

## 2013 Nemitsas Prize in Physics

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The Takis and Louki Nemitsas Foundation awarded the 2013 Nemitsas Prize in Physics to Professor George P. Efstathiou, a world-renowned Cypriot astrophysicist and cosmologist with a wealth of contribution to his field.

Takis Nemitsas, the Chairman of the Foundation, and Louki Nemitsas, the Vice Chairman, announced that the 4<sup>th</sup> award ceremony was as successful as previous ones, despite the negative impact of the financial crisis which has affected everyone, including the Foundation.

The President of the Republic of Cyprus, Mr Nicos Anastasiades, presented the award to Professor Efstathiou at a ceremony held at the Presidential Palace on 10 October 2013.

It is worth mentioning – and it is touching – that, together with the family of the winner, Professor Efstathiou’s parents, who

*“It is likely that our Universe is part of a much greater structure; just a little patch of an eternal multiverse”*

emigrated to England in 1950, were also in attendance.

Marios Mavronicolas, the coordinator of the Foundation, extensively referred to the professor’s scientific work, stress-

ing that Professor Efstathiou is internationally known for his significant contribution to astrophysics and cosmology. He also referred to the professor’s leading role in the Planck satellite, through which galactic observations were made that led to the identification of structures in the universe. Mr Mavronicolas expressed the Foundation’s pride at this year’s prize. He concluded saying that “The Nemitsas Foundation will honour Professor Efstathiou, but Professor Efstathiou also honours the Foundation by including the Nemitsas prize among the remarkable number of international prizes he has received.”



*A reception followed the ceremony in the grounds of the Presidential Palace*



*Leading political figures, including Archbishop Chrysostomos II and President of the Republic Mr Nicos Anastasiades and his First Lady Andri, attended the ceremony*

### **Professor George P. Efstathiou**

Receiving the Nemitsas Prize in Physics, Professor George P. Efstathiou said it was a tremendous honour, for himself and his family, to receive this prize. He paid special mention to his parents, who were also in attendance at the ceremony.

“My family comes from the ‘kokkinochoria’ area of Cyprus with a background in potato farming on my father’s side and small business on my mother’s side,” the Professor explained. “My father left for England in 1949 and my mother shortly afterwards. I was born in London in 1955. I have been to Cyprus many times, and I have been amazed at the changes to the island over the years.”

Professor Efstathiou’s interest in science came from a young age. “As a child, I was always interested in science, particularly astronomy: where did the planets and stars come from? How did the Universe begin? Does the Universe end?”

### **The influence of a very important teacher**

“Like many young people, I was strongly influenced by an inspirational high school teacher, Dick

Yarrow, who I would like to acknowledge here.

He taught me Physics – this is the science of how the Universe works and how the Universe behaves. It is through Physics that we can tackle the big questions that enthralled me as a child. So, I have pursued Physics ever since, as an undergraduate at Oxford, a PhD student at Durham, followed by postdoctoral appointments in Berkeley California and in Cambridge, where I have spent most of my academic career.”

### **A little about my science**

“Modern physics is based on three key principles encapsulated by three constants of Nature: the theory of gravity described by Newton’s gravitational constant  $G$  which measures the strength of the gravitational force; Einstein’s principle of relativity which links together space and time via the speed of light ( $c$ ); and Planck’s theory of quantum mechanics in which the Planck constant  $h$  distinguishes the quantum from the classical world,” Professor Efstathiou explained. “What we are trying to do in Physics is to understand everything about our Universe in terms of these principles: grav-

ity, relativity and quantum mechanics.”

He added, “Now this immediately raises a fundamental problem, because the constants  $G$ ,  $c$  and  $h$  define a ‘natural’ set of units for Physics – often called ‘Planck units’. These seem anything but natural to us. The natural unit of time is less than a trillionth, trillionth, trillionth of a second, very much less than the age of the Universe (nearly 14 billion years). The natural unit of length is microscopically small, much less than the size of our observable Universe and the natural unit of energy is enormously high – 14 orders of magnitude higher than the energy achieved at the Large Hadron Collider at CERN.

So if the natural time unit is  $10^{-44}$  seconds, why is our Universe so old? Why is our Universe so big? Did it ‘begin’ at  $10^{-44}$  seconds or was there something there beforehand? You see that the big questions of modern cosmology are very similar to the questions that might be asked by a six-year-old child!

Is it possible to answer these questions? The answer is yes and this is what my collaborators and I have been doing over the last few years with the aptly named Planck satellite. We launched this satellite in May 2009 and it has been measuring the temperature irregularities of the cosmic microwave background radiation – the remnant radiation from the hot big bang, which has cooled as the Universe has expanded and now has a temperature of only 2.7 Kelvin.”

Presenting a map produced by Planck, Professor Efstathiou explained: “It shows temperature

differences of about 1000<sup>th</sup> of a percent in different directions of the sky. This is a very important picture. Every bit of information that we can extract from this map tells us about Physics at the time that these irregularities were generated, which we believe happened just  $10^{-35}$  seconds after the birth of the Universe.”

