

## TASNEEM ZEHRA HUSAIN: A PROFILE

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Physicist Tasneem Zehra Husain describes herself as “Pakistan’s first female string theorist.” If pressed, she will admit she is also Pakistan’s *only* female string theorist, but quickly adds with a smile, “So far.” That is because when she is not writing out equations aimed at solving fundamental problems that baffled Einstein, she is trying to make science – even science as abstract and daunting as string theory – appeal to the imaginations and aspirations of adolescents everywhere – including Pakistan.

Pakistan does not have a strong tradition of educating women in anything, let alone advanced science. According to the World Bank, in 2000 two thirds of Pakistani women had no formal education at all, and only about one percent had completed any post-secondary education. In October, 2012, Taliban militants shot a 15-year old girl for promoting schooling for girls. Not an obvious environment from which to expect a woman to emerge as a world-class theoretical physicist.

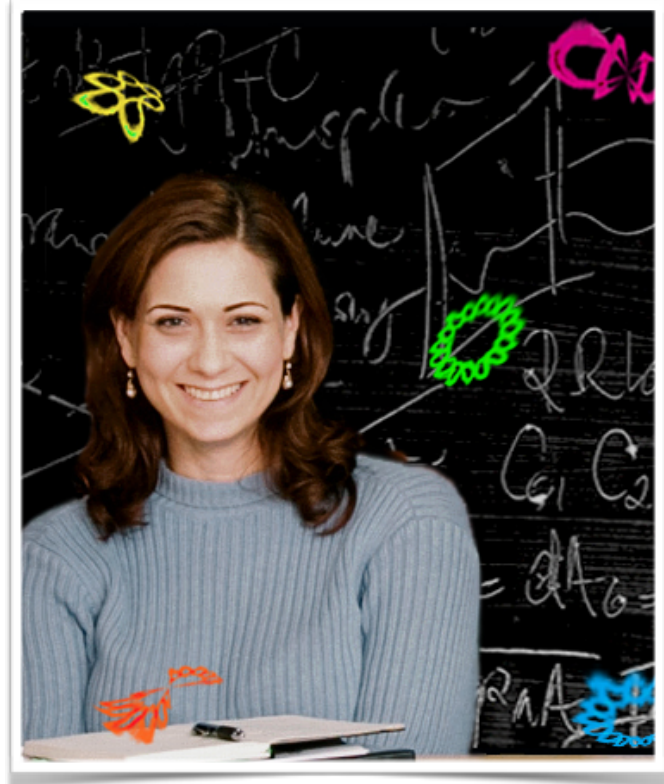
“I guess I never really felt odd about doing science and math because my parents were super-supportive and encouraged me to try everything,” she says. “I was 15 or 16 before I realized this did not happen in every house.” Husain’s father was an economist turned journalist with an international career – Husain herself was born in Montreal. Her mother was trained in arts and literature, and was heavily involved in the Alif Laila Book Bus Society, a charity aimed at improving the education of low income children, especially girls. Husain recalls being dragged into helping with the Book Bus very early on.

Her interest in science survived the fairly limited course offerings at Kinnaird, the premiere women’s college in Lahore, and ultimately sent her to the International Centre for Theoretical Physics in Trieste, Italy, founded by Pakistani Nobel laureate Abdus Salam.

At Stockholm University she wrote what may be the only doctoral dissertation in theoretical physics to use as its organizing metaphor the Judy Garland movie version of *The Wizard of Oz*. (Title: “If I Only Had a Brane,” branes being a mathematical construct in string theory.)

“String theory is the ultimate in unification,” she says. “It’s kind of fun to be looking at all the richness and detail of the universe, and to know there’s a basic principle under it all.”

That basic principle, in string theory, is that everything in the universe ultimately derives from



the vibrations of infinitesimally small bits of energy called strings. The math needed to describe these strings and the 11 (or more) dimensions required for their existence is extraordinarily advanced, but even though the math works, many find it difficult to accept this bizarre and so far untestable theory. There are probably no more than a thousand practicing string theorists in the world.

After a couple of years at Harvard's High Energy Theory group, she and Pakistan's other two (male) string theorists accepted an invitation to help start the School of Science and Engineering at Lahore University of Management Science. While back in Lahore, she accepted an offer from the head of her old secondary school to come and visit some science classes. It was a revelation. "The physics they were being taught was a hundred years old. They weren't seeing anything that anybody is working on today."

She created a series of presentations for them on key topics in modern physics such as quantum mechanics, but as importantly, she started to realize what was wrong with the way kids are taught science. Scientific discoveries are made by fallible, frustrated human beings who usually take a long, wandering path to get from A to B. Schools, on the other hand, often make it seem as if scientific progress comes from super-smart people confidently pushing through to an obvious end. This is not only incorrect, but is intimidating to young people who may not be confident of their abilities. "Putting all the trial and error back in gives people hope: it's normal not to figure it out the first time."

Bringing back that sense of muddle is part of the mission of Husain's forthcoming book, *Only the Longest Threads* (Paul Dry Books, March 2014). In it she retells some of the key discoveries of physics, including Newton's formulation of the laws of gravity and Einstein's theory of relativity, from the perspective of fictional observers trying to make sense out of the new and strange.

"These are things we accept now, but you hear about special relativity for the first time and you say 'Seriously, is the world that weird?'"

Which in a way is the position Husain puts herself in when she visits high school science classes in the Boston area, encouraging students to contemplate weirdness that may have no explanation now, or even in their lifetimes.

"They ask such great questions. Unlike graduate students they aren't afraid of sounding silly."

Meanwhile, there's still the science itself calling, all those little vibrating strings, the tiny new dimensions folded in on themselves. Having gotten off the academic track for two years to write *Only the Longest Threads*, Husain can, at least in principle, contemplate not actively doing science.

"If I weren't actually doing the work ..." Long pause. "I suppose I'd be teaching and writing." Short pause. "No, actually I can't imagine not doing it."