

# 10 Vital Questions to 10 Notable Physicists

## Part 1: An interview with Professor Lawrence M. Krauss

In the last decade the science of Cosmology has really come into its own, while many world renowned scientists, in the field, have become public icons, and popular science superstars.



Prof. Krauss is one such scientist with a reputation of being unorthodox, outspoken, and a unique force as a theoretical physicist. He has published over 200 scientific papers, the winner of numerous prizes and awards, appears regularly in the media on TV and radio, and is also the best selling author of seven books, the most recent being; *Hiding in the Mirror, The Mysterious Allure of Extra Dimensions, from Plato to String Theory and Beyond*. (Penguin, 2006)

Lawrence M. Krauss is director of the *Center for Education and Research in Cosmology and Astrophysics* at Case Western Reserve University in Cleveland, Ohio. He is also chair-elect of the *Forum on Physics and Society of the American Physical Society*.

Australian writer, Estelle Asmodelle puts some contemporary questions to Prof. Krauss.

**ESTELLE ASMODELLE:** Do you see the Intelligent Design issue as the general demise of empirical thinking in our society; by educators and scientists alike?

**LAWRENCE KRAUSS:** I see it as symptomatic of a general scientific illiteracy which is too prevalent in our society, and which is one of the reasons I, as a physicist, am spending time on this issue. I also see it as representing an inappropriate 'fear' of science that I would like to help people overcome.

**EA:** As a particle physicist as well as a Cosmologist and a proponent of the Standard Model in particle physics, what do you think of the recent claims of the Higgs Boson detection?

**LK:** I never believe claims of anything the first time around... I find I am less disappointed that way.

**EA:** From a philosophical point of view do you think incorporating the Anthropic Principle into Cosmology is a normal part of the scientific process, or it is something else?

**LK:** I think it is a sign of desperation, and lack of other good ideas. Once some interesting physics is discovered, this too shall probably pass.

**EA:** Now let's talk about an area in which you have made a significant contribution; Dark Energy. How do you envisage testing the existence of Dark Energy without relying on SNe (Supernovae) 1A data?

**LK:** Alas, while I am quite proud to have 'predicted' the existence of dark energy before it was directly inferred from SNe observations, I am also quite pessimistic about the possibilities at this point in experimentally uncovering its nature. I think observation will not give us any good handle on whether dark

energy is a cosmological constant or not, and we will unfortunately have to rely on theory.

**EA:** In a recent paper you published collaboratively there is mention of the cosmological constant being distinctly different from Dark Energy. Can you explain the relationship between the two as you see it?

**LK:** Well, the most likely possibility for dark energy is that it is a cosmological constant, or, as it is better known today, the energy of the vacuum. Unfortunately, there are many other forms of energy that might masquerade as this, and we would never know it.

**EA:** In reference to WMAP data; the scientific community seems convinced, beyond a shadow of doubt, that the CMB is the direct evidence of the Big Bang, but is there any possibility the data could be corrupted by black body radiation from nearby galaxies?

**LK:** I think it is quite possible; that certain aspects of the data could be corrupted by foregrounds, but that wouldn't change the fact that it is indeed evidence of the Big Bang. The evidence is just too overwhelming, from the beautiful black body nature of the radiation, its temperature, the magnitude of fluctuations etc...

**EA:** In your new book, *Hiding in the Mirror*, we are lead on a very interesting explorative into the search for hidden dimension, but I sense that you in fact think that those hidden dimensions do not exist. If this is true what fate do you think is in store for String Theory or M-theory?

**LK:** I think String Theory is in the doldrums right now. It is a fascinating idea, it just hasn't gone anywhere. We will need new particle physics data, I think, before we have any indication that string theory, and also the possibility of extra dimensions, has anything to do with our universe.

**EA:** One of the most difficult and seemingly insurmountable problems in Cosmology has been the unification of the General theory of Relativity with Quantum Theory. What approach do you think will lead to this unification; will it be a philosophical issue, or a pure science and mathematical issue?

**LK:** I hope it will be a scientific issue... and if I knew of a good approach, I would be doing it

right now! In fact, I have a few ideas and will let you know if they work out...

**EA:** As someone who follows the scientific method fairly stringently, in the sense of building an understanding of the universe based on all the work that has gone before, do you see room in Physics and especially cosmology for alternative theories; such as MOND (MODified Newtonian Dynamics), and also other more controversial theories such as VLS (Variable speed of light)?

**LK:** There is always room in physics for alternative theories. That is how we make progress. You just have to realize, however, that most of these ideas will be wrong... indeed, many of my own beautiful theories (at least I thought so), have not been taken up by nature. As for the two you mentioned... I wouldn't bet on either.

**EA:** Undoubtedly you've had a stellar career so far and I'm sure there is much more to contribute. However as someone who is involved in so many activities do you feel that less time is spent on actual pure research these days?

**LK:** I try to balance things when I can, so that I work intensively on a Research project, and then work on other things, or travel and give lectures. Of course I cannot control this completely, and when I am upset about some public policy I end up writing something, even if it is the middle of the night. But inevitably the outside activities do impact upon research time. It is a compromise in the end. But usually one I cannot control... namely, I feel like a fraud if I am not doing research, and I feel negligent if I am not also doing something else.

