personality and career because he was extremely lively, had a strong personality + outstanding physicist.

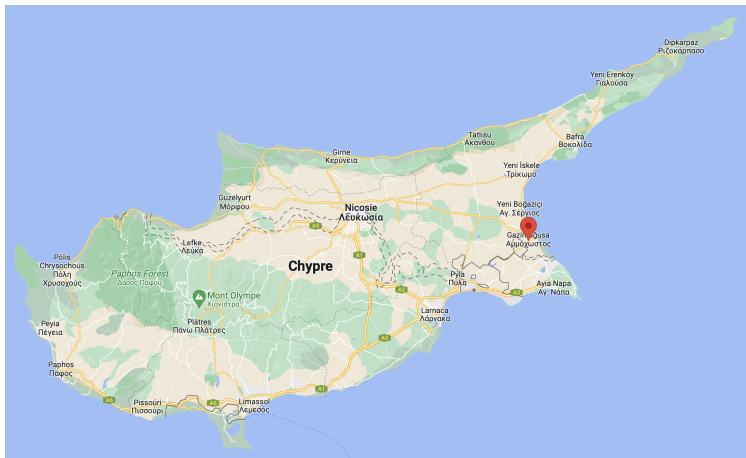
- He said he is a **“citizen of the world.”**
 - This may illustrate his character, which does not like limitations.
 - Maybe related to his personal history:
- He was **born in Cyprus in 1952, in Famagusta**



- He was always talking about this town as a **lost paradise**. With the most beautiful beaches of the Island.



- 1974: Turks invade the island and start to occupy the northern part of it.



Since then the country is divided in 2: The occupied part and the part that is member of the 27 countries of EEC

- Famagusta is just at the border:

- The town was taken in 2 days and all its inhabitants left, thinking that they would come back soon after everything gets fixed.
- However, things did not happen like that. Access to the town has been forbidden by the Turks. Only this town was abandoned to itself, surrounded by barbed wire since 1974.



- Since then, cactus and plants are growing up in the houses. They can be seen when you walk along the barbed wire.

■ **Costas was 22 years old.** He was doing his military service.

■ Then he came to Paris to do his Master + thesis with John.

- He would have probably come to Paris in any case, as a “citizen of the world.”

However, since he was kicked out of his lost paradise of Famagusta, maybe living his island was more difficult than expected.

- In fact, he kept very strong links with his island. Going back and forth.

- He was always disappointed to be the second best client of Cyprus Airways. The best client was going every week: “It is impossible to be the 1st.”

- He was for many years the official representative of the Cypriot community in France.

- He never asked for the French nationality. Maybe to remain faithful to its origins?

At 12 years old



Brother

Sister

Costas

[sent by Kakia]

Intermediate age



Luis

Costas

With other friends



Costas

Nick

Marios

Enjoying life... Also in conferences





At 67 years old



30 January, 2019

13 / 20

At almost 69 years old

No fancy, sophisticated food!

Pig prepared for the new 2021 year

[sent by Kakia]



■ Costas had many friends, from many origins. He was always introducing them to each other to create links between them.

- As an **outstanding physicist**, he had his own way of thinking:
“I am not a follower”
- I will take examples of new ideas and technics that opened totally new directions:

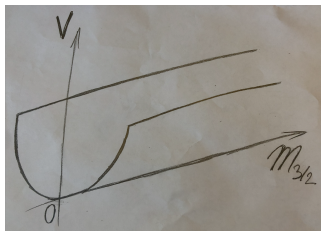
No-scale supergravity

■ In the early days of supergravity, supersymmetric vacua were known in Minkowski spacetime.

It was believed that introducing a breaking of supersymmetry would always introduce a non-trivial (large) cosmological constant.

- **In 1983, Cremmer, Ferrara, C.K., Nanopoulos:** This is not true

You can generate a potential ≥ 0 , with vanishing minima



The scale of susy breaking $m_{3/2}$ is a flat direction: **No-scale models**

- Construct models with **hierarchy of scales.**

In stringy theory

■ **In 1988, Ferrara, C.K, Porrati** constructed string theory models realizing the **spontaneous breaking of susy in Minkowski space at tree level:**

- Explicit worldsheet CFT.
- Spacetime d.o.f. in the each supermultiplet have different boundary conditions along compact directions. **String version of the Scherk-Schwarz mechanism, '79.**

■ **In 1990, C.K and Rostand** showed how to switch on **finite temperature in string theory:**

- Implement periodic/antiperiodic boundary conditions for bosons/fermions along the Euclidean time, while preserving modular invariance.

Hagedorn phase transition

■ At finite T , string theory develops an instability above the Hagedorn temperature $T_H \implies$ phase transition.

- Angelantonj, C.K., H.P., Toubas [2008] constructed models where **only the states lighter than M_{string} are in thermal equilibrium.**

- The temperature admits a **maximal value T_{max} . No Hagedorn phase transition.**

- The states heavier than M_{string} are not in thermal equilibrium: **Exactly at 0 temperature in $D = 2$, they are supersymmetric!**

- Physically = Freeze-out mechanism:

When the temperature goes below the mass, their number density drops, they don't see each other and they decouple from the thermal bath \implies relic density of (cold dark) matter.

Quantum effects in no-scale models

- The no-scale structure is broken at 1-loop: A potential is generated.

⇒ **Backreaction** on the classically static Minkowski background

⇒ **Cosmological evolution**

- Bourliot, Catelin-Jullien, Estes, C.K., Liu, H.P., Toumbas [2008-2012] **Attraction to a solution**

$$T(t) \propto m_{3/2}(t) \propto g_{\text{string}}^4(t) \propto \frac{1}{a(t)} \propto \frac{1}{\sqrt{t}}$$

T explore democratically all values below the maximal temperature:
Remnant of the no-scale structure

- Many fluids with computable state equations. But evolution as if the universe was dominated by radiation

$$\rho_{\text{th}} \neq 3P_{\text{th}} \quad \rho_{\text{th}} + \rho_{\text{kinetic}} = 3(P_{\text{th}} + P_{\text{kinetic}})$$

- Long story of **stabilization of moduli fields...**

Good Bye Costas and Thank You

for all you gave to the scientific
community and to your friends...