

feature



Tasneem Zehra Husain

“IF I ONLY HAD A BRANE”

by Syed Hamid Ali

TASNEEM ZEHRA HUSAIN BELIES THE STEREOTYPED WESTERN IMAGE OF THE NERDY SCIENTIST. SHE HAS MADE A MARK AMONG SCIENTISTS INTERNATIONALLY, IS DYING TO GET BACK TO TEACHING IN PAKISTAN AND PORTRAYS HER AWARD-WINNING SCIENTIFIC KNOWLEDGE IN A WITTY AND UNCOMPLICATED FASHION!

For the past two years, Tasneem has been a post-doctoral researcher in the High Energy Theory Group at Harvard University, where she works on the String Theory. *Libas* began with the basics:

Libas: What is the String Theory?

Tasneem: In Theoretical Physics it has always been considered more elegant and intellectually satisfying if apparently different phenomena can be explained by a single theory. In keeping with this tradition, many seemingly disparate phenomena have, over the years, been brought under the umbrella of an overarching

theory. It was, in fact, for his ability to see the weak nuclear force and electromagnetism as two faces of the same coin, that Abdus Salam (together with Sheldon Glashow and Steven Weinberg) was awarded the Physics Nobel Prize of 1979. As things stood about two decades ago, we had

a decent hold on the constituents of matter (called quarks and leptons) and we had been able to bring three of the four fundamental forces (the strong and weak nuclear forces and electromagnetism) into a single framework called quantum field theory. The fourth force, gravity,

“AND SO, WHEN WRITING ABOUT WORK I'D DONE WITH MEMBRANES (BRANES FOR SHORT), I HEARD THE SONG “IF I ONLY HAD A BRANE” (FROM THE WIZARD OF OZ) PLAY IN MY MIND, THE PUN SOUNDED WAY TOO DELICIOUS TO BE PASSED BY AND I DECIDED THERE AND THEN TO NAME MY THESIS THAT”

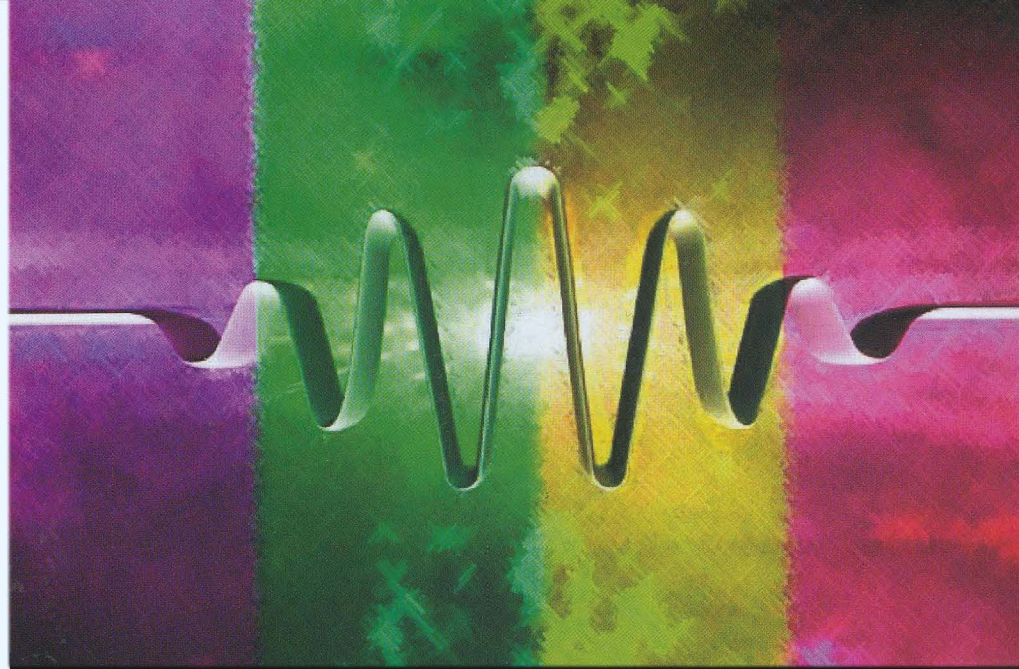
explained very successfully by Einstein's brilliant General Relativity violently resisted all attempts to be reconciled with the other three until a sudden and very beautiful breakthrough was provided by the String Theory.

