

Women in Physics in Italy: the leaky pipeline

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Italy is often considered a fortunate country for women in physics. Indeed, the number of women among students in higher education and in the early stages of the careers is relatively high, certainly much higher than in most other countries world wide. However, the percentage of women among physicists decreases very rapidly with increasing level in the careers; also, the presence of women in positions of power is generally negligible. In this report we summarize some representative data and discuss briefly some possible explanations and the proposed focus for future action.

Undergraduate courses in physics in Italy now witness the presence of many women, who are generally very successful in their studies. The percentage of women among students in physics has grown from 20.8% in 1960 to 36.4% in 1999 (532 degrees awarded to women and 929 to men in 1999) [1,2]. At the *PhD level* complete data are not available; however, from the analysis of a few Universities we know that a similar percentage is maintained, or even increased, in graduate courses. While the numbers are still far from 50%, they certainly point to less pronounced mechanisms of exclusion of girls and young women with respect to other countries, particularly those that are most advanced technologically, and to a clear similarity with latin countries such as France or Spain. The debate on the reasons is very interesting and still open, but cannot be addressed in this brief report.

At the entrance in the career in research or higher education we thus find that at least 1/3 of the possible candidates are women. Let us now follow how the situation at different levels. It is not easy to gain a general picture about *post-doctoral fellowships*, because these are not monitored in official statistical data. However the Istituto Nazionale per la Fisica della Materia (INFN) reports that post-doctoral fellowships are awarded to women in a percentage between 32 and 43% depending on the type of fellowship [2]. These data seem to indicate that, at least among condensed matter physicists, a large fraction of those who enter the very first level of the career with a post-doc position are women.

As we proceed along the careers the percentage of women decreases very rapidly. In the *University system* the percentage of women among those holding permanent positions in physics is 15.3%. It is interesting to look at the distribution among the three tenured levels: Ricercatore, Professore Associato, and Professore Ordinario (approximately corresponding to Lecturer, Associate Professor, and Full Professor): with increasing level, the percentage of women drops from 25.6%, 15.0%, down to 4.9% of the total [3]. Note that the situation at the highest level is even worse if one looks at other fields, such as electronic engineering, where physicists are also sometimes employed: here out of 108 full professors only 2 are women [3]. The trend is similar within *public Research Institutions*. There are two National Institutes that employ mostly physicists: the Istituto Nazionale di Fisica Nucleare (INFN), focusing on nuclear and high-energy physics, and the Istituto Nazionale per la Fisica della Materia (INFN), focusing on the physics of matter and materials. Here the percentage of women among researchers is 18.7% and 18.4%, respectively. At INFN, this percentage decreases rapidly with increasing career level from 24.1% (level III) to 17.1% (level II) and 4.4% (level I, highest) [4]. At INFN the numbers are too small for significant statistics at the highest levels, but the trend appears to be very similar or worse [2]. Physics is also present, among other disciplines, at the Consiglio Nazionale delle Ricerche (CNR) and the Ente per le Nuove Tecnologie, l'Energia e l'Ambiente (ENEA). Here the available data aggregate physics with mathematics, and show a

percentage of women in the three levels of 33.7%, 22.8%, 11.8% at CNR [2]; of 25.2%, 18.4%, 15.1% at ENEA [2]. In general, it appears that the percentage of women among physicists decreases sharply after the PhD and post-doctoral fellowship levels. *The first bottleneck is in the access to permanent positions; at each further step in the career more and more women are left behind: a very leaky pipeline.*

The presence of women in *governing bodies*, or in general in *positions of power* in physics, is even more discouraging. Not a single woman is present in the Executive and Directive Boards of INFN and INFN; at CNR one of the 7 members of the Directive Board is a woman. None of the Presidents of public research institutions is a woman. Even among the Directors of local research Laboratories, Sections (INFN), Units (INFN) and Institutes (CNR) the presence of women is almost negligible, as it is among the Directors of Physics Departments at Universities. We have noticed that in a few cases the choice of women (for participation in boards, committees etc) is higher when the components are elected rather than nominated. In general, however, *women in physics in Italy appear to be still excluded almost completely from positions of power and governance.* As far as career and power are concerned, the Italian case is thus quite different e.g. from the situation in France.

Amazingly, a public debate on this situation has started only very recently, mostly thanks to the concurrent actions at European level [5] and internationally, to the publication of official data [1,2], and to the creation of Equal Opportunity Committees (Comitati per le Pari Opportunità, CPOs). CPOs must exist by law at Universities and public Research Institutions; a CPO is now active at INFN, CNR, ENEA and in many Universities; it is also being created at INFN. The discussion is now focusing on the reasons behind the present situation and the focus for future actions. Among the main issues are:

Mechanisms for evaluation of research and teaching (both of individuals and institutions). It is generally felt that women would especially benefit from an effort to establish more fair and objective evaluation mechanisms. We feel that pressure in this direction would also represent a key contribution to the improvement of the Italian university and research system in general.

Mechanisms for selection of people in governing bodies and positions of power. The main mechanism is still the 'old boys network', that plays against women and often against the most innovative and active scientists in general.

Age and mechanisms of access to the first steps in the careers and to permanent positions. Access to permanent positions occurs at relatively high age (e.g. compared to France), hence maternity can affect the possibility to compete and is sometimes felt as alternative to career by young women physicists. Note that the most common fellowships do not foresee maternity leaves (they were recently introduced at INFN but not yet in most other Institutions and Universities).

Working conditions and everyday life in labs. This includes the organization of working time and space, but also the climate for women in the labs (collaborative vs. competitive/aggressive environments etc).

Role models. When discussing with young women physicists we often feel that very few women represent a model of achieving success in physics together with a 'normal' life, with friends and family and other interests. Also, role models are needed in which success for a woman does not imply adjustment to aggressive behaviors that are more common to men.

All these are very general issues: more actions, and more consultation, transparency and democracy are needed to face power mechanisms that still act against women and other weak groups in Italy.

1. ISTAT, *Rapporto sull'Italia* (Il Mulino, Bologna, 1999); *Donne all'Università* (Il Mulino, Bologna, 2001).
2. *Figlie di Minerva*, edited by R. Palomba (Franco Angeli, Milano, 2000).
3. Ministero dell'Istruzione, Università, e Ricerca (MIUR), <http://www.miur.it/> (2001).
4. R. Alba et al., *Relazione del Comitato per le Pari Opportunità dell'INFN*, anno 2000.
5. See e.g. ETAN Report on Women and Science: European Commission (2001).