1) How and what got you interested in theoretical physics? What gave you the initial spark to go in this field?

As a boy, I had a great fascination for everything to do electricity and magnetism. So I'd play with batteries, coils, springs and make various gadgets. My first love was mechanical stuff – all sorts. Although few young people today know what they are, Meccano sets were once popular. All my time after school went into making trains, bridges, cranes, etc. Thereafter I became more involved with vacuum tubes and transistors. My interest developed to the point that I made my own crystal receivers, then constructed super heterodyne receivers, radio transmitters, etc. After doing my A-levels I went to MIT to pursue this passion. But there I was in for a surprise; the world turned out to be so much bigger and more interesting than I had ever thought. There I encountered teachers who were at the very cutting-edge of science and who had developed great ideas that one nowadays finds in text books. Electrical engineering, or any engineering for that matter, began to look so small and unimportant compared to pure physics. One exceptionally inspiring teacher was Prof. Philip Morrison, who had polio from childhood and came to lectures in his wheel-chair. He was among those scientists who had discovered how stars get their energy, why they blow up, why some turn into pulsars and black-holes etc. When he spoke on the nature of space and time, nothing seemed more profound. Engineering fast slipped out of my mind. I came to realization that physics is beautiful: beautiful because it is simple. One is able to write down fundamental laws governing every kind of physical phenomena in the form of just a few equations. Though they are complex and difficult to solve, nevertheless the very thought that the whole universe can be reduced to a few equations gives one a sense of enormous power. I was faced with a choice: should I spend my life understanding electrical devices and learning to make better ones? Or did I want to learn about something really grand? Ultimately I decided that that my life would be better spent doing physics.

2) You studied in one of the dream institutes of any scientifically motivated student (MIT). What was it like and how would you say that experience differs from that of a student studying in a Pakistani institution?

Pakistani institutions are considered good if they succeed in transferring knowledge from teacher to student. Of course, very few of them actually do a good job at even that. But institutions like MIT see their success in pushing forward the frontiers of knowledge; their goal is to create a breed of student which is constantly seeking to analyze, create, and innovate. Of course, knowing the existing state of a field is crucial to this. But knowing the present is not enough.

3) Incidentally, there is a bit of confusion over which department you are exactly affiliated with currently. Are you still a part of Quaid-e-Azam University and how associated are you with LUMS SSE?

I retired from QAU two years ago after crossing sixty but I still have an office there and continue to supervise some thesis students. Having taught there for 38 years, it is not that easy to break off. Currently I am a visiting professor at SSE LUMS.

4) What do you think about LUMS SSE; its present and future?

Relative to most Pakistani universities, it has good teaching standards and few disruptions. The students are mostly from elite schools but a few have made it from less privileged backgrounds as well, a trend that hopefully will grow. Good faculty remains a serious constraint for future growth; LUMS has still a long way to go before coming close to even a middle-level U.S. university or a good Indian one. Success will be possible only if it is run so that political and ideological pressures, which have ruined other Pakistani universities, can be successfully resisted. Let's see.

5) What are your comments about the discovery of the Higgs particle? How do you see this development and what is the future of physics now that we have found the Higgs boson?

Now that the Higgs particle has been discovered, we can say with confidence that we have a precise picture of the smallest building blocks of matter and the forces between them. There has been a long-standing puzzle about why some particles, like the particle of light called the photon, have zero mass but other particles, like the electron, do have mass. So, yes all the fuss – and the $10 billion that went into building the world's largest atom smasher – was well worth it. The discovery was nice because the last piece of the Standard Model – the name given to the theory developed by Steven Weinberg, Abdus Salam, and Sheldon Glashow – has been found more or less where it was expected to be. But we still don't understand how the force of gravity fits into the picture, or why some quarks are heavy and others are light. We also suspect the existence of an entirely different set of particles called supersymmetric particles. There is a whole lot more to know.

6) You are an outspoken proponent of nuclear disarmament. What do you think are the necessary steps for stability, or maybe even survival, of the subcontinent, in this regard, from both Pakistani and Indian sides?

Pakistan and India have come to blows so many times that a nuclear war in this century is a real possibility. The safest way to avoid catastrophe is to give up these insane toys, which all militaries love. But for that it is necessary to have peace, and peace will come only if we stop spewing hatred and venom against each other. Europe has set such a terrific example of former enemies uniting to everyone's benefit. How I wish the borders could be opened up and Pakistanis and Indians could freely go back and forth!

7) Recently, there has been a circulation of some email exchange between several notable Pakistani academics, including yourself, two Nobel Laureates in physics and HEC authorities. Would you like to explain the situation to our readers?