Hailed as the holy grail of Theoretical Physics, this is our latest and most successful attempt towards ultimate unification. In one fell swoop, not only are the four fundamental forces united but they are also combined with matter and we are left with a single entity - a miniscule, almost impossibly small string. This infinitesimal strand of energy gives rise to the diverse Universe we see, merely by vibrating in different ways. Just as a single guitar string can sound various notes when it vibrates in different ways, so too does our teeny tiny string play many notes, as it wiggles its way through space. We can't hear these notes - they are way beyond the scale at which we can hear - but instead we see them manifested as different particles. If a miraculous magnifying glass were to allow us to peer down to 10-33 m, all the so called 'point' particles, would reveal yet another layer of structure and appear to us as whirling, winding strings. An electron and a photon (a 'light particle') are then just two guises adopted by a string - or in other words, they are two different notes that can be played on the same string. In that sense, we are all elaborate musical compositions - made up of many tiny notes, playing together in perfect harmony. It is a deeply beautiful analogy. There is no doubt about it - the aesthetic appeal of the String Theory is difficult to match and perhaps impossible to surpass.

From then on, it was a journey into sheer madness. My entire thesis took on a 'Wizard of Oz' theme complete with illustrations and chapter headings. Even the actual work that formed the scientific backbone of the thesis had 'Wizard of Oz' references woven into it. To crown it all, was an accompanying popup and stereogram (one of those 'magic eye' images you stare at until a 3D picture appears). Of course, as a result of all this, the last few months of my PhD were one of the major highlights of my life. It was a perpetual party, everyone on our floor caught on and our group would often stop by with new and crazy suggestions or else just an update on the 'progress'.

L: Is Physics palatable?

T: To me personally, physics is the perfect blend of poetry and precision



A BRILLIANT ACADEMIC CAREER

Tasneem short circuited her schooling a little by taking her A' Levels early - shortly after her fifteenth birthday. She then went to Kinnaird College for her BSc and was awarded the Boswell Medal for the best Science student at her convocation.

From there, it was on to the Quaid-e-Azam University where Tasneem graduated with two gold medals - one for standing first in the MSc examinations and the other for maintaining a straight A record throughout her two years of study.

And then began the stint abroad. There was a year in Italy, at the International Centre for Theoretical Physics (ICTP) in Trieste, Italy. Primarily a research centre, this amazing institution - the brainchild of Pakistani Nobel laureate Abdus Salam - has also started a select post graduate program. Ten young students are chosen from around the world to come to Trieste for a year for

an intensive few months of coursework and a summer full of research. Since the ICTP is host to conferences and workshops all year round, it is a highly fertile place intellectually and an inspiring setting in which to begin a research career.

Tasneem then moved on to Stockholm University for her PhD, which again, was a slightly unconventional choice since it is almost the default option for young aspiring scientists to set their sights on a reputed institution in America. Slightly apprehensive in the beginning, Tasneem quickly realized that this was the perfect way to cap an unconventional academic career. "I was unbelievably lucky in my supervisor. Fresh out of Harvard, Ansar Fayyazuddin spent five years in Stockholm and I arrived there just a month after he did."

Tasneem is now about to join the School of Science & Engineering in Lahore as a teacher.

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Pieces of the Puzzle:

Frontiers of Physics, brought to teenagers.



The holy grail of Physics is a theory encompassing the Universe.

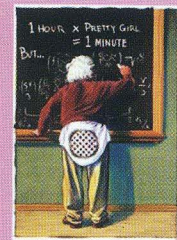
We collect the very different and puzzling pieces in this giant jigsaw, then fit them together and watch as a picture begins to emerge.



