Women in physics in India

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First, I would like to thank Prof. Krishna Mishra for inviting me to this brainstorming session and I am happy than NASI in Allahabad is organising a workshop on the role of women scientists and teachers in the promotion of science and technology next month.

A brief note about my background. My educational background is a master's in physics from IIT Mumbai and a PhD from New York. I returned to India after a couple of post-doctoral positions in the US and I have been at 2 Department of Atomic Energy research institutes in India, Institute of Physics in Bhubaneswar and then here in Allahabad. I am a Professor at the Harish-chandra research institute in Allahabad and have been here since 1995. I work on mesoscopic physics, a subfield of condensed matter physics. But since 2000, I have also been involved in an International group in physics, IUPAP's women in physics cell, which has been working to increase the representation of women in physics, particularly at higher and decision-making levels. But although the group has focussed on women on physics, most of the issues are almost the same as that for women in other branches of science and technology. So I thought i will talk a little about what we learnt in our group.

Let me also mention that the aim of the workshop next month appears to be two-fold, one is to encourage girl students to pursue science as a career and the other is to utilise or apply science and technology to reduce drudgery of women, especially in rural areas. I will focus on the first topic of getting girls interested in a career in science or engineering and interested in reaching the top of her profession, the hurdles she will have to face, and the ways to improve her chances of making it to the top.

My involvement in this activity came about by accident, although I was always a feminist, perhaps even before I joined IIT Mumbai as a student, but definitely during my colleage years and after that, I was always concerned about the fact that there were so few women who managed to survive the competition and make it as succesful scientists or engineers. In 1999, I was

asked by IUPAP to collect data from about 30-40 women physicists in India for an international compilation of women in physics. I did it by sending the questionnaire to women I knew who sent it to their friends and so on. Some of the statistics we gathered was quite interesting. Since in the first round, a large fraction of the respondents had 'made it', so to speak, as a scientist, in either a prestigious research institute, Govt. lab, or an IIT, we found that a large fraction was unmarried or had no children! As the database was increased over the years to include others, we found that the main reason for dropping out, at least in India, was marriage and children. Given a choice between family and career, a majority opted for family. There were also problem regarding two career couples - there were old-fasioned unwritten anti-nepotism rules which prevented couples from getting jobs in the same institute- and lack of proper day-care centres for working couples with kids. But still what was interesting was the perception among the more succesful that there was no gender bias. But this perception changed as many of us started thinking about these issues and and started looking at statistics like those we had ourselves collected and later more professionally collected statistics which are now available as an INSA report.

We found that the number of women at the Master's level was around 30% which reduced to about 20% at the PhD level. But a survey of women faculty in 8 premier research institutes in the country found that only 20 of the 245 researchers of the physics faculty were women, while the 7 Indian Institutes of Technology had 16 women physicists as part of physics departments which had 201 faculty members. Universities fared little better, as 11 university physics departments surveyed had only 30 women faculty members out of 258. Even more importantly, this fraction has remained roughly constant over more than a decade, whereas the numbers entering the field have increased. Even more telling, the Bhatnagar award (the premier scientific national award in the country) has never gone to a women physicist, (only 8 out of 333 have ever got it!) and representation in decision making bodies, including memberships of academies of sciences, directorships of institutes, membership of grant and award giving committees, is so low, as to be almost negligible.

But why is is that none of us, the working women scientists ever realised this before we started looking at statistics? Perhaps the perception that science has no gender bias was needed for us to be able to work and succeed. But now i think that is is important for working scientists to be aware of these

issues because awareness is needed to counter conscious and unconscious biases. The statistics clearly indicate that there is cause for concern.

My next level of involvement with these issues started from 2000 when I became part of the IUPAP (International union of pure and applied physics) working group on women in physics. Our task was to first find out reasons for the low representation of women in physics and find ways of improving it. As part of our work, we organised three international conferences on women in physics in Paris, Rio de janeiro in Brazil and Seoul in Korea and lots of issues which are common to women professionals all over the world came up in these conferences. The topics that were addressed were 1) how to attract girls to the subject 2) how to launch a career in the subject 3) how to get women into leadership positions nationally and internationally 4) how to improve the institutional climate 5) how to balance career and family and 6) learn from what has worked in other countries. These questions and ideas are relevant not only for physics but generally for science and technology and one can apply what one has learnt from these efforts also to promoting scientific culture for women in India.

India has even more severe problems than many other countries, because many girl children are simply not sent to schools because of poverty. But even among the economically privileged section, girls do face systematic discrimination. There are of course the standard problems of subject material in science subjects including examples and problems being gender-biased, and role models and images of women presented as subordinate - for instance, as nurses instead of doctors or as assistants or subjects with males as the scientists or observers. In many co-educational schools, teachers often talk more to the boys in the class, expecting them to be smarter. Since achievement so often depends on expectations, the fact that society and even teachers expect the girls to be less capable affects their achievement, which in turn affects their self-esteem. These are similar to the problems faced by girls in other Western countries. But in India, there are other issues. Elite education is expensive. For instance, getting into IIT's via various coaching classes is prohibitively expensive, and families hesitate to spend as much for their daughters as for their sons, since their daughters are likely to get married and not necessarily, in a sense, pay back the investment! Other than that, girls, much more than boys, are still subject to an enormous social pressure to conform. Even in middle class families, boys are allowed much more freedom to be different and to question elders and teachers. whereas the girl-child

is 'allowed' to study, but only on condition that she otherwise conforms socially. This hampers the creation of an inquisitive and questioning mind. The questioning mind questions everything including religion, traditions and social mores. If limits are placed on some forms of questioning by a patriarchal society, how is the mind free to create? As the child grows up, more and more restrictions are placed on her movements, and actions. Marriage looms large on the horizon. Parents are afraid of over-educating her, because she may not get a suitable groom. If she does get married, she (and her husband) will have to deal with the problem of finding jobs in nearby places, or deal with a commuting marriage, not easy in India. If she has children, her divided responsibility during the early years of her children may drive her out of the competitive job market altogether.

