

Women in Physics: An Indian Perspective

Neelima Gupte¹, Jyoti Gyanchandani², Sunita Nair³, and Sumathi Rao⁴

¹*Indian Institute of Technology, Madras;* ²*Bhabha Atomic Research Centre;* ³*Raman Research Institute;*
⁴*Harish-Chandra Research Institute*

Understanding nature, which is what physics is all about, is a global human endeavor. However, for a variety of reasons, women are conspicuously underrepresented in physics. In the new millennium, it is certainly important to correct this underrepresentation—both for the sake of the women, who should have the same opportunities and resources to realize and fulfill all they desire to accomplish in their lives, as well as for the sake of physics, which must draw on the full potential of humankind to solve its myriad questions.

Within the Indian context, the participation of women in public life has been quite high. Even before independence, thanks to an enlightened Indian leadership, especially that of Mahatma Gandhi, both men and women have been involved in the freedom struggle. This led to the emergence of strong women leaders in the subcontinent. Indian women have held most political positions of importance, such as prime minister, chief ministers of various states, and leaders of legislatures. Women have also held positions of prominence in the judiciary and in other professions.

However, India is a country of many contrasts. Along with women of very high levels of accomplishment, it also has problems such as high levels of female illiteracy, female infanticide, and dowry deaths. This leads to unusual statistics. For instance, although almost half the women in India are illiterate, roughly a third of science graduates are women and a reasonable fraction of them stay on in science.

It is interesting that a survey of all the working scientists in the country reveals that, unlike in the West, there is very little perception at either school or college level that women cannot do physics and math. The more standard reasons for dropping out seem to be family or marriage related. It becomes difficult for women to cope with the simultaneous time demands of their gender roles and their professional commitments. While training up to the Ph.D. level puts heavy demands on the time and commitment of women vis-à-vis the demands of society, which expects them to fulfill the commitments of marriage and raising a family during the crucial years of training, postgraduate degrees in science are common, and are even encouraged by parents. Moreover, jobs such as college teaching or working in scientific establishments after a Master's degree are perceived as highly desirable and prestigious for women.

However, in graduate school and beyond, the dropout percentage of women becomes far more significant. Whether or not a woman completes a Ph.D. and/or pursues postdoctoral fellowships is completely dependent on her marital status, the employment of the spouse, and family support. The women who go ahead for a Ph.D., postponing marriage, often marry other students. This leads to the problem of finding two jobs in the same place. So either the couple has to compromise on the career of one of them (usually that of the woman), or end up with many years of a commuting marriage. Moreover, most jobs in academics require many years of postdoctoral training. This again entails commuting marriages, postponing or coping with the additional problems of child-bearing, and dealing with a great deal of family pressure.

Even after all this effort, suitable academic jobs are difficult to get. Those who do manage to get suitable jobs along with their spouses still have to deal with problems of child-rearing, given the fact that suitable day-care centers and crèches with educated caregivers are still relatively new concepts in India.

In spite of these handicaps, women physicists in India form roughly 10% of the physics faculty in all of the universities, and have significant presence as researchers in the various government institutions and research laboratories. This is a pretty impressive achievement.

Additionally, many women physicists have been working on frontier problems at the international level. In particle physics, Indian women physicists were involved in the top quark discovery and theorists have written highly cited and useful papers in phenomenology and quantum field theory. In fact, one of the most highly cited particle

physicists from India is a woman. In astrophysics, they have authored well-received papers in galactic dynamics, plasma physics, and physical cosmology, and have been involved in the development of India's various observational facilities. Two women astrophysicists have been appointed directors of planetaria.

In condensed-matter physics and nonlinear physics, some of the most active researchers in the country are women, and they have contributed extensively to the fields of strongly correlated electron systems, nonlinear dynamics, and statistical mechanics. Many women have made solid contributions in the areas of nuclear physics, material science, and applied physics. However, it is still true that recognition of the achievements of women physicists is small. There have been extremely few prestigious awards or fellowships in academies of sciences awarded to women physicists in India.

One can now ask what can be done for the betterment of women's careers in physics. At the college and high-school levels, there are many students, both boys and girls, who are interested in science in general, and physics in particular, but are pushed toward professional courses by peer as well as parental pressures. To offset this, scientific discoveries and profiles of scientists need to be highlighted in the media.

We need to provide support for high-school and college teachers so they can expose their students to the possibilities and options of careers in basic as well as applied physics. The best way to do this may be to help teachers maintain contact with current research. This would both help the very many extremely competent women who teach at this level to maintain their own scientific levels and careers, and enable them to enthuse students toward careers in physics.

To attract young women into Ph.D. programs and beyond requires some special efforts. In particular, it needs a certain sensitizing of society to the view that both men and women should share responsibilities for home and child care. Unfortunately, although women have become more progressive over the years in India, men, and society in general, have not kept pace. So special efforts are needed to involve the media in debunking stereotyped roles for women and men, and in the general "sensitizing" of the male half of the population.

To help women through the crucial child-bearing and -rearing years, perhaps schemes of part-time work (with part-time salaries) can be instituted for both women and men, but with the option of being later converted to a normal full-time position. Another possibility is to allow reentry into the career path after taking time off, which would require that age restrictions for various positions be dropped. It should also be possible for women who perform well to have faster tracks after reentry.

A simple way to ensure that the special problems of women are looked at with empathy and insight is to appoint women members to evaluation committees. It is also necessary to have strong guidelines preventing institutions from undermining efforts toward affirmative action. Although the Indian government does have strong rules discouraging sexual harassment at the workplace, and many institutions have panels to address gender-specific discrimination and sexual harassment, much more needs to be done toward making the work environment safe and women-friendly at all institutions.

Recognition, mentoring, and rewarding of women achievers is also required. This is needed not only for the morale of the women in a male-dominated field, but also because these women serve as role models for new generations of women scientists.

If men and women are the two pillars on which society is built, a fair, sensitive, and mature society will ensure that both these pillars are strong and receive justice. We hope the discussions at this conference will lead to further concrete efforts toward this end.