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Everything is Relative...

Asked to explain his famous theory, Einstein once remarked,

"Put your hand on a hot stove for a minute, and it seems like an hour. Sit with a pretty girl for an hour, and it seems like a minute. That's relativity."

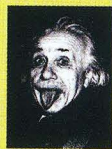
And it is, almost; but not quite.

A Matter of the Utmost Gravity

There was Newton who claimed he uncovered the truth when a falling apple hit him on the head; and then there was Einstein who said space-time is just a giant trampoline.

Who was right?
And why is it such a big deal anyway?

Tasneem's thesis

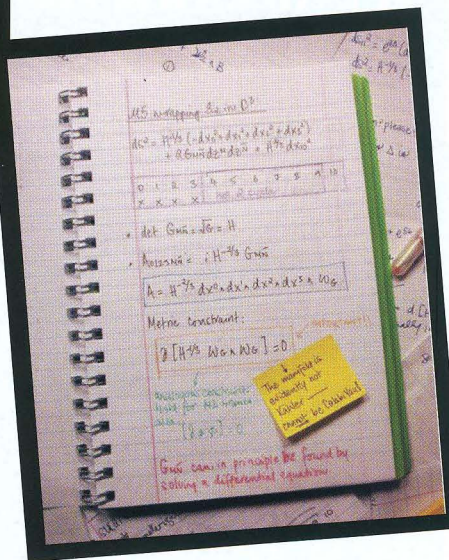


"I AM KEENLY AWARE OF THE FACT THAT THE SCIENCES ARE NOT OFTEN PERCEIVED AS BEING EITHER BEAUTIFUL OR FUN AND IN RECENT YEARS, IT HAS BECOME MY MISSION OF SORTS TO TRY TO COMMUNICATE THE SENSE OF EXCITEMENT AND THE DEEP JOY PHYSICS GIVES ME"

year, I gathered information by reading extensively on the subject, talking to everyone I met at conferences, students, teachers and policy makers. During this time, I was chosen to represent Pakistan at the annual meeting of Nobel Laureates at Lindau, Germany. This is a conference of sorts, geared towards 'promising young scientists', the point being for the giants of the field to mingle with and

sound, self-consistent and does not violate any observed fact, they've come up with a possible answer! It might not turn out to be the final answer, but again that is, at least to me, one of the most wonderful things about theoretical Physics. Nothing is written in stone; nothing is sacred except the rationality and rigour of the method of questioning.

It had long seemed extremely unfair to me that high school students, with their boundless energy and zest for life are taught Science in such an arcane, outdated black and white fashion. So, I developed a series of five bright and colourful animated slide shows introducing the frontiers of Physics to O/A Level students in a conversational and intuitive manner. In addition to a popular level description of theories at the horizons of Science, I touched upon the philosophy and methodology of Science, so that students had a sense not only of what has been done, but also how and why. The response to these presentations was staggering. The children positively lapped up the knowledge, asked excellent questions (some of which would be welcomed in a graduate level course on the subject) and walked away excited and enthusiastic. Following these talks, I started getting requests from schools to train their Science teachers. It took me the next year to plan these out in detail, but I have now started holding such workshops as well.



and I would be hard put to think of anything else that could be more intellectually and aesthetically satisfying. However, I am keenly aware of the fact that the Sciences are not often perceived as being either beautiful or fun and in recent years, it has become my mission of sorts to try to communicate the sense of excitement and the deep joy Physics gives me.

Looking back, I think this started with my PhD. In the last few months, faced with the prospect of writing a thesis, and tottering on the brink of becoming the quintessential tense, overworked graduate student who wanders the corridors at night in a daze and is a zombie by day, I relieved the pressure by approaching the problem differently. It had never seemed fair to me anyway that a degree for which you work so hard, for so long, and which is most often a labour of love, should become in its last days an occasion for such dread. I decided that I wanted my thesis to reflect the fun I'd had over the years, getting to know Physics from the inside.