### **Is the Universe bigger and older than we thought?**

So what have we learnt from these important findings? The results from the Planck satellite lead to a theoretical prediction: “The agreement is basically perfect; we have clearly uncovered a fundamental truth about the birth of our Universe. The theory is based on the idea that the irregularities started as quantum mechanical fluctuations in a tiny region of space. The Universe then expanded faster than the speed of light to make the entire observable Universe, stretching the quantum fluctuations to huge scales. Everything that we see in our Universe, the planets, stars and galaxies, came from these quantum fluctuations. This is how we can understand why the Universe is so much bigger and older than implied by the natural scales of Physics.”

It is an incredible human achievement that Professor Efstathiou and his team have been able to test Physics at such early times, before even the matter in the Universe was created.

“If this theory is correct, then it is likely that our Universe is part of a much greater structure; just a little patch of an eternal multiverse. Fur-



*President Nicos Anastasiades presents Professor George P. Efstathiou with his award*



*Professor George P. Efstathiou*



thermore, our current understanding of quantum gravity implies the existence of extra dimensions – five or six additional space dimensions to the three dimensions that we are familiar with. Is it possible to test these ideas? The answer is yes and that is the focus of my research in the immediate future.”

### **Address by the President of the Republic of Cyprus, Mr Nicos Anastasiades**

“It is a great joy and an honour for me to be here today, to celebrate a distinguished son of this country, a notable Cypriot scientist, whose contribution to world science honours our country and is recognised in the world’s most important centres of science. As the President of the Republic of Cyprus, it brings me great pleasure to see the success of Cypriots who emigrated during difficult times at home to seek a better life overseas and have managed to not only grow and thrive, but to excel and to honour their homeland at the high-

**“I am grateful to the Nemitsas Foundation for its contribution and to George Efstathiou for making the nation proud”**

est levels in the arts and sciences. Tonight, we have the opportunity and the honour to award one Cypriot prodigy, one of three children born to Peter Efstathiou from Achna, and Christina Parperis from Famagusta, who immigrated to England in

the 1950s. We shall award the Takis and Louki Nemitsas Prize in Physics to renowned Professor George Petros Efstathiou, a brilliant Cosmologist, who at a very young age embarked on a distinguished academic career at both Oxford and Cambridge Universities, as a Professor of Astronomy and Astrophysics. George P. Efstathiou is renowned in international scientific circles for his pioneering use of computer simulations of structure formation in the Universe. His work gave the first indications of a hitherto invisible force, the so-called ‘dark energy’. He has researched the traces of radiation left over from the birth of the cosmos and discovered that our Universe is part of a much greater structure. Of course, I am not the best qualified to describe



*President Nicos Anastasiades addressing the ceremony*



the achievements of George P. Efstathiou in a field that most of us can barely comprehend. I will add only that he founded and is a director of the Kavli Institute for Cosmology, which is one of the most important of its kind in the world and has already been awarded three prestigious international honours in the field of Cosmology. We are proud that people like George P. Efstathiou transcend our homeland's narrow borders and promote the spiritual virtues of our country universally. For this, we thank him warmly.

Let us be honest, however. How much would we know of, and how much would we appreciate the existence of this brilliant scientist who honours us, had it not been for the contribution of the Takis and Louki Nemitsas Foundation, highlighting and rewarding our worthy and distinguished compatriots around the globe?

I wish to take this opportunity to praise the work of the Foundation and the generosity of Takis and Louki Nemitsas, who bestowed upon the Republic of Cyprus the Foundation, including all of their movable and immovable property. Since its establishment in 2009, the Takis and Louki Nemitsas Foundation has been awarding scholarships to Cypriot scientists whose research elicits inventions, discoveries and improvements "which would bear great benefit to Cyprus and thus to the whole world", as stated in the *aims of the Foundation*. I also want to stress the fact that the Board of Trustees works voluntarily and altruistically. The Academic Council, the Secretary and the Coordinator of the Foundation and other committees also work in the same manner. Their contribution is immeasurable.



Such initiatives not only reaffirm the greatness and generosity of our people, but also enhance our desire to be useful and beneficial to our country and to our people as exemplified by Takis and Louki Nemitsas. In such difficult times as our country is experiencing, these undertakings are an invaluable contribution to our efforts to rebuild our economy and adjust our strength in the face of the situation we are enduring. I recognise the trying conditions presently experienced by the Nemitsas Foundation, and I share the concerns of Takis Nemitsas about the Foundation's future and its ability to maintain its commendable contribution. The economic crisis we are experiencing has been a serious blow to the whole of Cypriot society and has unfavourably affected a multitude of foundations, organisations, citizens, and the state itself. The economic potential of the state has decreased radically, but our intention to help maintain worthy institutions, such as tonight's, must be taken as a given. Together, we shall endeavour to cooperate in the hope of finding the best possible way to solve the shared problems we all face. It is my hope and expectation that in a year's time, when we award the 5<sup>th</sup> Nemitsas Prize honouring another worthy child of our homeland, we will be able to speak with more certainty and confidence about the future of our country and people. I thank you for the confidence you have given us. I am grateful to the Nemitsas Foundation for its contribution and to George P. Efstathiou for making the nation proud. I warmly and profoundly congratulate you."