This is about a physics thesis that was guided by an "HEC meritorious professor", and with the resulting publications paid for by the HEC. The thesis title was "A quantitative study on chromotherapy" and it contained equations that made it look respectable. But it was complete nonsense. Several notable Pakistani physicists, who actually know their subject, said so too. After months of trying we failed to convince the HEC, which even now refuses to reveal the names of the referees. As a last-ditch effort, I sent a copy to two distinguished physicists who I have known for many years. One was the physics Nobel Prize (1979) winner, Steven Weinberg, and the other was the physics Nobel Prize (1988) winner, Jack Steinberger.

Weinberg wrote a point by point criticism which ended up saying: "I am appalled by what I have seen. The thesis shows a lack of understanding of the fundamentals of physics. This thesis is not only unworthy of a PhD, it is positively dangerous, since it might lead patients with severe illnesses to rely on 'chromotherapy' rather than on scientific medicine. I find it difficult to understand how this thesis could have earned its author any academic degree".

Steinberger was equally shocked: "a reasonable physics department should not have accepted anything like this work….Following world news this past decade, I have been very unhappy about the Pakistani political instability and social problems, but I had imagined that its cultural level was better than what I now see".

8) Has there been any development from the HECs' side on this issue since those emails were made public on social media?

Unfortunately there wasn't the slightest apology or admission of wrong doing by the HEC. They will continue to do what they have done in the past – i.e. support spurious research that the world considers to be rubbish, but which gets published in some odd "foreign" journal. The obsession with publications, and lack of scientific judgment, means that the HEC is unlikely to play a role commensurate with the huge funding it has been provided by the government for a decade.

9) It will probably be old news by the time this goes to print, but, what do you think about the whole Agha Waqar Ahmed fiasco?

This episode shows how desperate we are for good news. This man promised a new Pakistan with limitless energy, no need for petrol or gas, and no more load-shedding. For an energy starved nation, it was a vision of paradise and nobody cared that the laws of physics would have to be violated for water to be used as a fuel. Lacking commonsense and good judgment, politicians and media anchors went ballistic. Of course, months later there is no water car and nobody talks about it anymore. But this kind of outrageous stupidity will occur again and again. To prevent that, ordinary people must know at least some science. More importantly, they must know that science works from facts and principles. It is not magic.

10) What does it say about the state of education in Pakistan?

It says as much about our culture of servility and obedience. If you play the system, you rise. Else you make it to the boondocks. I know of at least one intelligent colleague who knew the water car was a total fraud. But he is ambitious and didn't want to contradict what the "great" scientists of Pakistan were saying in support of this idiocy. So he lent his support on a TV program for the idea, qualifying it slightly so that he could save a little bit of his conscience.

11) What concrete steps do you think HEC ought to take to improve the state of affairs of our higher education?

HEC's past record and the inability of its leaders to understand elementary things does not inspire confidence. But here is what I consider to be key for having a working university system – improve the quality of students and teachers. So there must be national entrance examinations for choosing the best students for entrance into public universities. Equally, university and college teachers should go through tests for basic competence before being selected. We have far too many teachers who have big degrees but know nothing. They must be relentlessly weeded out of the system because they cause standards to degenerate. Ditto for many university vice chancellors; they are incompetent political appointees who flout all norms of decency and know they will get away with it. Can you imagine what that university is like whose head buys Viagra using money actually meant for library books and furniture? That's the specific situation for Sind University, but such abominations are not infrequent elsewhere as well.

12) What do you think, in general, about these free education startups from giants like, your alma matter (MIT) or others like Stanford, Harvard, Berkeley, and many others? Will these have far reaching effects on education of the future?

I think they are quite thrilling. Today any highly-motivated student can go online and find lectures of various lengths and have access to class materials that was once the prerogative of only a very few privileged people. I also see Khan Academy as making a terrific contribution, albeit at a more basic level. So, yes, the delivery of education has changed in the West and it will keep changing. But will all

Americans, Europeans, Japanese, etc. benefit from this? The answer is no! Only those who have gone to good schools, or have some strong inner motivation (for whatever reason) will gain.

13) What promise do you think such projects hold for a country like ours'?

Not very much for now. There will be some bright kids at GIKI, LUMS, or NUST who will find these on-line materials interesting and actually try to follow some courses. But it's supplemental stuff and will not be used by most university or college teachers. There's also the language and cultural barrier for most. Public university students in Pakistan generally can't follow that kind of English and manner of speaking. We really need good stuff in Urdu.

14) What would you say a group of students like us can do to further help the spread of scientific way of thinking?

First get to know the facts in any dispute that you enter. Let reason, commonsense, and objectivity be the only criterion. If the issue is important enough, then fight for it even though the consequences may not be good for you. Remember what Faiz said: *bol keh lub azad hain teray….*