L: Is passion for science teachable?

T: In the year following my PhD and before I started my postdoctoral work, I spent some serious time thinking about how Science should be taught, consolidating my own views, gathered over time, into a reasonably coherent personal philosophy of the subject. This being my 'research project' for the

inspire the scientists of tomorrow. This meeting was tailor-made for the sorts of conversations I wanted to carry out, and I came back home a week later having had a wonderful time but also having gathered a lot of 'data' on different approaches of teaching and communicating Science and the responses provoked by each. Incorporating this information into my mental picture, I refined my theory.

In my opinion, one of the most crucial points to impress upon young minds is the fact that they can conjure up what they will, pick any starting point they want as long as you, then follow it through mathematically, exploring its implications fully and critically. If the structure they've built is logically

Then, I got quite involved with UNESCO's World Year of Physics initiative. The idea was to declare 2005 the year of Physics and to use this platform to expose children world wide to the wonder and beauty of this subject, perhaps even motivating them to adopt Physics as a career. Towards the end of 2004, I got quite involved in planning this out, >406

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< 322 IF I ONLY HAD A BRANE

even designing Pakistan's logo for WYP. I subsequently lead the Pakistan team to the Launch Conference, held at UNESCO's Paris headquarters in January 2005. I headed to Cambridge the next month, to start my academic research again, but I stayed involved with WYP efforts, in particular with the Physics Stories project spearheaded by the Argonne National Laboratory. Out of this experience grew the desire to compile an anthology of sorts, a collection of Physics related stories and poems...and that has gone down in my list of things to do in the near future.

L: How does it feel to constantly be dealing with such intangible objects?

T: It's difficult to explain. Most of the time, it feels as though you're playing with a very challenging jigsaw puzzle. Somewhere in the process of connecting small, apparently disjointed pieces of information and assembling them into a cohesive image, your intuition takes over; perhaps even before you are able to put it in words and often long before you can clearly see it, you will begin to feel the pattern. That instant, just before the fog lifts, when you first begin to sense the order in the apparent chaos, is thrilling beyond description. The lure of that magic moment, the hope of experiencing that feeling again is one of my strongest motivations to keep going when I feel caught in a rut, or suffocated by equations.

It's an addiction of sorts. What we grapple with is not something you can shake off, or leave at the door when you finally walk home. It's something that completely takes possession of your mind; most of the time you are working on problems tantalizing enough that you catch yourself thinking about possible solutions at all odd hours, in all odd places. The thing is, to do theoretical Physics well, you have to have a passion for it - but I guess that's true of any creative discipline.

L: You are poised to return to Pakistan in a few months and join the fledging SSE (the School of Science & Engineering at the Lahore University of Management Sciences). Any comments?

T: Moving back is of course a leap of faith. You're in uncharted waters and there's a somewhat disconcerting feeling of being without a safety net. Taking this step alone seems to many to be tantamount to professional suicide.

I've been on the Virtual Project Development Team for the School for well over a year now and I've had the opportunity of talking things over with many of the people involved in this project. Most of them are Pakistanis, brilliant high achievers who are currently pushing the frontiers of research in their fields at some of the best and most highly respected institutions, yet they are all not only willing but actually excited about the prospect of coming back to Lahore together, committed to the vision of creating a world class research institution in Pakistan. Each one of them is giving up a promising career abroad and so they are all equally vested in making this place work. The school employs an extremely stringent hiring criterion, comparable to that anywhere in the world and as a result, they have slowly and painstakingly amassed a bright, vibrant, highly qualified team of people. We want this institution to be among the best in the world.

It's not about buying the biggest machines anymore but about finding the smartest solution to the problem – and we, in this subcontinent, are both intelligent and ingenious. If we can manage to attract even a fraction of the talent that abounds in our country and we are able to focus their intellectual energies, I am confident that in just a few years, the SSE will become a force to reckon with.