Prof. Ashoke Sen visits BARC

How false vacuum is different from ether...

It is not really ether. I mean one cannot distinguish false vacuum from ordinary vacuum. Ether makes sense if there's an experiment which you can do to distinguish it from the usual vacuum. Actually, one doesn't need ether to explain the propagation of matter. Finally, one cannot distinguish false vacuum from real vacuum...

Devising phase diagram for different false vacua...

In String Theory or for that matter in a fundamental theory, it is pertinent to have a phase diagram. In String Theory what happens is that we have many different phases and near each phase we can have a phase diagram. But there are many many phases that you've and still you don't know how the whole thing fits together. You can study phase diagrams in individual regions and we can see that there is true vacuum and false vacuum in individual regions but we still don't have a way to fit everything together. Basically, what we have to do is to merge all of them. Firstly, we have not discovered all these phases. We are finding newer and newer phases almost every day. So, we need to first find all these phases and see how these different phases fit together. It is certainly a problem. But in principle, it can be solved. But we haven't been able to solve it yet...

Expansion of the Universe...

For a most part of the universe, expansion is adiabatic i.e. entropy is conserved. But, in the early universe, there were phases in which it was not adiabatic. There is a first order phase transition which actually leads to entropy production. However, for most parts it is adiabatic. Also, the density of Dark Energy is uniform...

Discovery of Higgs Field and the existence of other states...

By doing an experiment the kind of environment you're producing was already there in the early universe. In the early universe (when it underwent an extremely high temperature phase) it did not trigger the production of killer bubble. Otherwise, we wouldn't have existed. This tells us that by doing low energy experiments in accelerators, we are not going to produce the killer bubble...

'The Future of our Universe'

Select edited excerpts of Prof. Ashoke Sen's talk at Trombay Colloquium in BARC in February

Big Bang Theory and the Origins of Potential...

The potential is a part of the Theory. It is not dependant on Time. Big Bang, of course, is a time dependant phenomenon. The potential is a property of the Theory which is there forever. Once you have a given fundamental theory, we can calculate what that potential is. This is the potential of scalar field, which is a part of the Theory. The Higgs potential, for example, is part of the Theory. It doesn't depend on the Big Bang phenomenon...

Interlink between Dark Matter and Normal Matter, and Energy and Dark Energy...

Dark energy, as I understand, doesn't exchange energy with anything - that's again part of Einstein's Equations. Normal Matter and Dark Matter could exchange energy. However, experimentally, we know that it doesn't, because if it could exchange energy we might have already seen the Dark Matter. We can expect there's a small interaction between the Dark Matter and the Normal Matter but insofar we have not yet detected such a thing actually taking place...

Gravitational pull stronger than the Dark Energy expansion force...

Dark energy is on account of gravity. The expansion of the Universe is controlled by gravitational force. Gravity depends on the kind of energy density. Dark Energy density tells us what is the source of gravity that is produced. The Dark energy density gives an overall accelerated expansion. The gravitational force between the matter and the galaxy is larger than the Dark Energy expansion...

Vivek Bhasin, Director, BARC handing over a memento to Prof. Ashoke Sen. Dr. A.K. Tyagi, Director Chemistry Group and Bio Science Group is standing next to him.

Possibility of other universe existing where the potential is higher than the potential of our universe...

This is certainly possible. Most likely that is what is happening. One of the ways we believe our universe is produced is by this cascading effect i.e. you start from a high potential system and then produce a killer bubble of lower potential, which expands and then produces a killer bubble of even lower potential system and it expands and so on. And according to that, indeed we're expanding into somebody else's universe.

If we had been close to the world of the expansion, we could have observed it. But we already know that the observed universe doesn't have any such one. If you are expanding into somebody else's universe then the world has gone very far away. But in principle it is possible to observe this...