But besides this, there are also conscious and unconscious biases operating against hiring and promoting women, both by men and women. While biases against women in India is blatant at some levels, like female foeticide, honour killings and dowry killings, at higher levels of education, most of the biases are subtle, not so blatant and hence hard to counter. For instance, if both a man and a married woman whose husband is elsewhere apply for a job, the bias that the woman may be unlikely to come prevents her getting selected. And also, a soft voice and tentative style and a gentle personality are associated with lack of confidence, so many women come across as less effective in a seminar or interview even if they are more knowledgeable. I can give a specific example. When I was younger and had just started to teach, when a student asked me a question, i would answer it and then pause to think of why the student had asked the question and whether I could explain it in another way to make it clearer. Later one or two of the students whom I got to know personally told me that the students generally interpreted the pause as an indication that I was not sure of the answer. I had to really think whether I should change my style or wait for at least the smarter students to understand and appreciate my effors to communicate more clearly. Today, as a senior woman, I can afford to continue my style, but it was hard as a young faculty member to be considered not confident because of my style.

Even more difficult to counter are the family and social mores which hold the woman solely responsible for home and family. How can a woman put in the same hours of work that a man can, unless the family members, the husbands in particular share house-work and childcare?

So how does one go about remedying the situation? A lot of the prob-

lem is societal and without an overthrow of the patriarchal society, perhaps complete parity is hard to achieve. However, even at the grassroots level, sufficient awareness can be spread through the media (which is a very powerful organ of social change) that it is a good idea for families to treat boys and girls on par and that boys should also be taught to accept 'home-making' as one of their duties. Of course, side by side, society recognises that both sons and daughters are equally responsible for looking after their parents in old age.

But there are several practical levels at which interventions can be made. At the Government level, the Department of Science and Technology has initiated special fellowships to enable women to get back into science after a break in their career. This scheme provides funding for up to three years. The Department of Science and Technology also relaxes the age limit for various schemes by 5 years for women, to allow for the fact that they may have had a break in their career. The University Grants Commission (UGC) has announced 50 postdoctoral fellowships per year for women with a break in career. The L'Oreal foundation has started in Mumbai, a special fellowship for girls to pursue science, based on merit and need. A committee on "Women in Science" has been formed by INSA which has now got a large database of statistics and information about women in science. The committee has also suggested starting a role model programme, which will involve mentoring, and holding special lectures and workshops for girl students in science, etc. The committee has also brought out a book called Lilavati's daughters which gives biographical sketches of eminent women scientists.

But closer to home for the working women is the employer, the institute, university or college. They have to make sure that their policies not only do not discriminate against women, but are actually women friendly. The environment in the work-place should not be such that the women feel isolated or victimised. For instance, they should not tolerate sexist comments or attitudes in the workplace. They should make sure that there is a women's grievance cell and that women at all levels feel free to approach it. The taboo subject of sexual or gender based harrasment also has to be addressed and not swept under the rug.

One of the most positive outcomes of the IUPAP meetings on women in physics for us was that it brought about an explicit recognition of the problem in the Indian context, where family responsibilities are so overwhelmingly important. After the conference, networking among Indian women physicists

also increased and we have kept in touch with each other and supported one another. In order to raise awareness, we have written articles and given talks. Although officially mandated policies in India are supportive of women, e.g., it is mandated that all institutions have daycare facilities, and that they set up women's grievance cells to deal with complaints of sexual harassment, etc, the real problem is that these recommendations rarely get implemented in practice. Several of us now have managed to set up these women's grievance cells at our home institutes, and have tried to make sure that the climate for working women is positive. There have also been several workshops arranged in several places in India looking at these issues, and that is also important, because networking and teamwork is needed for things to change.

Unfortunately, all the measures mentioned above may still not solve the problems faced by women in getting the past the barrier of getting their first job, nor is it sufficient to ensure their career advancement. Besides social mores and conditioning regarding family responsibilities that will take time to change, attitudes and perceptions of working scientists (mostly male), particularly those in powerful positions (all male), also need to change. Whether or not there are explicit biases in hiring, suitable women candidates get bypassed simply because women are still excluded from informal networks of professionals, and fail to get noticed. Young women who want take up careers are still routinely discouraged by 'friendly and kind' senior people, who advise them to look for 'soft jobs' near their husband's workplace. The two-body problem of working couples has not yet been addressed and archaic anti-nepotism rules, written or unwritten, are still the norm. Day-care is by no means available in most places and society still holds the 'mother' solely responsible for the children. Talks in conferences, open fellowships, grants, awards, etc, are controlled by a few powerful people in the country to whom women are still 'invisible'. Thus, the discouragement faced by the average woman scientist or engineer still needs to be countered by support groups and mentors, which do not now exist to any great extent. This is one place where workshops and brainstorming sessions like this can help. We have to organize ourselves to help ourselves and if we do that, what we can hope to see in the next few years, is a network of women scientists who are 'visible' and can stand up and expect to be counted. We need to do this so that the next generation of women in science who are now in the beginning stages of their career get the success and recognition they deserve and become acknowledged leaders of their fields.